

PARTE I

TABELAS
DE
NAVEGAÇÃO ESTIMADA E COSTEIRA

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Tabela 4 — Distância ao horizonte visível

Tabela 5 — Distância ao horizonte radar

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R

TABELA 1

R ou φm

359 359° 315
181 181 225

TÁBUAS DE CARTEAÇÃO

001 001 045
179 179 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|-----|----|------|-----|-----|-------|-----|-----|-------|-----|-----|-------|-----|-----|-------|-----|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 50.0 | 0.9 | 100 | 100.0 | 1.7 | 150 | 150.0 | 2.6 | 200 | 200.0 | 3.5 | 250 | 250.0 | 4.4 |
| 1 | 1.0 | 0.0 | 1 | 51.0 | 0.9 | 1 | 101.0 | 1.8 | 1 | 151.0 | 2.6 | 1 | 201.0 | 3.5 | 1 | 251.0 | 4.4 |
| 2 | 2.0 | 0.0 | 2 | 52.0 | 0.9 | 2 | 102.0 | 1.8 | 2 | 152.0 | 2.7 | 2 | 202.0 | 3.5 | 2 | 252.0 | 4.4 |
| 3 | 3.0 | 0.1 | 3 | 53.0 | 0.9 | 3 | 103.0 | 1.8 | 3 | 153.0 | 2.7 | 3 | 203.0 | 3.5 | 3 | 253.0 | 4.4 |
| 4 | 4.0 | 0.1 | 4 | 54.0 | 0.9 | 4 | 104.0 | 1.8 | 4 | 154.0 | 2.7 | 4 | 204.0 | 3.6 | 4 | 254.0 | 4.4 |
| 5 | 5.0 | 0.1 | 5 | 55.0 | 1.0 | 5 | 105.0 | 1.8 | 5 | 155.0 | 2.7 | 5 | 205.0 | 3.6 | 5 | 255.0 | 4.5 |
| 6 | 6.0 | 0.1 | 6 | 56.0 | 1.0 | 6 | 106.0 | 1.8 | 6 | 156.0 | 2.7 | 6 | 206.0 | 3.6 | 6 | 256.0 | 4.5 |
| 7 | 7.0 | 0.1 | 7 | 57.0 | 1.0 | 7 | 107.0 | 1.9 | 7 | 157.0 | 2.7 | 7 | 207.0 | 3.6 | 7 | 257.0 | 4.5 |
| 8 | 8.0 | 0.1 | 8 | 58.0 | 1.0 | 8 | 108.0 | 1.9 | 8 | 158.0 | 2.8 | 8 | 208.0 | 3.6 | 8 | 258.0 | 4.5 |
| 9 | 9.0 | 0.2 | 9 | 59.0 | 1.0 | 9 | 109.0 | 1.9 | 9 | 159.0 | 2.8 | 9 | 209.0 | 3.6 | 9 | 259.0 | 4.5 |
| 10 | 10.0 | 0.2 | 60 | 60.0 | 1.0 | 110 | 110.0 | 1.9 | 160 | 160.0 | 2.8 | 210 | 210.0 | 3.7 | 260 | 260.0 | 4.5 |
| 1 | 11.0 | 0.2 | 1 | 61.0 | 1.1 | 1 | 111.0 | 1.9 | 1 | 161.0 | 2.8 | 1 | 211.0 | 3.7 | 1 | 261.0 | 4.6 |
| 2 | 12.0 | 0.2 | 2 | 62.0 | 1.1 | 2 | 112.0 | 2.0 | 2 | 162.0 | 2.8 | 2 | 212.0 | 3.7 | 2 | 262.0 | 4.6 |
| 3 | 13.0 | 0.2 | 3 | 63.0 | 1.1 | 3 | 113.0 | 2.0 | 3 | 163.0 | 2.8 | 3 | 213.0 | 3.7 | 3 | 263.0 | 4.6 |
| 4 | 14.0 | 0.2 | 4 | 64.0 | 1.1 | 4 | 114.0 | 2.0 | 4 | 164.0 | 2.9 | 4 | 214.0 | 3.7 | 4 | 264.0 | 4.6 |
| 5 | 15.0 | 0.3 | 5 | 65.0 | 1.1 | 5 | 115.0 | 2.0 | 5 | 165.0 | 2.9 | 5 | 215.0 | 3.8 | 5 | 265.0 | 4.6 |
| 6 | 16.0 | 0.3 | 6 | 66.0 | 1.2 | 6 | 116.0 | 2.0 | 6 | 166.0 | 2.9 | 6 | 216.0 | 3.8 | 6 | 266.0 | 4.6 |
| 7 | 17.0 | 0.3 | 7 | 67.0 | 1.2 | 7 | 117.0 | 2.0 | 7 | 167.0 | 2.9 | 7 | 217.0 | 3.8 | 7 | 267.0 | 4.7 |
| 8 | 18.0 | 0.3 | 8 | 68.0 | 1.2 | 8 | 118.0 | 2.1 | 8 | 168.0 | 2.9 | 8 | 218.0 | 3.8 | 8 | 268.0 | 4.7 |
| 9 | 19.0 | 0.3 | 9 | 69.0 | 1.2 | 9 | 119.0 | 2.1 | 9 | 169.0 | 2.9 | 9 | 219.0 | 3.8 | 9 | 269.0 | 4.7 |
| 20 | 20.0 | 0.3 | 70 | 70.0 | 1.2 | 120 | 120.0 | 2.1 | 170 | 170.0 | 3.0 | 220 | 220.0 | 3.8 | 270 | 270.0 | 4.7 |
| 1 | 21.0 | 0.4 | 1 | 71.0 | 1.2 | 1 | 121.0 | 2.1 | 1 | 171.0 | 3.0 | 1 | 221.0 | 3.9 | 1 | 271.0 | 4.7 |
| 2 | 22.0 | 0.4 | 2 | 72.0 | 1.3 | 2 | 122.0 | 2.1 | 2 | 172.0 | 3.0 | 2 | 222.0 | 3.9 | 2 | 272.0 | 4.7 |
| 3 | 23.0 | 0.4 | 3 | 73.0 | 1.3 | 3 | 123.0 | 2.1 | 3 | 173.0 | 3.0 | 3 | 223.0 | 3.9 | 3 | 273.0 | 4.8 |
| 4 | 24.0 | 0.4 | 4 | 74.0 | 1.3 | 4 | 124.0 | 2.2 | 4 | 174.0 | 3.0 | 4 | 224.0 | 3.9 | 4 | 274.0 | 4.8 |
| 5 | 25.0 | 0.4 | 5 | 75.0 | 1.3 | 5 | 125.0 | 2.2 | 5 | 175.0 | 3.1 | 5 | 225.0 | 3.9 | 5 | 275.0 | 4.8 |
| 6 | 26.0 | 0.5 | 6 | 76.0 | 1.3 | 6 | 126.0 | 2.2 | 6 | 176.0 | 3.1 | 6 | 226.0 | 3.9 | 6 | 276.0 | 4.8 |
| 7 | 27.0 | 0.5 | 7 | 77.0 | 1.3 | 7 | 127.0 | 2.2 | 7 | 177.0 | 3.1 | 7 | 227.0 | 4.0 | 7 | 277.0 | 4.8 |
| 8 | 28.0 | 0.5 | 8 | 78.0 | 1.4 | 8 | 128.0 | 2.2 | 8 | 178.0 | 3.1 | 8 | 228.0 | 4.0 | 8 | 278.0 | 4.9 |
| 9 | 29.0 | 0.5 | 9 | 79.0 | 1.4 | 9 | 129.0 | 2.3 | 9 | 179.0 | 3.1 | 9 | 229.0 | 4.0 | 9 | 279.0 | 4.9 |
| 30 | 30.0 | 0.5 | 80 | 80.0 | 1.4 | 130 | 130.0 | 2.3 | 180 | 180.0 | 3.1 | 230 | 230.0 | 4.0 | 280 | 280.0 | 4.9 |
| 1 | 31.0 | 0.5 | 1 | 81.0 | 1.4 | 1 | 131.0 | 2.3 | 1 | 181.0 | 3.2 | 1 | 231.0 | 4.0 | 1 | 281.0 | 4.9 |
| 2 | 32.0 | 0.6 | 2 | 82.0 | 1.4 | 2 | 132.0 | 2.3 | 2 | 182.0 | 3.2 | 2 | 232.0 | 4.0 | 2 | 282.0 | 4.9 |
| 3 | 33.0 | 0.6 | 3 | 83.0 | 1.4 | 3 | 133.0 | 2.3 | 3 | 183.0 | 3.2 | 3 | 233.0 | 4.1 | 3 | 283.0 | 4.9 |
| 4 | 34.0 | 0.6 | 4 | 84.0 | 1.5 | 4 | 134.0 | 2.3 | 4 | 184.0 | 3.2 | 4 | 234.0 | 4.1 | 4 | 284.0 | 5.0 |
| 5 | 35.0 | 0.6 | 5 | 85.0 | 1.5 | 5 | 135.0 | 2.4 | 5 | 185.0 | 3.2 | 5 | 235.0 | 4.1 | 5 | 285.0 | 5.0 |
| 6 | 36.0 | 0.6 | 6 | 86.0 | 1.5 | 6 | 136.0 | 2.4 | 6 | 186.0 | 3.2 | 6 | 236.0 | 4.1 | 6 | 286.0 | 5.0 |
| 7 | 37.0 | 0.6 | 7 | 87.0 | 1.5 | 7 | 137.0 | 2.4 | 7 | 187.0 | 3.3 | 7 | 237.0 | 4.1 | 7 | 287.0 | 5.0 |
| 8 | 38.0 | 0.7 | 8 | 88.0 | 1.5 | 8 | 138.0 | 2.4 | 8 | 188.0 | 3.3 | 8 | 238.0 | 4.2 | 8 | 288.0 | 5.0 |
| 9 | 39.0 | 0.7 | 9 | 89.0 | 1.6 | 9 | 139.0 | 2.4 | 9 | 189.0 | 3.3 | 9 | 239.0 | 4.2 | 9 | 289.0 | 5.0 |
| 40 | 40.0 | 0.7 | 90 | 90.0 | 1.6 | 140 | 140.0 | 2.4 | 190 | 190.0 | 3.3 | 240 | 240.0 | 4.2 | 290 | 290.0 | 5.1 |
| 1 | 41.0 | 0.7 | 1 | 91.0 | 1.6 | 1 | 141.0 | 2.5 | 1 | 191.0 | 3.3 | 1 | 241.0 | 4.2 | 1 | 291.0 | 5.1 |
| 2 | 42.0 | 0.7 | 2 | 92.0 | 1.6 | 2 | 142.0 | 2.5 | 2 | 192.0 | 3.4 | 2 | 242.0 | 4.2 | 2 | 292.0 | 5.1 |
| 3 | 43.0 | 0.8 | 3 | 93.0 | 1.6 | 3 | 143.0 | 2.5 | 3 | 193.0 | 3.4 | 3 | 243.0 | 4.2 | 3 | 293.0 | 5.1 |
| 4 | 44.0 | 0.8 | 4 | 94.0 | 1.6 | 4 | 144.0 | 2.5 | 4 | 194.0 | 3.4 | 4 | 244.0 | 4.3 | 4 | 294.0 | 5.1 |
| 5 | 45.0 | 0.8 | 5 | 95.0 | 1.7 | 5 | 145.0 | 2.5 | 5 | 195.0 | 3.4 | 5 | 245.0 | 4.3 | 5 | 295.0 | 5.1 |
| 6 | 46.0 | 0.8 | 6 | 96.0 | 1.7 | 6 | 146.0 | 2.5 | 6 | 196.0 | 3.4 | 6 | 246.0 | 4.3 | 6 | 296.0 | 5.2 |
| 7 | 47.0 | 0.8 | 7 | 97.0 | 1.7 | 7 | 147.0 | 2.6 | 7 | 197.0 | 3.4 | 7 | 247.0 | 4.3 | 7 | 297.0 | 5.2 |
| 8 | 48.0 | 0.8 | 8 | 98.0 | 1.7 | 8 | 148.0 | 2.6 | 8 | 198.0 | 3.5 | 8 | 248.0 | 4.3 | 8 | 298.0 | 5.2 |
| 9 | 49.0 | 0.9 | 9 | 99.0 | 1.7 | 9 | 149.0 | 2.6 | 9 | 199.0 | 3.5 | 9 | 249.0 | 4.3 | 9 | 299.0 | 5.2 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 271 315
269 269 225

R

089 089° 045
091 091 135

R ou φm

R

TABELA 1

R ou φm

359 359° 315
181 181 225

TÁBUAS DE CARTEAÇÃO

001 001 045
179 179 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-----|-----|-------|-----|-----|-------|-----|-----|-------|-----|-----|-------|-----|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 300.0 | 5.2 | 350 | 349.9 | 6.1 | 400 | 399.9 | 7.0 | 450 | 449.9 | 7.9 | 500 | 499.9 | 8.7 | 550 | 549.9 | 9.6 |
| 1 | 301.0 | 5.3 | 1 | 350.9 | 6.1 | 1 | 400.9 | 7.0 | 1 | 450.9 | 7.9 | 1 | 500.9 | 8.7 | 1 | 550.9 | 9.6 |
| 2 | 302.0 | 5.3 | 2 | 351.9 | 6.1 | 2 | 401.9 | 7.0 | 2 | 451.9 | 7.9 | 2 | 501.9 | 8.8 | 2 | 551.9 | 9.6 |
| 3 | 303.0 | 5.3 | 3 | 352.9 | 6.2 | 3 | 402.9 | 7.0 | 3 | 452.9 | 7.9 | 3 | 502.9 | 8.8 | 3 | 552.9 | 9.7 |
| 4 | 304.0 | 5.3 | 4 | 353.9 | 6.2 | 4 | 403.9 | 7.1 | 4 | 453.9 | 7.9 | 4 | 503.9 | 8.8 | 4 | 553.9 | 9.7 |
| 5 | 305.0 | 5.3 | 5 | 354.9 | 6.2 | 5 | 404.9 | 7.1 | 5 | 454.9 | 7.9 | 5 | 504.9 | 8.8 | 5 | 554.9 | 9.7 |
| 6 | 306.0 | 5.3 | 6 | 355.9 | 6.2 | 6 | 405.9 | 7.1 | 6 | 455.9 | 8.0 | 6 | 505.9 | 8.8 | 6 | 555.9 | 9.7 |
| 7 | 307.0 | 5.4 | 7 | 356.9 | 6.2 | 7 | 406.9 | 7.1 | 7 | 456.9 | 8.0 | 7 | 506.9 | 8.8 | 7 | 556.9 | 9.7 |
| 8 | 308.0 | 5.4 | 8 | 357.9 | 6.2 | 8 | 407.9 | 7.1 | 8 | 457.9 | 8.0 | 8 | 507.9 | 8.9 | 8 | 557.9 | 9.7 |
| 9 | 309.0 | 5.4 | 9 | 358.9 | 6.3 | 9 | 408.9 | 7.1 | 9 | 458.9 | 8.0 | 9 | 508.9 | 8.9 | 9 | 558.9 | 9.8 |
| 310 | 310.0 | 5.4 | 360 | 359.9 | 6.3 | 410 | 409.9 | 7.2 | 460 | 459.9 | 8.0 | 510 | 509.9 | 8.9 | 560 | 559.9 | 9.8 |
| 1 | 311.0 | 5.4 | 1 | 360.9 | 6.3 | 1 | 410.9 | 7.2 | 1 | 460.9 | 8.0 | 1 | 510.9 | 8.9 | 1 | 560.9 | 9.8 |
| 2 | 312.0 | 5.4 | 2 | 361.9 | 6.3 | 2 | 411.9 | 7.2 | 2 | 461.9 | 8.1 | 2 | 511.9 | 8.9 | 2 | 561.9 | 9.8 |
| 3 | 313.0 | 5.5 | 3 | 362.9 | 6.3 | 3 | 412.9 | 7.2 | 3 | 462.9 | 8.1 | 3 | 512.9 | 9.0 | 3 | 562.9 | 9.8 |
| 4 | 314.0 | 5.5 | 4 | 363.9 | 6.4 | 4 | 413.9 | 7.2 | 4 | 463.9 | 8.1 | 4 | 513.9 | 9.0 | 4 | 563.9 | 9.8 |
| 5 | 315.0 | 5.5 | 5 | 364.9 | 6.4 | 5 | 414.9 | 7.2 | 5 | 464.9 | 8.1 | 5 | 514.9 | 9.0 | 5 | 564.9 | 9.9 |
| 6 | 316.0 | 5.5 | 6 | 365.9 | 6.4 | 6 | 415.9 | 7.3 | 6 | 465.9 | 8.1 | 6 | 515.9 | 9.0 | 6 | 565.9 | 9.9 |
| 7 | 317.0 | 5.5 | 7 | 366.9 | 6.4 | 7 | 416.9 | 7.3 | 7 | 466.9 | 8.2 | 7 | 516.9 | 9.0 | 7 | 566.9 | 9.9 |
| 8 | 318.0 | 5.5 | 8 | 367.9 | 6.4 | 8 | 417.9 | 7.3 | 8 | 467.9 | 8.2 | 8 | 517.9 | 9.0 | 8 | 567.9 | 9.9 |
| 9 | 319.0 | 5.6 | 9 | 368.9 | 6.4 | 9 | 418.9 | 7.3 | 9 | 468.9 | 8.2 | 9 | 518.9 | 9.1 | 9 | 568.9 | 9.9 |
| 320 | 320.0 | 5.6 | 370 | 369.9 | 6.5 | 420 | 419.9 | 7.3 | 470 | 469.9 | 8.2 | 520 | 519.9 | 9.1 | 570 | 569.9 | 9.9 |
| 1 | 321.0 | 5.6 | 1 | 370.9 | 6.5 | 1 | 420.9 | 7.3 | 1 | 470.9 | 8.2 | 1 | 520.9 | 9.1 | 1 | 570.9 | 10.0 |
| 2 | 322.0 | 5.6 | 2 | 371.9 | 6.5 | 2 | 421.9 | 7.4 | 2 | 471.9 | 8.2 | 2 | 521.9 | 9.1 | 2 | 571.9 | 10.0 |
| 3 | 323.0 | 5.6 | 3 | 372.9 | 6.5 | 3 | 422.9 | 7.4 | 3 | 472.9 | 8.3 | 3 | 522.9 | 9.1 | 3 | 572.9 | 10.0 |
| 4 | 324.0 | 5.7 | 4 | 373.9 | 6.5 | 4 | 423.9 | 7.4 | 4 | 473.9 | 8.3 | 4 | 523.9 | 9.1 | 4 | 573.9 | 10.0 |
| 5 | 325.0 | 5.7 | 5 | 374.9 | 6.5 | 5 | 424.9 | 7.4 | 5 | 474.9 | 8.3 | 5 | 524.9 | 9.2 | 5 | 574.9 | 10.0 |
| 6 | 326.0 | 5.7 | 6 | 375.9 | 6.6 | 6 | 425.9 | 7.4 | 6 | 475.9 | 8.3 | 6 | 525.9 | 9.2 | 6 | 575.9 | 10.1 |
| 7 | 327.0 | 5.7 | 7 | 376.9 | 6.6 | 7 | 426.9 | 7.5 | 7 | 476.9 | 8.3 | 7 | 526.9 | 9.2 | 7 | 576.9 | 10.1 |
| 8 | 327.9 | 5.7 | 8 | 377.9 | 6.6 | 8 | 427.9 | 7.5 | 8 | 477.9 | 8.3 | 8 | 527.9 | 9.2 | 8 | 577.9 | 10.1 |
| 9 | 328.9 | 5.7 | 9 | 378.9 | 6.6 | 9 | 428.9 | 7.5 | 9 | 478.9 | 8.4 | 9 | 528.9 | 9.2 | 9 | 578.9 | 10.1 |
| 330 | 329.9 | 5.8 | 380 | 379.9 | 6.6 | 430 | 429.9 | 7.5 | 480 | 479.9 | 8.4 | 530 | 529.9 | 9.2 | 580 | 579.9 | 10.1 |
| 1 | 330.9 | 5.8 | 1 | 380.9 | 6.6 | 1 | 430.9 | 7.5 | 1 | 480.9 | 8.4 | 1 | 530.9 | 9.3 | 1 | 580.9 | 10.1 |
| 2 | 331.9 | 5.8 | 2 | 381.9 | 6.7 | 2 | 431.9 | 7.5 | 2 | 481.9 | 8.4 | 2 | 531.9 | 9.3 | 2 | 581.9 | 10.2 |
| 3 | 332.9 | 5.8 | 3 | 382.9 | 6.7 | 3 | 432.9 | 7.6 | 3 | 482.9 | 8.4 | 3 | 532.9 | 9.3 | 3 | 582.9 | 10.2 |
| 4 | 333.9 | 5.8 | 4 | 383.9 | 6.7 | 4 | 433.9 | 7.6 | 4 | 483.9 | 8.4 | 4 | 533.9 | 9.3 | 4 | 583.9 | 10.2 |
| 5 | 334.9 | 5.8 | 5 | 384.9 | 6.7 | 5 | 434.9 | 7.6 | 5 | 484.9 | 8.5 | 5 | 534.9 | 9.3 | 5 | 584.9 | 10.2 |
| 6 | 335.9 | 5.9 | 6 | 385.9 | 6.7 | 6 | 435.9 | 7.6 | 6 | 485.9 | 8.5 | 6 | 535.9 | 9.4 | 6 | 585.9 | 10.2 |
| 7 | 336.9 | 5.9 | 7 | 386.9 | 6.8 | 7 | 436.9 | 7.6 | 7 | 486.9 | 8.5 | 7 | 536.9 | 9.4 | 7 | 586.9 | 10.2 |
| 8 | 337.9 | 5.9 | 8 | 387.9 | 6.8 | 8 | 437.9 | 7.6 | 8 | 487.9 | 8.5 | 8 | 537.9 | 9.4 | 8 | 587.9 | 10.3 |
| 9 | 338.9 | 5.9 | 9 | 388.9 | 6.8 | 9 | 438.9 | 7.7 | 9 | 488.9 | 8.5 | 9 | 538.9 | 9.4 | 9 | 588.9 | 10.3 |
| 340 | 339.9 | 5.9 | 390 | 389.9 | 6.8 | 440 | 439.9 | 7.7 | 490 | 489.9 | 8.6 | 540 | 539.9 | 9.4 | 590 | 589.9 | 10.3 |
| 1 | 340.9 | 6.0 | 1 | 390.9 | 6.8 | 1 | 440.9 | 7.7 | 1 | 490.9 | 8.6 | 1 | 540.9 | 9.4 | 1 | 590.9 | 10.3 |
| 2 | 341.9 | 6.0 | 2 | 391.9 | 6.8 | 2 | 441.9 | 7.7 | 2 | 491.9 | 8.6 | 2 | 541.9 | 9.5 | 2 | 591.9 | 10.3 |
| 3 | 342.9 | 6.0 | 3 | 392.9 | 6.9 | 3 | 442.9 | 7.7 | 3 | 492.9 | 8.6 | 3 | 542.9 | 9.5 | 3 | 592.9 | 10.3 |
| 4 | 343.9 | 6.0 | 4 | 393.9 | 6.9 | 4 | 443.9 | 7.7 | 4 | 493.9 | 8.6 | 4 | 543.9 | 9.5 | 4 | 593.9 | 10.4 |
| 5 | 344.9 | 6.0 | 5 | 394.9 | 6.9 | 5 | 444.9 | 7.8 | 5 | 494.9 | 8.6 | 5 | 544.9 | 9.5 | 5 | 594.9 | 10.4 |
| 6 | 345.9 | 6.0 | 6 | 395.9 | 6.9 | 6 | 445.9 | 7.8 | 6 | 495.9 | 8.7 | 6 | 545.9 | 9.5 | 6 | 595.9 | 10.4 |
| 7 | 346.9 | 6.1 | 7 | 396.9 | 6.9 | 7 | 446.9 | 7.8 | 7 | 496.9 | 8.7 | 7 | 546.9 | 9.5 | 7 | 596.9 | 10.4 |
| 8 | 347.9 | 6.1 | 8 | 397.9 | 6.9 | 8 | 447.9 | 7.8 | 8 | 497.9 | 8.7 | 8 | 547.9 | 9.6 | 8 | 597.9 | 10.4 |
| 9 | 348.9 | 6.1 | 9 | 398.9 | 7.0 | 9 | 448.9 | 7.8 | 9 | 498.9 | 8.7 | 9 | 548.9 | 9.6 | 9 | 598.9 | 10.5 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 271 315
269 269 225

R

089 089° 045
091 091 135

R ou φm

R

TABELA 1

R ou φm

359 358° 315

181 182 225

TÁBUAS DE CARTEAÇÃO

001 002 045

179 178 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----------|------|-----|----------|------|-----|----------|-------|-----|----------|-------|-----|----------|-------|-----|----------|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 50.0 | 1.7 | 100 | 99.9 | 3.5 | 150 | 149.9 | 5.2 | 200 | 199.9 | 7.0 | 250 | 249.8 | 8.7 |
| 1 | 1.0 | 0.0 | 1 | 51.0 | 1.8 | 1 | 100.9 | 3.5 | 1 | 150.9 | 5.3 | 1 | 200.9 | 7.0 | 1 | 250.8 | 8.8 |
| 2 | 2.0 | 0.1 | 2 | 52.0 | 1.8 | 2 | 101.9 | 3.6 | 2 | 151.9 | 5.3 | 2 | 201.9 | 7.0 | 2 | 251.8 | 8.8 |
| 3 | 3.0 | 0.1 | 3 | 53.0 | 1.8 | 3 | 102.9 | 3.6 | 3 | 152.9 | 5.3 | 3 | 202.9 | 7.1 | 3 | 252.8 | 8.8 |
| 4 | 4.0 | 0.1 | 4 | 54.0 | 1.9 | 4 | 103.9 | 3.6 | 4 | 153.9 | 5.4 | 4 | 203.9 | 7.1 | 4 | 253.8 | 8.9 |
| 5 | 5.0 | 0.2 | 5 | 55.0 | 1.9 | 5 | 104.9 | 3.7 | 5 | 154.9 | 5.4 | 5 | 204.9 | 7.2 | 5 | 254.8 | 8.9 |
| 6 | 6.0 | 0.2 | 6 | 56.0 | 2.0 | 6 | 105.9 | 3.7 | 6 | 155.9 | 5.4 | 6 | 205.9 | 7.2 | 6 | 255.8 | 8.9 |
| 7 | 7.0 | 0.2 | 7 | 57.0 | 2.0 | 7 | 106.9 | 3.7 | 7 | 156.9 | 5.5 | 7 | 206.9 | 7.2 | 7 | 256.8 | 9.0 |
| 8 | 8.0 | 0.3 | 8 | 58.0 | 2.0 | 8 | 107.9 | 3.8 | 8 | 157.9 | 5.5 | 8 | 207.9 | 7.3 | 8 | 257.8 | 9.0 |
| 9 | 9.0 | 0.3 | 9 | 59.0 | 2.1 | 9 | 108.9 | 3.8 | 9 | 158.9 | 5.5 | 9 | 208.9 | 7.3 | 9 | 258.8 | 9.0 |
| 10 | 10.0 | 0.3 | 60 | 60.0 | 2.1 | 110 | 109.9 | 3.8 | 160 | 159.9 | 5.6 | 210 | 209.9 | 7.3 | 260 | 259.8 | 9.1 |
| 1 | 11.0 | 0.4 | 1 | 61.0 | 2.1 | 1 | 110.9 | 3.9 | 1 | 160.9 | 5.6 | 1 | 210.9 | 7.4 | 1 | 260.8 | 9.1 |
| 2 | 12.0 | 0.4 | 2 | 62.0 | 2.2 | 2 | 111.9 | 3.9 | 2 | 161.9 | 5.7 | 2 | 211.9 | 7.4 | 2 | 261.8 | 9.1 |
| 3 | 13.0 | 0.5 | 3 | 63.0 | 2.2 | 3 | 112.9 | 3.9 | 3 | 162.9 | 5.7 | 3 | 212.9 | 7.4 | 3 | 262.8 | 9.2 |
| 4 | 14.0 | 0.5 | 4 | 64.0 | 2.2 | 4 | 113.9 | 4.0 | 4 | 163.9 | 5.7 | 4 | 213.9 | 7.5 | 4 | 263.8 | 9.2 |
| 5 | 15.0 | 0.5 | 5 | 65.0 | 2.3 | 5 | 114.9 | 4.0 | 5 | 164.9 | 5.8 | 5 | 214.9 | 7.5 | 5 | 264.8 | 9.2 |
| 6 | 16.0 | 0.6 | 6 | 66.0 | 2.3 | 6 | 115.9 | 4.0 | 6 | 165.9 | 5.8 | 6 | 215.9 | 7.5 | 6 | 265.8 | 9.3 |
| 7 | 17.0 | 0.6 | 7 | 67.0 | 2.3 | 7 | 116.9 | 4.1 | 7 | 166.9 | 5.8 | 7 | 216.9 | 7.6 | 7 | 266.8 | 9.3 |
| 8 | 18.0 | 0.6 | 8 | 68.0 | 2.4 | 8 | 117.9 | 4.1 | 8 | 167.9 | 5.9 | 8 | 217.9 | 7.6 | 8 | 267.8 | 9.4 |
| 9 | 19.0 | 0.7 | 9 | 69.0 | 2.4 | 9 | 118.9 | 4.2 | 9 | 168.9 | 5.9 | 9 | 218.9 | 7.6 | 9 | 268.8 | 9.4 |
| 20 | 20.0 | 0.7 | 70 | 70.0 | 2.4 | 120 | 119.9 | 4.2 | 170 | 169.9 | 5.9 | 220 | 219.9 | 7.7 | 270 | 269.8 | 9.4 |
| 1 | 21.0 | 0.7 | 1 | 71.0 | 2.5 | 1 | 120.9 | 4.2 | 1 | 170.9 | 6.0 | 1 | 220.9 | 7.7 | 1 | 270.8 | 9.5 |
| 2 | 22.0 | 0.8 | 2 | 72.0 | 2.5 | 2 | 121.9 | 4.3 | 2 | 171.9 | 6.0 | 2 | 221.9 | 7.7 | 2 | 271.8 | 9.5 |
| 3 | 23.0 | 0.8 | 3 | 73.0 | 2.5 | 3 | 122.9 | 4.3 | 3 | 172.9 | 6.0 | 3 | 222.9 | 7.8 | 3 | 272.8 | 9.5 |
| 4 | 24.0 | 0.8 | 4 | 74.0 | 2.6 | 4 | 123.9 | 4.3 | 4 | 173.9 | 6.1 | 4 | 223.9 | 7.8 | 4 | 273.8 | 9.6 |
| 5 | 25.0 | 0.9 | 5 | 75.0 | 2.6 | 5 | 124.9 | 4.4 | 5 | 174.9 | 6.1 | 5 | 224.9 | 7.9 | 5 | 274.8 | 9.6 |
| 6 | 26.0 | 0.9 | 6 | 76.0 | 2.7 | 6 | 125.9 | 4.4 | 6 | 175.9 | 6.1 | 6 | 225.9 | 7.9 | 6 | 275.8 | 9.6 |
| 7 | 27.0 | 0.9 | 7 | 77.0 | 2.7 | 7 | 126.9 | 4.4 | 7 | 176.9 | 6.2 | 7 | 226.9 | 7.9 | 7 | 276.8 | 9.7 |
| 8 | 28.0 | 1.0 | 8 | 78.0 | 2.7 | 8 | 127.9 | 4.5 | 8 | 177.9 | 6.2 | 8 | 227.9 | 8.0 | 8 | 277.8 | 9.7 |
| 9 | 29.0 | 1.0 | 9 | 79.0 | 2.8 | 9 | 128.9 | 4.5 | 9 | 178.9 | 6.2 | 9 | 228.9 | 8.0 | 9 | 278.8 | 9.7 |
| 30 | 30.0 | 1.0 | 80 | 80.0 | 2.8 | 130 | 129.9 | 4.5 | 180 | 179.9 | 6.3 | 230 | 229.9 | 8.0 | 280 | 279.8 | 9.8 |
| 1 | 31.0 | 1.1 | 1 | 81.0 | 2.8 | 1 | 130.9 | 4.6 | 1 | 180.9 | 6.3 | 1 | 230.9 | 8.1 | 1 | 280.8 | 9.8 |
| 2 | 32.0 | 1.1 | 2 | 82.0 | 2.9 | 2 | 131.9 | 4.6 | 2 | 181.9 | 6.4 | 2 | 231.9 | 8.1 | 2 | 281.8 | 9.8 |
| 3 | 33.0 | 1.2 | 3 | 82.9 | 2.9 | 3 | 132.9 | 4.6 | 3 | 182.9 | 6.4 | 3 | 232.9 | 8.1 | 3 | 282.8 | 9.9 |
| 4 | 34.0 | 1.2 | 4 | 83.9 | 2.9 | 4 | 133.9 | 4.7 | 4 | 183.9 | 6.4 | 4 | 233.9 | 8.2 | 4 | 283.8 | 9.9 |
| 5 | 35.0 | 1.2 | 5 | 84.9 | 3.0 | 5 | 134.9 | 4.7 | 5 | 184.9 | 6.5 | 5 | 234.9 | 8.2 | 5 | 284.8 | 9.9 |
| 6 | 36.0 | 1.3 | 6 | 85.9 | 3.0 | 6 | 135.9 | 4.7 | 6 | 185.9 | 6.5 | 6 | 235.9 | 8.2 | 6 | 285.8 | 10.0 |
| 7 | 37.0 | 1.3 | 7 | 86.9 | 3.0 | 7 | 136.9 | 4.8 | 7 | 186.9 | 6.5 | 7 | 236.9 | 8.3 | 7 | 286.8 | 10.0 |
| 8 | 38.0 | 1.3 | 8 | 87.9 | 3.1 | 8 | 137.9 | 4.8 | 8 | 187.9 | 6.6 | 8 | 237.9 | 8.3 | 8 | 287.8 | 10.1 |
| 9 | 39.0 | 1.4 | 9 | 88.9 | 3.1 | 9 | 138.9 | 4.9 | 9 | 188.9 | 6.6 | 9 | 238.9 | 8.3 | 9 | 288.8 | 10.1 |
| 40 | 40.0 | 1.4 | 90 | 89.9 | 3.1 | 140 | 139.9 | 4.9 | 190 | 189.9 | 6.6 | 240 | 239.9 | 8.4 | 290 | 289.8 | 10.1 |
| 1 | 41.0 | 1.4 | 1 | 90.9 | 3.2 | 1 | 140.9 | 4.9 | 1 | 190.9 | 6.7 | 1 | 240.9 | 8.4 | 1 | 290.8 | 10.2 |
| 2 | 42.0 | 1.5 | 2 | 91.9 | 3.2 | 2 | 141.9 | 5.0 | 2 | 191.9 | 6.7 | 2 | 241.9 | 8.4 | 2 | 291.8 | 10.2 |
| 3 | 43.0 | 1.5 | 3 | 92.9 | 3.2 | 3 | 142.9 | 5.0 | 3 | 192.9 | 6.7 | 3 | 242.9 | 8.5 | 3 | 292.8 | 10.2 |
| 4 | 44.0 | 1.5 | 4 | 93.9 | 3.3 | 4 | 143.9 | 5.0 | 4 | 193.9 | 6.8 | 4 | 243.9 | 8.5 | 4 | 293.8 | 10.3 |
| 5 | 45.0 | 1.6 | 5 | 94.9 | 3.3 | 5 | 144.9 | 5.1 | 5 | 194.9 | 6.8 | 5 | 244.9 | 8.6 | 5 | 294.8 | 10.3 |
| 6 | 46.0 | 1.6 | 6 | 95.9 | 3.4 | 6 | 145.9 | 5.1 | 6 | 195.9 | 6.8 | 6 | 245.9 | 8.6 | 6 | 295.8 | 10.3 |
| 7 | 47.0 | 1.6 | 7 | 96.9 | 3.4 | 7 | 146.9 | 5.1 | 7 | 196.9 | 6.9 | 7 | 246.8 | 8.6 | 7 | 296.8 | 10.4 |
| 8 | 48.0 | 1.7 | 8 | 97.9 | 3.4 | 8 | 147.9 | 5.2 | 8 | 197.9 | 6.9 | 8 | 247.8 | 8.7 | 8 | 297.8 | 10.4 |
| 9 | 49.0 | 1.7 | 9 | 98.9 | 3.5 | 9 | 148.9 | 5.2 | 9 | 198.9 | 6.9 | 9 | 248.8 | 8.7 | 9 | 298.8 | 10.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 272 315

269 268 225

R

089 088° 045

091 092 135

R ou φm

R

TABELA 1

R ou φm

359 358° 315
181 182 225

TÁBUAS DE CARTEAÇÃO

001 002 045
178 178 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 299.8 | 10.5 | 350 | 349.8 | 12.2 | 400 | 399.8 | 14.0 | 450 | 449.7 | 15.7 | 500 | 499.7 | 17.4 | 550 | 549.7 | 19.2 |
| 1 | 300.8 | 10.5 | 1 | 350.8 | 12.2 | 1 | 400.8 | 14.0 | 1 | 450.7 | 15.7 | 1 | 500.7 | 17.5 | 1 | 550.7 | 19.2 |
| 2 | 301.8 | 10.5 | 2 | 351.8 | 12.3 | 2 | 401.8 | 14.0 | 2 | 451.7 | 15.8 | 2 | 501.7 | 17.5 | 2 | 551.7 | 19.3 |
| 3 | 302.8 | 10.6 | 3 | 352.8 | 12.3 | 3 | 402.8 | 14.1 | 3 | 452.7 | 15.8 | 3 | 502.7 | 17.6 | 3 | 552.7 | 19.3 |
| 4 | 303.8 | 10.6 | 4 | 353.8 | 12.4 | 4 | 403.8 | 14.1 | 4 | 453.7 | 15.8 | 4 | 503.7 | 17.6 | 4 | 553.7 | 19.3 |
| 5 | 304.8 | 10.6 | 5 | 354.8 | 12.4 | 5 | 404.8 | 14.1 | 5 | 454.7 | 15.9 | 5 | 504.7 | 17.6 | 5 | 554.7 | 19.4 |
| 6 | 305.8 | 10.7 | 6 | 355.8 | 12.4 | 6 | 405.8 | 14.2 | 6 | 455.7 | 15.9 | 6 | 505.7 | 17.7 | 6 | 555.7 | 19.4 |
| 7 | 306.8 | 10.7 | 7 | 356.8 | 12.5 | 7 | 406.8 | 14.2 | 7 | 456.7 | 15.9 | 7 | 506.7 | 17.7 | 7 | 556.7 | 19.4 |
| 8 | 307.8 | 10.7 | 8 | 357.8 | 12.5 | 8 | 407.8 | 14.2 | 8 | 457.7 | 16.0 | 8 | 507.7 | 17.7 | 8 | 557.7 | 19.5 |
| 9 | 308.8 | 10.8 | 9 | 358.8 | 12.5 | 9 | 408.8 | 14.3 | 9 | 458.7 | 16.0 | 9 | 508.7 | 17.8 | 9 | 558.7 | 19.5 |
| 310 | 309.8 | 10.8 | 360 | 359.8 | 12.6 | 410 | 409.8 | 14.3 | 460 | 459.7 | 16.1 | 510 | 509.7 | 17.8 | 560 | 559.7 | 19.5 |
| 1 | 310.8 | 10.9 | 1 | 360.8 | 12.6 | 1 | 410.7 | 14.3 | 1 | 460.7 | 16.1 | 1 | 510.7 | 17.8 | 1 | 560.7 | 19.6 |
| 2 | 311.8 | 10.9 | 2 | 361.8 | 12.6 | 2 | 411.7 | 14.4 | 2 | 461.7 | 16.1 | 2 | 511.7 | 17.9 | 2 | 561.7 | 19.6 |
| 3 | 312.8 | 10.9 | 3 | 362.8 | 12.7 | 3 | 412.7 | 14.4 | 3 | 462.7 | 16.2 | 3 | 512.7 | 17.9 | 3 | 562.7 | 19.6 |
| 4 | 313.8 | 11.0 | 4 | 363.8 | 12.7 | 4 | 413.7 | 14.4 | 4 | 463.7 | 16.2 | 4 | 513.7 | 17.9 | 4 | 563.7 | 19.7 |
| 5 | 314.8 | 11.0 | 5 | 364.8 | 12.7 | 5 | 414.7 | 14.5 | 5 | 464.7 | 16.2 | 5 | 514.7 | 18.0 | 5 | 564.7 | 19.7 |
| 6 | 315.8 | 11.0 | 6 | 365.8 | 12.8 | 6 | 415.7 | 14.5 | 6 | 465.7 | 16.3 | 6 | 515.7 | 18.0 | 6 | 565.7 | 19.8 |
| 7 | 316.8 | 11.1 | 7 | 366.8 | 12.8 | 7 | 416.7 | 14.6 | 7 | 466.7 | 16.3 | 7 | 516.7 | 18.0 | 7 | 566.7 | 19.8 |
| 8 | 317.8 | 11.1 | 8 | 367.8 | 12.8 | 8 | 417.7 | 14.6 | 8 | 467.7 | 16.3 | 8 | 517.7 | 18.1 | 8 | 567.7 | 19.8 |
| 9 | 318.8 | 11.1 | 9 | 368.8 | 12.9 | 9 | 418.7 | 14.6 | 9 | 468.7 | 16.4 | 9 | 518.7 | 18.1 | 9 | 568.7 | 19.9 |
| 320 | 319.8 | 11.2 | 370 | 369.8 | 12.9 | 420 | 419.7 | 14.7 | 470 | 469.7 | 16.4 | 520 | 519.7 | 18.1 | 570 | 569.7 | 19.9 |
| 1 | 320.8 | 11.2 | 1 | 370.8 | 12.9 | 1 | 420.7 | 14.7 | 1 | 470.7 | 16.4 | 1 | 520.7 | 18.2 | 1 | 570.7 | 19.9 |
| 2 | 321.8 | 11.2 | 2 | 371.8 | 13.0 | 2 | 421.7 | 14.7 | 2 | 471.7 | 16.5 | 2 | 521.7 | 18.2 | 2 | 571.7 | 20.0 |
| 3 | 322.8 | 11.3 | 3 | 372.8 | 13.0 | 3 | 422.7 | 14.8 | 3 | 472.7 | 16.5 | 3 | 522.7 | 18.3 | 3 | 572.7 | 20.0 |
| 4 | 323.8 | 11.3 | 4 | 373.8 | 13.1 | 4 | 423.7 | 14.8 | 4 | 473.7 | 16.5 | 4 | 523.7 | 18.3 | 4 | 573.7 | 20.0 |
| 5 | 324.8 | 11.3 | 5 | 374.8 | 13.1 | 5 | 424.7 | 14.8 | 5 | 474.7 | 16.6 | 5 | 524.7 | 18.3 | 5 | 574.6 | 20.1 |
| 6 | 325.8 | 11.4 | 6 | 375.8 | 13.1 | 6 | 425.7 | 14.9 | 6 | 475.7 | 16.6 | 6 | 525.7 | 18.4 | 6 | 575.6 | 20.1 |
| 7 | 326.8 | 11.4 | 7 | 376.8 | 13.2 | 7 | 426.7 | 14.9 | 7 | 476.7 | 16.6 | 7 | 526.7 | 18.4 | 7 | 576.6 | 20.1 |
| 8 | 327.8 | 11.4 | 8 | 377.8 | 13.2 | 8 | 427.7 | 14.9 | 8 | 477.7 | 16.7 | 8 | 527.7 | 18.4 | 8 | 577.6 | 20.2 |
| 9 | 328.8 | 11.5 | 9 | 378.8 | 13.2 | 9 | 428.7 | 15.0 | 9 | 478.7 | 16.7 | 9 | 528.7 | 18.5 | 9 | 578.6 | 20.2 |
| 330 | 329.8 | 11.5 | 380 | 379.8 | 13.3 | 430 | 429.7 | 15.0 | 480 | 479.7 | 16.8 | 530 | 529.7 | 18.5 | 580 | 579.6 | 20.2 |
| 1 | 330.8 | 11.6 | 1 | 380.8 | 13.3 | 1 | 430.7 | 15.0 | 1 | 480.7 | 16.8 | 1 | 530.7 | 18.5 | 1 | 580.6 | 20.3 |
| 2 | 331.8 | 11.6 | 2 | 381.8 | 13.3 | 2 | 431.7 | 15.1 | 2 | 481.7 | 16.8 | 2 | 531.7 | 18.6 | 2 | 581.6 | 20.3 |
| 3 | 332.8 | 11.6 | 3 | 382.8 | 13.4 | 3 | 432.7 | 15.1 | 3 | 482.7 | 16.9 | 3 | 532.7 | 18.6 | 3 | 582.6 | 20.3 |
| 4 | 333.8 | 11.7 | 4 | 383.8 | 13.4 | 4 | 433.7 | 15.1 | 4 | 483.7 | 16.9 | 4 | 533.7 | 18.6 | 4 | 583.6 | 20.4 |
| 5 | 334.8 | 11.7 | 5 | 384.8 | 13.4 | 5 | 434.7 | 15.2 | 5 | 484.7 | 16.9 | 5 | 534.7 | 18.7 | 5 | 584.6 | 20.4 |
| 6 | 335.8 | 11.7 | 6 | 385.8 | 13.5 | 6 | 435.7 | 15.2 | 6 | 485.7 | 17.0 | 6 | 535.7 | 18.7 | 6 | 585.6 | 20.5 |
| 7 | 336.8 | 11.8 | 7 | 386.8 | 13.5 | 7 | 436.7 | 15.3 | 7 | 486.7 | 17.0 | 7 | 536.7 | 18.7 | 7 | 586.6 | 20.5 |
| 8 | 337.8 | 11.8 | 8 | 387.8 | 13.5 | 8 | 437.7 | 15.3 | 8 | 487.7 | 17.0 | 8 | 537.7 | 18.8 | 8 | 587.6 | 20.5 |
| 9 | 338.8 | 11.8 | 9 | 388.8 | 13.6 | 9 | 438.7 | 15.3 | 9 | 488.7 | 17.1 | 9 | 538.7 | 18.8 | 9 | 588.6 | 20.6 |
| 340 | 339.8 | 11.9 | 390 | 389.8 | 13.6 | 440 | 439.7 | 15.4 | 490 | 489.7 | 17.1 | 540 | 539.7 | 18.8 | 590 | 589.6 | 20.6 |
| 1 | 340.8 | 11.9 | 1 | 390.8 | 13.6 | 1 | 440.7 | 15.4 | 1 | 490.7 | 17.1 | 1 | 540.7 | 18.9 | 1 | 590.6 | 20.6 |
| 2 | 341.8 | 11.9 | 2 | 391.8 | 13.7 | 2 | 441.7 | 15.4 | 2 | 491.7 | 17.2 | 2 | 541.7 | 18.9 | 2 | 591.6 | 20.7 |
| 3 | 342.8 | 12.0 | 3 | 392.8 | 13.7 | 3 | 442.7 | 15.5 | 3 | 492.7 | 17.2 | 3 | 542.7 | 19.0 | 3 | 592.6 | 20.7 |
| 4 | 343.8 | 12.0 | 4 | 393.8 | 13.8 | 4 | 443.7 | 15.5 | 4 | 493.7 | 17.2 | 4 | 543.7 | 19.0 | 4 | 593.6 | 20.7 |
| 5 | 344.8 | 12.0 | 5 | 394.8 | 13.8 | 5 | 444.7 | 15.5 | 5 | 494.7 | 17.3 | 5 | 544.7 | 19.0 | 5 | 594.6 | 20.8 |
| 6 | 345.8 | 12.1 | 6 | 395.8 | 13.8 | 6 | 445.7 | 15.6 | 6 | 495.7 | 17.3 | 6 | 545.7 | 19.1 | 6 | 595.6 | 20.8 |
| 7 | 346.8 | 12.1 | 7 | 396.8 | 13.9 | 7 | 446.7 | 15.6 | 7 | 496.7 | 17.3 | 7 | 546.7 | 19.1 | 7 | 596.6 | 20.8 |
| 8 | 347.8 | 12.1 | 8 | 397.8 | 13.9 | 8 | 447.7 | 15.6 | 8 | 497.7 | 17.4 | 8 | 547.7 | 19.1 | 8 | 597.6 | 20.9 |
| 9 | 348.8 | 12.2 | 9 | 398.8 | 13.9 | 9 | 448.7 | 15.7 | 9 | 498.7 | 17.4 | 9 | 548.7 | 19.2 | 9 | 598.6 | 20.9 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 272 315
269 268 225

R

089 088° 045
091 092 135

R ou φm

R
359 **357°** 315
181 **183** 225

TABELA 1
TÁBUAS DE CARTEAÇÃO

R ou φ m
001 **003** 045
179 **177** 135

| ΔL | ap | $\Delta \varphi$ | ΔL | ap | $\Delta \varphi$ | ΔL | ap | $\Delta \varphi$ | ΔL | ap | $\Delta \varphi$ | ΔL | ap | $\Delta \varphi$ | ΔL | ap | $\Delta \varphi$ |
|------------|------|------------------|------------|------|------------------|------------|-------|------------------|------------|-------|------------------|------------|-------|------------------|------------|-------|------------------|
| D | | | D | | | D | | | D | | | D | | | D | | |
| 0 | 0.0 | 0.0 | 50 | 49.9 | 2.6 | 100 | 99.9 | 5.2 | 150 | 149.8 | 7.9 | 200 | 199.7 | 10.5 | 250 | 249.7 | 13.1 |
| 1 | 1.0 | 0.1 | 1 | 50.9 | 2.7 | 1 | 100.9 | 5.3 | 1 | 150.8 | 7.9 | 1 | 200.7 | 10.5 | 1 | 250.7 | 13.1 |
| 2 | 2.0 | 0.1 | 2 | 51.9 | 2.7 | 2 | 101.9 | 5.3 | 2 | 151.8 | 8.0 | 2 | 201.7 | 10.6 | 2 | 251.7 | 13.2 |
| 3 | 3.0 | 0.2 | 3 | 52.9 | 2.8 | 3 | 102.9 | 5.4 | 3 | 152.8 | 8.0 | 3 | 202.7 | 10.6 | 3 | 252.7 | 13.2 |
| 4 | 4.0 | 0.2 | 4 | 53.9 | 2.8 | 4 | 103.9 | 5.4 | 4 | 153.8 | 8.1 | 4 | 203.7 | 10.7 | 4 | 253.7 | 13.3 |
| 5 | 5.0 | 0.3 | 5 | 54.9 | 2.9 | 5 | 104.9 | 5.5 | 5 | 154.8 | 8.1 | 5 | 204.7 | 10.7 | 5 | 254.7 | 13.3 |
| 6 | 6.0 | 0.3 | 6 | 55.9 | 2.9 | 6 | 105.9 | 5.5 | 6 | 155.8 | 8.2 | 6 | 205.7 | 10.8 | 6 | 255.6 | 13.4 |
| 7 | 7.0 | 0.4 | 7 | 56.9 | 3.0 | 7 | 106.9 | 5.6 | 7 | 156.8 | 8.2 | 7 | 206.7 | 10.8 | 7 | 256.6 | 13.5 |
| 8 | 8.0 | 0.4 | 8 | 57.9 | 3.0 | 8 | 107.9 | 5.7 | 8 | 157.8 | 8.3 | 8 | 207.7 | 10.9 | 8 | 257.6 | 13.5 |
| 9 | 9.0 | 0.5 | 9 | 58.9 | 3.1 | 9 | 108.9 | 5.7 | 9 | 158.8 | 8.3 | 9 | 208.7 | 10.9 | 9 | 258.6 | 13.6 |
| 10 | 10.0 | 0.5 | 60 | 59.9 | 3.1 | 110 | 109.8 | 5.8 | 160 | 159.8 | 8.4 | 210 | 209.7 | 11.0 | 260 | 259.6 | 13.6 |
| 1 | 11.0 | 0.6 | 1 | 60.9 | 3.2 | 1 | 110.8 | 5.8 | 1 | 160.8 | 8.4 | 1 | 210.7 | 11.0 | 1 | 260.6 | 13.7 |
| 2 | 12.0 | 0.6 | 2 | 61.9 | 3.2 | 2 | 111.8 | 5.9 | 2 | 161.8 | 8.5 | 2 | 211.7 | 11.1 | 2 | 261.6 | 13.7 |
| 3 | 13.0 | 0.7 | 3 | 62.9 | 3.3 | 3 | 112.8 | 5.9 | 3 | 162.8 | 8.5 | 3 | 212.7 | 11.1 | 3 | 262.6 | 13.8 |
| 4 | 14.0 | 0.7 | 4 | 63.9 | 3.3 | 4 | 113.8 | 6.0 | 4 | 163.8 | 8.6 | 4 | 213.7 | 11.2 | 4 | 263.6 | 13.8 |
| 5 | 15.0 | 0.8 | 5 | 64.9 | 3.4 | 5 | 114.8 | 6.0 | 5 | 164.8 | 8.6 | 5 | 214.7 | 11.3 | 5 | 264.6 | 13.9 |
| 6 | 16.0 | 0.8 | 6 | 65.9 | 3.5 | 6 | 115.8 | 6.1 | 6 | 165.8 | 8.7 | 6 | 215.7 | 11.3 | 6 | 265.6 | 13.9 |
| 7 | 17.0 | 0.9 | 7 | 66.9 | 3.5 | 7 | 116.8 | 6.1 | 7 | 166.8 | 8.7 | 7 | 216.7 | 11.4 | 7 | 266.6 | 14.0 |
| 8 | 18.0 | 0.9 | 8 | 67.9 | 3.6 | 8 | 117.8 | 6.2 | 8 | 167.8 | 8.8 | 8 | 217.7 | 11.4 | 8 | 267.6 | 14.0 |
| 9 | 19.0 | 1.0 | 9 | 68.9 | 3.6 | 9 | 118.8 | 6.2 | 9 | 168.8 | 8.8 | 9 | 218.7 | 11.5 | 9 | 268.6 | 14.1 |
| 20 | 20.0 | 1.0 | 70 | 69.9 | 3.7 | 120 | 119.8 | 6.3 | 170 | 169.8 | 8.9 | 220 | 219.7 | 11.5 | 270 | 269.6 | 14.1 |
| 1 | 21.0 | 1.1 | 1 | 70.9 | 3.7 | 1 | 120.8 | 6.3 | 1 | 170.8 | 8.9 | 1 | 220.7 | 11.6 | 1 | 270.6 | 14.2 |
| 2 | 22.0 | 1.2 | 2 | 71.9 | 3.8 | 2 | 121.8 | 6.4 | 2 | 171.8 | 9.0 | 2 | 221.7 | 11.6 | 2 | 271.6 | 14.2 |
| 3 | 23.0 | 1.2 | 3 | 72.9 | 3.8 | 3 | 122.8 | 6.4 | 3 | 172.8 | 9.1 | 3 | 222.7 | 11.7 | 3 | 272.6 | 14.3 |
| 4 | 24.0 | 1.3 | 4 | 73.9 | 3.9 | 4 | 123.8 | 6.5 | 4 | 173.8 | 9.1 | 4 | 223.7 | 11.7 | 4 | 273.6 | 14.3 |
| 5 | 25.0 | 1.3 | 5 | 74.9 | 3.9 | 5 | 124.8 | 6.5 | 5 | 174.8 | 9.2 | 5 | 224.7 | 11.8 | 5 | 274.6 | 14.4 |
| 6 | 26.0 | 1.4 | 6 | 75.9 | 4.0 | 6 | 125.8 | 6.6 | 6 | 175.8 | 9.2 | 6 | 225.7 | 11.8 | 6 | 275.6 | 14.4 |
| 7 | 27.0 | 1.4 | 7 | 76.9 | 4.0 | 7 | 126.8 | 6.6 | 7 | 176.8 | 9.3 | 7 | 226.7 | 11.9 | 7 | 276.6 | 14.5 |
| 8 | 28.0 | 1.5 | 8 | 77.9 | 4.1 | 8 | 127.8 | 6.7 | 8 | 177.8 | 9.3 | 8 | 227.7 | 11.9 | 8 | 277.6 | 14.5 |
| 9 | 29.0 | 1.5 | 9 | 78.9 | 4.1 | 9 | 128.8 | 6.8 | 9 | 178.8 | 9.4 | 9 | 228.7 | 12.0 | 9 | 278.6 | 14.6 |
| 30 | 30.0 | 1.6 | 80 | 79.9 | 4.2 | 130 | 129.8 | 6.8 | 180 | 179.8 | 9.4 | 230 | 229.7 | 12.0 | 280 | 279.6 | 14.7 |
| 1 | 31.0 | 1.6 | 1 | 80.9 | 4.2 | 1 | 130.8 | 6.9 | 1 | 180.8 | 9.5 | 1 | 230.7 | 12.1 | 1 | 280.6 | 14.7 |
| 2 | 32.0 | 1.7 | 2 | 81.9 | 4.3 | 2 | 131.8 | 6.9 | 2 | 181.8 | 9.5 | 2 | 231.7 | 12.1 | 2 | 281.6 | 14.8 |
| 3 | 33.0 | 1.7 | 3 | 82.9 | 4.3 | 3 | 132.8 | 7.0 | 3 | 182.7 | 9.6 | 3 | 232.7 | 12.2 | 3 | 282.6 | 14.8 |
| 4 | 34.0 | 1.8 | 4 | 83.9 | 4.4 | 4 | 133.8 | 7.0 | 4 | 183.7 | 9.6 | 4 | 233.7 | 12.2 | 4 | 283.6 | 14.9 |
| 5 | 35.0 | 1.8 | 5 | 84.9 | 4.4 | 5 | 134.8 | 7.1 | 5 | 184.7 | 9.7 | 5 | 234.7 | 12.3 | 5 | 284.6 | 14.9 |
| 6 | 36.0 | 1.9 | 6 | 85.9 | 4.5 | 6 | 135.8 | 7.1 | 6 | 185.7 | 9.7 | 6 | 235.7 | 12.4 | 6 | 285.6 | 15.0 |
| 7 | 36.9 | 1.9 | 7 | 86.9 | 4.6 | 7 | 136.8 | 7.2 | 7 | 186.7 | 9.8 | 7 | 236.7 | 12.4 | 7 | 286.6 | 15.0 |
| 8 | 37.9 | 2.0 | 8 | 87.9 | 4.6 | 8 | 137.8 | 7.2 | 8 | 187.7 | 9.8 | 8 | 237.7 | 12.5 | 8 | 287.6 | 15.1 |
| 9 | 38.9 | 2.0 | 9 | 88.9 | 4.7 | 9 | 138.8 | 7.3 | 9 | 188.7 | 9.9 | 9 | 238.7 | 12.5 | 9 | 288.6 | 15.1 |
| 40 | 39.9 | 2.1 | 90 | 89.9 | 4.7 | 140 | 139.8 | 7.3 | 190 | 189.7 | 9.9 | 240 | 239.7 | 12.6 | 290 | 289.6 | 15.2 |
| 1 | 40.9 | 2.1 | 1 | 90.9 | 4.8 | 1 | 140.8 | 7.4 | 1 | 190.7 | 10.0 | 1 | 240.7 | 12.6 | 1 | 290.6 | 15.2 |
| 2 | 41.9 | 2.2 | 2 | 91.9 | 4.8 | 2 | 141.8 | 7.4 | 2 | 191.7 | 10.0 | 2 | 241.7 | 12.7 | 2 | 291.6 | 15.3 |
| 3 | 42.9 | 2.3 | 3 | 92.9 | 4.9 | 3 | 142.8 | 7.5 | 3 | 192.7 | 10.1 | 3 | 242.7 | 12.7 | 3 | 292.6 | 15.3 |
| 4 | 43.9 | 2.3 | 4 | 93.9 | 4.9 | 4 | 143.8 | 7.5 | 4 | 193.7 | 10.2 | 4 | 243.7 | 12.8 | 4 | 293.6 | 15.4 |
| 5 | 44.9 | 2.4 | 5 | 94.9 | 5.0 | 5 | 144.8 | 7.6 | 5 | 194.7 | 10.2 | 5 | 244.7 | 12.8 | 5 | 294.6 | 15.4 |
| 6 | 45.9 | 2.4 | 6 | 95.9 | 5.0 | 6 | 145.8 | 7.6 | 6 | 195.7 | 10.3 | 6 | 245.7 | 12.9 | 6 | 295.6 | 15.5 |
| 7 | 46.9 | 2.5 | 7 | 96.9 | 5.1 | 7 | 146.8 | 7.7 | 7 | 196.7 | 10.3 | 7 | 246.7 | 12.9 | 7 | 296.6 | 15.5 |
| 8 | 47.9 | 2.5 | 8 | 97.9 | 5.1 | 8 | 147.8 | 7.7 | 8 | 197.7 | 10.4 | 8 | 247.7 | 13.0 | 8 | 297.6 | 15.6 |
| 9 | 48.9 | 2.6 | 9 | 98.9 | 5.2 | 9 | 148.8 | 7.8 | 9 | 198.7 | 10.4 | 9 | 248.7 | 13.0 | 9 | 298.6 | 15.6 |
| D | ap | $\Delta \varphi$ | D | ap | $\Delta \varphi$ | D | ap | $\Delta \varphi$ | D | ap | $\Delta \varphi$ | D | ap | $\Delta \varphi$ | D | ap | $\Delta \varphi$ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 **273** 315
269 **267** 225
R

089 **087°** 045
091 **093** 135
R ou φ m

R

TABELA 1

R ou φm

359 357° 315
181 183 225

TÁBUAS DE CARTEAÇÃO

001 003 045
179 177 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 299.6 | 15.7 | 350 | 349.5 | 18.3 | 400 | 399.5 | 20.9 | 450 | 449.4 | 23.6 | 500 | 499.3 | 26.2 | 550 | 549.2 | 28.8 |
| 1 | 300.6 | 15.8 | 1 | 350.5 | 18.4 | 1 | 400.5 | 21.0 | 1 | 450.4 | 23.6 | 1 | 500.3 | 26.2 | 1 | 550.2 | 28.8 |
| 2 | 301.6 | 15.8 | 2 | 351.5 | 18.4 | 2 | 401.4 | 21.0 | 2 | 451.4 | 23.7 | 2 | 501.3 | 26.3 | 2 | 551.2 | 28.9 |
| 3 | 302.6 | 15.9 | 3 | 352.5 | 18.5 | 3 | 402.4 | 21.1 | 3 | 452.4 | 23.7 | 3 | 502.3 | 26.3 | 3 | 552.2 | 28.9 |
| 4 | 303.6 | 15.9 | 4 | 353.5 | 18.5 | 4 | 403.4 | 21.1 | 4 | 453.4 | 23.8 | 4 | 503.3 | 26.4 | 4 | 553.2 | 29.0 |
| 5 | 304.6 | 16.0 | 5 | 354.5 | 18.6 | 5 | 404.4 | 21.2 | 5 | 454.4 | 23.8 | 5 | 504.3 | 26.4 | 5 | 554.2 | 29.0 |
| 6 | 305.6 | 16.0 | 6 | 355.5 | 18.6 | 6 | 405.4 | 21.2 | 6 | 455.4 | 23.9 | 6 | 505.3 | 26.5 | 6 | 555.2 | 29.1 |
| 7 | 306.6 | 16.1 | 7 | 356.5 | 18.7 | 7 | 406.4 | 21.3 | 7 | 456.4 | 23.9 | 7 | 506.3 | 26.5 | 7 | 556.2 | 29.2 |
| 8 | 307.6 | 16.1 | 8 | 357.5 | 18.7 | 8 | 407.4 | 21.4 | 8 | 457.4 | 24.0 | 8 | 507.3 | 26.6 | 8 | 557.2 | 29.2 |
| 9 | 308.6 | 16.2 | 9 | 358.5 | 18.8 | 9 | 408.4 | 21.4 | 9 | 458.4 | 24.0 | 9 | 508.3 | 26.6 | 9 | 558.2 | 29.3 |
| 310 | 309.6 | 16.2 | 360 | 359.5 | 18.8 | 410 | 409.4 | 21.5 | 460 | 459.4 | 24.1 | 510 | 509.3 | 26.7 | 560 | 559.2 | 29.3 |
| 1 | 310.6 | 16.3 | 1 | 360.5 | 18.9 | 1 | 410.4 | 21.5 | 1 | 460.4 | 24.1 | 1 | 510.3 | 26.7 | 1 | 560.2 | 29.4 |
| 2 | 311.6 | 16.3 | 2 | 361.5 | 18.9 | 2 | 411.4 | 21.6 | 2 | 461.4 | 24.2 | 2 | 511.3 | 26.8 | 2 | 561.2 | 29.4 |
| 3 | 312.6 | 16.4 | 3 | 362.5 | 19.0 | 3 | 412.4 | 21.6 | 3 | 462.4 | 24.2 | 3 | 512.3 | 26.8 | 3 | 562.2 | 29.5 |
| 4 | 313.6 | 16.4 | 4 | 363.5 | 19.1 | 4 | 413.4 | 21.7 | 4 | 463.4 | 24.3 | 4 | 513.3 | 26.9 | 4 | 563.2 | 29.5 |
| 5 | 314.6 | 16.5 | 5 | 364.5 | 19.1 | 5 | 414.4 | 21.7 | 5 | 464.4 | 24.3 | 5 | 514.3 | 27.0 | 5 | 564.2 | 29.6 |
| 6 | 315.6 | 16.5 | 6 | 365.5 | 19.2 | 6 | 415.4 | 21.8 | 6 | 465.4 | 24.4 | 6 | 515.3 | 27.0 | 6 | 565.2 | 29.6 |
| 7 | 316.6 | 16.6 | 7 | 366.5 | 19.2 | 7 | 416.4 | 21.8 | 7 | 466.4 | 24.4 | 7 | 516.3 | 27.1 | 7 | 566.2 | 29.7 |
| 8 | 317.6 | 16.6 | 8 | 367.5 | 19.3 | 8 | 417.4 | 21.9 | 8 | 467.4 | 24.5 | 8 | 517.3 | 27.1 | 8 | 567.2 | 29.7 |
| 9 | 318.6 | 16.7 | 9 | 368.5 | 19.3 | 9 | 418.4 | 21.9 | 9 | 468.4 | 24.5 | 9 | 518.3 | 27.2 | 9 | 568.2 | 29.8 |
| 320 | 319.6 | 16.7 | 370 | 369.5 | 19.4 | 420 | 419.4 | 22.0 | 470 | 469.4 | 24.6 | 520 | 519.3 | 27.2 | 570 | 569.2 | 29.8 |
| 1 | 320.6 | 16.8 | 1 | 370.5 | 19.4 | 1 | 420.4 | 22.0 | 1 | 470.4 | 24.7 | 1 | 520.3 | 27.3 | 1 | 570.2 | 29.9 |
| 2 | 321.6 | 16.9 | 2 | 371.5 | 19.5 | 2 | 421.4 | 22.1 | 2 | 471.4 | 24.7 | 2 | 521.3 | 27.3 | 2 | 571.2 | 29.9 |
| 3 | 322.6 | 16.9 | 3 | 372.5 | 19.5 | 3 | 422.4 | 22.1 | 3 | 472.4 | 24.8 | 3 | 522.3 | 27.4 | 3 | 572.2 | 30.0 |
| 4 | 323.6 | 17.0 | 4 | 373.5 | 19.6 | 4 | 423.4 | 22.2 | 4 | 473.4 | 24.8 | 4 | 523.3 | 27.4 | 4 | 573.2 | 30.0 |
| 5 | 324.6 | 17.0 | 5 | 374.5 | 19.6 | 5 | 424.4 | 22.2 | 5 | 474.3 | 24.9 | 5 | 524.3 | 27.5 | 5 | 574.2 | 30.1 |
| 6 | 325.6 | 17.1 | 6 | 375.5 | 19.7 | 6 | 425.4 | 22.3 | 6 | 475.3 | 24.9 | 6 | 525.3 | 27.5 | 6 | 575.2 | 30.1 |
| 7 | 326.6 | 17.1 | 7 | 376.5 | 19.7 | 7 | 426.4 | 22.3 | 7 | 476.3 | 25.0 | 7 | 526.3 | 27.6 | 7 | 576.2 | 30.2 |
| 8 | 327.6 | 17.2 | 8 | 377.5 | 19.8 | 8 | 427.4 | 22.4 | 8 | 477.3 | 25.0 | 8 | 527.3 | 27.6 | 8 | 577.2 | 30.3 |
| 9 | 328.5 | 17.2 | 9 | 378.5 | 19.8 | 9 | 428.4 | 22.5 | 9 | 478.3 | 25.1 | 9 | 528.3 | 27.7 | 9 | 578.2 | 30.3 |
| 330 | 329.5 | 17.3 | 380 | 379.5 | 19.9 | 430 | 429.4 | 22.5 | 480 | 479.3 | 25.1 | 530 | 529.3 | 27.7 | 580 | 579.2 | 30.4 |
| 1 | 330.5 | 17.3 | 1 | 380.5 | 19.9 | 1 | 430.4 | 22.6 | 1 | 480.3 | 25.2 | 1 | 530.3 | 27.8 | 1 | 580.2 | 30.4 |
| 2 | 331.5 | 17.4 | 2 | 381.5 | 20.0 | 2 | 431.4 | 22.6 | 2 | 481.3 | 25.2 | 2 | 531.3 | 27.8 | 2 | 581.2 | 30.5 |
| 3 | 332.5 | 17.4 | 3 | 382.5 | 20.0 | 3 | 432.4 | 22.7 | 3 | 482.3 | 25.3 | 3 | 532.3 | 27.9 | 3 | 582.2 | 30.5 |
| 4 | 333.5 | 17.5 | 4 | 383.5 | 20.1 | 4 | 433.4 | 22.7 | 4 | 483.3 | 25.3 | 4 | 533.3 | 27.9 | 4 | 583.2 | 30.6 |
| 5 | 334.5 | 17.5 | 5 | 384.5 | 20.1 | 5 | 434.4 | 22.8 | 5 | 484.3 | 25.4 | 5 | 534.3 | 28.0 | 5 | 584.2 | 30.6 |
| 6 | 335.5 | 17.6 | 6 | 385.5 | 20.2 | 6 | 435.4 | 22.8 | 6 | 485.3 | 25.4 | 6 | 535.3 | 28.1 | 6 | 585.2 | 30.7 |
| 7 | 336.5 | 17.6 | 7 | 386.5 | 20.3 | 7 | 436.4 | 22.9 | 7 | 486.3 | 25.5 | 7 | 536.3 | 28.1 | 7 | 586.2 | 30.7 |
| 8 | 337.5 | 17.7 | 8 | 387.5 | 20.3 | 8 | 437.4 | 22.9 | 8 | 487.3 | 25.5 | 8 | 537.3 | 28.2 | 8 | 587.2 | 30.8 |
| 9 | 338.5 | 17.7 | 9 | 388.5 | 20.4 | 9 | 438.4 | 23.0 | 9 | 488.3 | 25.6 | 9 | 538.3 | 28.2 | 9 | 588.2 | 30.8 |
| 340 | 339.5 | 17.8 | 390 | 389.5 | 20.4 | 440 | 439.4 | 23.0 | 490 | 489.3 | 25.6 | 540 | 539.3 | 28.3 | 590 | 589.2 | 30.9 |
| 1 | 340.5 | 17.8 | 1 | 390.5 | 20.5 | 1 | 440.4 | 23.1 | 1 | 490.3 | 25.7 | 1 | 540.3 | 28.3 | 1 | 590.2 | 30.9 |
| 2 | 341.5 | 17.9 | 2 | 391.5 | 20.5 | 2 | 441.4 | 23.1 | 2 | 491.3 | 25.7 | 2 | 541.3 | 28.4 | 2 | 591.2 | 31.0 |
| 3 | 342.5 | 18.0 | 3 | 392.5 | 20.6 | 3 | 442.4 | 23.2 | 3 | 492.3 | 25.8 | 3 | 542.3 | 28.4 | 3 | 592.2 | 31.0 |
| 4 | 343.5 | 18.0 | 4 | 393.5 | 20.6 | 4 | 443.4 | 23.2 | 4 | 493.3 | 25.9 | 4 | 543.3 | 28.5 | 4 | 593.2 | 31.1 |
| 5 | 344.5 | 18.1 | 5 | 394.5 | 20.7 | 5 | 444.4 | 23.3 | 5 | 494.3 | 25.9 | 5 | 544.3 | 28.5 | 5 | 594.2 | 31.1 |
| 6 | 345.5 | 18.1 | 6 | 395.5 | 20.7 | 6 | 445.4 | 23.3 | 6 | 495.3 | 26.0 | 6 | 545.3 | 28.6 | 6 | 595.2 | 31.2 |
| 7 | 346.5 | 18.2 | 7 | 396.5 | 20.8 | 7 | 446.4 | 23.4 | 7 | 496.3 | 26.0 | 7 | 546.3 | 28.6 | 7 | 596.2 | 31.2 |
| 8 | 347.5 | 18.2 | 8 | 397.5 | 20.8 | 8 | 447.4 | 23.4 | 8 | 497.3 | 26.1 | 8 | 547.3 | 28.7 | 8 | 597.2 | 31.3 |
| 9 | 348.5 | 18.3 | 9 | 398.5 | 20.9 | 9 | 448.4 | 23.5 | 9 | 498.3 | 26.1 | 9 | 548.3 | 28.7 | 9 | 598.2 | 31.3 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 273 315
269 267 225

R

089 087° 045
091 093 135

R ou φm

R

TABELA 1

R ou φm

359 356° 315
181 184 225

TÁBUAS DE CARTEAÇÃO

001° 004 045
179 176 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|-----|----|------|-----|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 49.9 | 3.5 | 100 | 99.8 | 7.0 | 150 | 149.6 | 10.5 | 200 | 199.5 | 14.0 | 250 | 249.4 | 17.4 |
| 1 | 1.0 | 0.1 | 1 | 50.9 | 3.6 | 1 | 100.8 | 7.0 | 1 | 150.6 | 10.5 | 1 | 200.5 | 14.0 | 1 | 250.4 | 17.5 |
| 2 | 2.0 | 0.1 | 2 | 51.9 | 3.6 | 2 | 101.8 | 7.1 | 2 | 151.6 | 10.6 | 2 | 201.5 | 14.1 | 2 | 251.4 | 17.6 |
| 3 | 3.0 | 0.2 | 3 | 52.9 | 3.7 | 3 | 102.7 | 7.2 | 3 | 152.6 | 10.7 | 3 | 202.5 | 14.2 | 3 | 252.4 | 17.6 |
| 4 | 4.0 | 0.3 | 4 | 53.9 | 3.8 | 4 | 103.7 | 7.3 | 4 | 153.6 | 10.7 | 4 | 203.5 | 14.2 | 4 | 253.4 | 17.7 |
| 5 | 5.0 | 0.3 | 5 | 54.9 | 3.8 | 5 | 104.7 | 7.3 | 5 | 154.6 | 10.8 | 5 | 204.5 | 14.3 | 5 | 254.4 | 17.8 |
| 6 | 6.0 | 0.4 | 6 | 55.9 | 3.9 | 6 | 105.7 | 7.4 | 6 | 155.6 | 10.9 | 6 | 205.5 | 14.4 | 6 | 255.4 | 17.9 |
| 7 | 7.0 | 0.5 | 7 | 56.9 | 4.0 | 7 | 106.7 | 7.5 | 7 | 156.6 | 11.0 | 7 | 206.5 | 14.4 | 7 | 256.4 | 17.9 |
| 8 | 8.0 | 0.6 | 8 | 57.9 | 4.0 | 8 | 107.7 | 7.5 | 8 | 157.6 | 11.0 | 8 | 207.5 | 14.5 | 8 | 257.4 | 18.0 |
| 9 | 9.0 | 0.6 | 9 | 58.9 | 4.1 | 9 | 108.7 | 7.6 | 9 | 158.6 | 11.1 | 9 | 208.5 | 14.6 | 9 | 258.4 | 18.1 |
| 10 | 10.0 | 0.7 | 60 | 59.9 | 4.2 | 110 | 109.7 | 7.7 | 160 | 159.6 | 11.2 | 210 | 209.5 | 14.6 | 260 | 259.4 | 18.1 |
| 1 | 11.0 | 0.8 | 1 | 60.9 | 4.3 | 1 | 110.7 | 7.7 | 1 | 160.6 | 11.2 | 1 | 210.5 | 14.7 | 1 | 260.4 | 18.2 |
| 2 | 12.0 | 0.8 | 2 | 61.8 | 4.3 | 2 | 111.7 | 7.8 | 2 | 161.6 | 11.3 | 2 | 211.5 | 14.8 | 2 | 261.4 | 18.3 |
| 3 | 13.0 | 0.9 | 3 | 62.8 | 4.4 | 3 | 112.7 | 7.9 | 3 | 162.6 | 11.4 | 3 | 212.5 | 14.9 | 3 | 262.4 | 18.3 |
| 4 | 14.0 | 1.0 | 4 | 63.8 | 4.5 | 4 | 113.7 | 8.0 | 4 | 163.6 | 11.4 | 4 | 213.5 | 14.9 | 4 | 263.4 | 18.4 |
| 5 | 15.0 | 1.0 | 5 | 64.8 | 4.5 | 5 | 114.7 | 8.0 | 5 | 164.6 | 11.5 | 5 | 214.5 | 15.0 | 5 | 264.4 | 18.5 |
| 6 | 16.0 | 1.1 | 6 | 65.8 | 4.6 | 6 | 115.7 | 8.1 | 6 | 165.6 | 11.6 | 6 | 215.5 | 15.1 | 6 | 265.4 | 18.6 |
| 7 | 17.0 | 1.2 | 7 | 66.8 | 4.7 | 7 | 116.7 | 8.2 | 7 | 166.6 | 11.6 | 7 | 216.5 | 15.1 | 7 | 266.3 | 18.6 |
| 8 | 18.0 | 1.3 | 8 | 67.8 | 4.7 | 8 | 117.7 | 8.2 | 8 | 167.6 | 11.7 | 8 | 217.5 | 15.2 | 8 | 267.3 | 18.7 |
| 9 | 19.0 | 1.3 | 9 | 68.8 | 4.8 | 9 | 118.7 | 8.3 | 9 | 168.6 | 11.8 | 9 | 218.5 | 15.3 | 9 | 268.3 | 18.8 |
| 20 | 20.0 | 1.4 | 70 | 69.8 | 4.9 | 120 | 119.7 | 8.4 | 170 | 169.6 | 11.9 | 220 | 219.5 | 15.3 | 270 | 269.3 | 18.8 |
| 1 | 20.9 | 1.5 | 1 | 70.8 | 5.0 | 1 | 120.7 | 8.4 | 1 | 170.6 | 11.9 | 1 | 220.5 | 15.4 | 1 | 270.3 | 18.9 |
| 2 | 21.9 | 1.5 | 2 | 71.8 | 5.0 | 2 | 121.7 | 8.5 | 2 | 171.6 | 12.0 | 2 | 221.5 | 15.5 | 2 | 271.3 | 19.0 |
| 3 | 22.9 | 1.6 | 3 | 72.8 | 5.1 | 3 | 122.7 | 8.6 | 3 | 172.6 | 12.1 | 3 | 222.5 | 15.6 | 3 | 272.3 | 19.0 |
| 4 | 23.9 | 1.7 | 4 | 73.8 | 5.2 | 4 | 123.7 | 8.6 | 4 | 173.6 | 12.1 | 4 | 223.5 | 15.6 | 4 | 273.3 | 19.1 |
| 5 | 24.9 | 1.7 | 5 | 74.8 | 5.2 | 5 | 124.7 | 8.7 | 5 | 174.6 | 12.2 | 5 | 224.5 | 15.7 | 5 | 274.3 | 19.2 |
| 6 | 25.9 | 1.8 | 6 | 75.8 | 5.3 | 6 | 125.7 | 8.8 | 6 | 175.6 | 12.3 | 6 | 225.4 | 15.8 | 6 | 275.3 | 19.3 |
| 7 | 26.9 | 1.9 | 7 | 76.8 | 5.4 | 7 | 126.7 | 8.9 | 7 | 176.6 | 12.3 | 7 | 226.4 | 15.8 | 7 | 276.3 | 19.3 |
| 8 | 27.9 | 2.0 | 8 | 77.8 | 5.4 | 8 | 127.7 | 8.9 | 8 | 177.6 | 12.4 | 8 | 227.4 | 15.9 | 8 | 277.3 | 19.4 |
| 9 | 28.9 | 2.0 | 9 | 78.8 | 5.5 | 9 | 128.7 | 9.0 | 9 | 178.6 | 12.5 | 9 | 228.4 | 16.0 | 9 | 278.3 | 19.5 |
| 30 | 29.9 | 2.1 | 80 | 79.8 | 5.6 | 130 | 129.7 | 9.1 | 180 | 179.6 | 12.6 | 230 | 229.4 | 16.0 | 280 | 279.3 | 19.5 |
| 1 | 30.9 | 2.2 | 1 | 80.8 | 5.7 | 1 | 130.7 | 9.1 | 1 | 180.6 | 12.6 | 1 | 230.4 | 16.1 | 1 | 280.3 | 19.6 |
| 2 | 31.9 | 2.2 | 2 | 81.8 | 5.7 | 2 | 131.7 | 9.2 | 2 | 181.6 | 12.7 | 2 | 231.4 | 16.2 | 2 | 281.3 | 19.7 |
| 3 | 32.9 | 2.3 | 3 | 82.8 | 5.8 | 3 | 132.7 | 9.3 | 3 | 182.6 | 12.8 | 3 | 232.4 | 16.3 | 3 | 282.3 | 19.7 |
| 4 | 33.9 | 2.4 | 4 | 83.8 | 5.9 | 4 | 133.7 | 9.3 | 4 | 183.6 | 12.8 | 4 | 233.4 | 16.3 | 4 | 283.3 | 19.8 |
| 5 | 34.9 | 2.4 | 5 | 84.8 | 5.9 | 5 | 134.7 | 9.4 | 5 | 184.5 | 12.9 | 5 | 234.4 | 16.4 | 5 | 284.3 | 19.9 |
| 6 | 35.9 | 2.5 | 6 | 85.8 | 6.0 | 6 | 135.7 | 9.5 | 6 | 185.5 | 13.0 | 6 | 235.4 | 16.5 | 6 | 285.3 | 20.0 |
| 7 | 36.9 | 2.6 | 7 | 86.8 | 6.1 | 7 | 136.7 | 9.6 | 7 | 186.5 | 13.0 | 7 | 236.4 | 16.5 | 7 | 286.3 | 20.0 |
| 8 | 37.9 | 2.7 | 8 | 87.8 | 6.1 | 8 | 137.7 | 9.6 | 8 | 187.5 | 13.1 | 8 | 237.4 | 16.6 | 8 | 287.3 | 20.1 |
| 9 | 38.9 | 2.7 | 9 | 88.8 | 6.2 | 9 | 138.7 | 9.7 | 9 | 188.5 | 13.2 | 9 | 238.4 | 16.7 | 9 | 288.3 | 20.2 |
| 40 | 39.9 | 2.8 | 90 | 89.8 | 6.3 | 140 | 139.7 | 9.8 | 190 | 189.5 | 13.3 | 240 | 239.4 | 16.7 | 290 | 289.3 | 20.2 |
| 1 | 40.9 | 2.9 | 1 | 90.8 | 6.3 | 1 | 140.7 | 9.8 | 1 | 190.5 | 13.3 | 1 | 240.4 | 16.8 | 1 | 290.3 | 20.3 |
| 2 | 41.9 | 2.9 | 2 | 91.8 | 6.4 | 2 | 141.7 | 9.9 | 2 | 191.5 | 13.4 | 2 | 241.4 | 16.9 | 2 | 291.3 | 20.4 |
| 3 | 42.9 | 3.0 | 3 | 92.8 | 6.5 | 3 | 142.7 | 10.0 | 3 | 192.5 | 13.5 | 3 | 242.4 | 17.0 | 3 | 292.3 | 20.4 |
| 4 | 43.9 | 3.1 | 4 | 93.8 | 6.6 | 4 | 143.6 | 10.0 | 4 | 193.5 | 13.5 | 4 | 243.4 | 17.0 | 4 | 293.3 | 20.5 |
| 5 | 44.9 | 3.1 | 5 | 94.8 | 6.6 | 5 | 144.6 | 10.1 | 5 | 194.5 | 13.6 | 5 | 244.4 | 17.1 | 5 | 294.3 | 20.6 |
| 6 | 45.9 | 3.2 | 6 | 95.8 | 6.7 | 6 | 145.6 | 10.2 | 6 | 195.5 | 13.7 | 6 | 245.4 | 17.2 | 6 | 295.3 | 20.6 |
| 7 | 46.9 | 3.3 | 7 | 96.8 | 6.8 | 7 | 146.6 | 10.3 | 7 | 196.5 | 13.7 | 7 | 246.4 | 17.2 | 7 | 296.3 | 20.7 |
| 8 | 47.9 | 3.3 | 8 | 97.8 | 6.8 | 8 | 147.6 | 10.3 | 8 | 197.5 | 13.8 | 8 | 247.4 | 17.3 | 8 | 297.3 | 20.8 |
| 9 | 48.9 | 3.4 | 9 | 98.8 | 6.9 | 9 | 148.6 | 10.4 | 9 | 198.5 | 13.9 | 9 | 248.4 | 17.4 | 9 | 298.3 | 20.9 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 274 315
269 266 225

R

089 086° 045
091 094 135

R ou φm

R

TABELA 1

R ou φm

359 356° 315
181 184 225

TÁBUAS DE CARTEAÇÃO

001 004 045
179 176 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 299.3 | 20.9 | 350 | 349.1 | 24.4 | 400 | 399.0 | 27.9 | 450 | 448.9 | 31.4 | 500 | 498.8 | 34.9 | 550 | 548.7 | 38.4 |
| 1 | 300.3 | 21.0 | 1 | 350.1 | 24.5 | 1 | 400.0 | 28.0 | 1 | 449.9 | 31.5 | 1 | 499.8 | 34.9 | 1 | 549.7 | 38.4 |
| 2 | 301.3 | 21.1 | 2 | 351.1 | 24.6 | 2 | 401.0 | 28.0 | 2 | 450.9 | 31.5 | 2 | 500.8 | 35.0 | 2 | 550.7 | 38.5 |
| 3 | 302.3 | 21.1 | 3 | 352.1 | 24.6 | 3 | 402.0 | 28.1 | 3 | 451.9 | 31.6 | 3 | 501.8 | 35.1 | 3 | 551.7 | 38.6 |
| 4 | 303.3 | 21.2 | 4 | 353.1 | 24.7 | 4 | 403.0 | 28.2 | 4 | 452.9 | 31.7 | 4 | 502.8 | 35.2 | 4 | 552.7 | 38.6 |
| 5 | 304.3 | 21.3 | 5 | 354.1 | 24.8 | 5 | 404.0 | 28.3 | 5 | 453.9 | 31.7 | 5 | 503.8 | 35.2 | 5 | 553.6 | 38.7 |
| 6 | 305.3 | 21.3 | 6 | 355.1 | 24.8 | 6 | 405.0 | 28.3 | 6 | 454.9 | 31.8 | 6 | 504.8 | 35.3 | 6 | 554.6 | 38.8 |
| 7 | 306.3 | 21.4 | 7 | 356.1 | 24.9 | 7 | 406.0 | 28.4 | 7 | 455.9 | 31.9 | 7 | 505.8 | 35.4 | 7 | 555.6 | 38.9 |
| 8 | 307.2 | 21.5 | 8 | 357.1 | 25.0 | 8 | 407.0 | 28.5 | 8 | 456.9 | 31.9 | 8 | 506.8 | 35.4 | 8 | 556.6 | 38.9 |
| 9 | 308.2 | 21.6 | 9 | 358.1 | 25.0 | 9 | 408.0 | 28.5 | 9 | 457.9 | 32.0 | 9 | 507.8 | 35.5 | 9 | 557.6 | 39.0 |
| 310 | 309.2 | 21.6 | 360 | 359.1 | 25.1 | 410 | 409.0 | 28.6 | 460 | 458.9 | 32.1 | 510 | 508.8 | 35.6 | 560 | 558.6 | 39.1 |
| 1 | 310.2 | 21.7 | 1 | 360.1 | 25.2 | 1 | 410.0 | 28.7 | 1 | 459.9 | 32.2 | 1 | 509.8 | 35.6 | 1 | 559.6 | 39.1 |
| 2 | 311.2 | 21.8 | 2 | 361.1 | 25.3 | 2 | 411.0 | 28.7 | 2 | 460.9 | 32.2 | 2 | 510.8 | 35.7 | 2 | 560.6 | 39.2 |
| 3 | 312.2 | 21.8 | 3 | 362.1 | 25.3 | 3 | 412.0 | 28.8 | 3 | 461.9 | 32.3 | 3 | 511.8 | 35.8 | 3 | 561.6 | 39.3 |
| 4 | 313.2 | 21.9 | 4 | 363.1 | 25.4 | 4 | 413.0 | 28.9 | 4 | 462.9 | 32.4 | 4 | 512.7 | 35.9 | 4 | 562.6 | 39.3 |
| 5 | 314.2 | 22.0 | 5 | 364.1 | 25.5 | 5 | 414.0 | 28.9 | 5 | 463.9 | 32.4 | 5 | 513.7 | 35.9 | 5 | 563.6 | 39.4 |
| 6 | 315.2 | 22.0 | 6 | 365.1 | 25.5 | 6 | 415.0 | 29.0 | 6 | 464.9 | 32.5 | 6 | 514.7 | 36.0 | 6 | 564.6 | 39.5 |
| 7 | 316.2 | 22.1 | 7 | 366.1 | 25.6 | 7 | 416.0 | 29.1 | 7 | 465.9 | 32.6 | 7 | 515.7 | 36.1 | 7 | 565.6 | 39.6 |
| 8 | 317.2 | 22.2 | 8 | 367.1 | 25.7 | 8 | 417.0 | 29.2 | 8 | 466.9 | 32.6 | 8 | 516.7 | 36.1 | 8 | 566.6 | 39.6 |
| 9 | 318.2 | 22.3 | 9 | 368.1 | 25.7 | 9 | 418.0 | 29.2 | 9 | 467.9 | 32.7 | 9 | 517.7 | 36.2 | 9 | 567.6 | 39.7 |
| 320 | 319.2 | 22.3 | 370 | 369.1 | 25.8 | 420 | 419.0 | 29.3 | 470 | 468.9 | 32.8 | 520 | 518.7 | 36.3 | 570 | 568.6 | 39.8 |
| 1 | 320.2 | 22.4 | 1 | 370.1 | 25.9 | 1 | 420.0 | 29.4 | 1 | 469.9 | 32.9 | 1 | 519.7 | 36.3 | 1 | 569.6 | 39.8 |
| 2 | 321.2 | 22.5 | 2 | 371.1 | 25.9 | 2 | 421.0 | 29.4 | 2 | 470.9 | 32.9 | 2 | 520.7 | 36.4 | 2 | 570.6 | 39.9 |
| 3 | 322.2 | 22.5 | 3 | 372.1 | 26.0 | 3 | 422.0 | 29.5 | 3 | 471.8 | 33.0 | 3 | 521.7 | 36.5 | 3 | 571.6 | 40.0 |
| 4 | 323.2 | 22.6 | 4 | 373.1 | 26.1 | 4 | 423.0 | 29.6 | 4 | 472.8 | 33.1 | 4 | 522.7 | 36.6 | 4 | 572.6 | 40.0 |
| 5 | 324.2 | 22.7 | 5 | 374.1 | 26.2 | 5 | 424.0 | 29.6 | 5 | 473.8 | 33.1 | 5 | 523.7 | 36.6 | 5 | 573.6 | 40.1 |
| 6 | 325.2 | 22.7 | 6 | 375.1 | 26.2 | 6 | 425.0 | 29.7 | 6 | 474.8 | 33.2 | 6 | 524.7 | 36.7 | 6 | 574.6 | 40.2 |
| 7 | 326.2 | 22.8 | 7 | 376.1 | 26.3 | 7 | 426.0 | 29.8 | 7 | 475.8 | 33.3 | 7 | 525.7 | 36.8 | 7 | 575.6 | 40.2 |
| 8 | 327.2 | 22.9 | 8 | 377.1 | 26.4 | 8 | 427.0 | 29.9 | 8 | 476.8 | 33.3 | 8 | 526.7 | 36.8 | 8 | 576.6 | 40.3 |
| 9 | 328.2 | 22.9 | 9 | 378.1 | 26.4 | 9 | 428.0 | 29.9 | 9 | 477.8 | 33.4 | 9 | 527.7 | 36.9 | 9 | 577.6 | 40.4 |
| 330 | 329.2 | 23.0 | 380 | 379.1 | 26.5 | 430 | 429.0 | 30.0 | 480 | 478.8 | 33.5 | 530 | 528.7 | 37.0 | 580 | 578.6 | 40.5 |
| 1 | 330.2 | 23.1 | 1 | 380.1 | 26.6 | 1 | 429.9 | 30.1 | 1 | 479.8 | 33.6 | 1 | 529.7 | 37.0 | 1 | 579.6 | 40.5 |
| 2 | 331.2 | 23.2 | 2 | 381.1 | 26.6 | 2 | 430.9 | 30.1 | 2 | 480.8 | 33.6 | 2 | 530.7 | 37.1 | 2 | 580.6 | 40.6 |
| 3 | 332.2 | 23.2 | 3 | 382.1 | 26.7 | 3 | 431.9 | 30.2 | 3 | 481.8 | 33.7 | 3 | 531.7 | 37.2 | 3 | 581.6 | 40.7 |
| 4 | 333.2 | 23.3 | 4 | 383.1 | 26.8 | 4 | 432.9 | 30.3 | 4 | 482.8 | 33.8 | 4 | 532.7 | 37.2 | 4 | 582.6 | 40.7 |
| 5 | 334.2 | 23.4 | 5 | 384.1 | 26.9 | 5 | 433.9 | 30.3 | 5 | 483.8 | 33.8 | 5 | 533.7 | 37.3 | 5 | 583.6 | 40.8 |
| 6 | 335.2 | 23.4 | 6 | 385.1 | 26.9 | 6 | 434.9 | 30.4 | 6 | 484.8 | 33.9 | 6 | 534.7 | 37.4 | 6 | 584.6 | 40.9 |
| 7 | 336.2 | 23.5 | 7 | 386.1 | 27.0 | 7 | 435.9 | 30.5 | 7 | 485.8 | 34.0 | 7 | 535.7 | 37.5 | 7 | 585.6 | 40.9 |
| 8 | 337.2 | 23.6 | 8 | 387.1 | 27.1 | 8 | 436.9 | 30.6 | 8 | 486.8 | 34.0 | 8 | 536.7 | 37.5 | 8 | 586.6 | 41.0 |
| 9 | 338.2 | 23.6 | 9 | 388.1 | 27.1 | 9 | 437.9 | 30.6 | 9 | 487.8 | 34.1 | 9 | 537.7 | 37.6 | 9 | 587.6 | 41.1 |
| 340 | 339.2 | 23.7 | 390 | 389.0 | 27.2 | 440 | 438.9 | 30.7 | 490 | 488.8 | 34.2 | 540 | 538.7 | 37.7 | 590 | 588.6 | 41.2 |
| 1 | 340.2 | 23.8 | 1 | 390.0 | 27.3 | 1 | 439.9 | 30.8 | 1 | 489.8 | 34.3 | 1 | 539.7 | 37.7 | 1 | 589.6 | 41.2 |
| 2 | 341.2 | 23.9 | 2 | 391.0 | 27.3 | 2 | 440.9 | 30.8 | 2 | 490.8 | 34.3 | 2 | 540.7 | 37.8 | 2 | 590.6 | 41.3 |
| 3 | 342.2 | 23.9 | 3 | 392.0 | 27.4 | 3 | 441.9 | 30.9 | 3 | 491.8 | 34.4 | 3 | 541.7 | 37.9 | 3 | 591.6 | 41.4 |
| 4 | 343.2 | 24.0 | 4 | 393.0 | 27.5 | 4 | 442.9 | 31.0 | 4 | 492.8 | 34.5 | 4 | 542.7 | 37.9 | 4 | 592.6 | 41.4 |
| 5 | 344.2 | 24.1 | 5 | 394.0 | 27.6 | 5 | 443.9 | 31.0 | 5 | 493.8 | 34.5 | 5 | 543.7 | 38.0 | 5 | 593.6 | 41.5 |
| 6 | 345.2 | 24.1 | 6 | 395.0 | 27.6 | 6 | 444.9 | 31.1 | 6 | 494.8 | 34.6 | 6 | 544.7 | 38.1 | 6 | 594.5 | 41.6 |
| 7 | 346.2 | 24.2 | 7 | 396.0 | 27.7 | 7 | 445.9 | 31.2 | 7 | 495.8 | 34.7 | 7 | 545.7 | 38.2 | 7 | 595.5 | 41.6 |
| 8 | 347.2 | 24.3 | 8 | 397.0 | 27.8 | 8 | 446.9 | 31.3 | 8 | 496.8 | 34.7 | 8 | 546.7 | 38.2 | 8 | 596.5 | 41.7 |
| 9 | 348.1 | 24.3 | 9 | 398.0 | 27.8 | 9 | 447.9 | 31.3 | 9 | 497.8 | 34.8 | 9 | 547.7 | 38.3 | 9 | 597.5 | 41.8 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 274 315
269 266 225

089 086° 045
091 094 135

R

R ou φm

R

TABELA 1

R ou φm

359 355° 315
181 185 225

TÁBUAS DE CARTEAÇÃO

001 005 045
179 175 138

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|-----|----|------|-----|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 49.8 | 4.4 | 100 | 99.6 | 8.7 | 150 | 149.4 | 13.1 | 200 | 199.2 | 17.4 | 250 | 249.0 | 21.8 |
| 1 | 1.0 | 0.1 | 1 | 50.8 | 4.4 | 1 | 100.6 | 8.8 | 1 | 150.4 | 13.2 | 1 | 200.2 | 17.5 | 1 | 250.0 | 21.9 |
| 2 | 2.0 | 0.2 | 2 | 51.8 | 4.5 | 2 | 101.6 | 8.9 | 2 | 151.4 | 13.2 | 2 | 201.2 | 17.6 | 2 | 251.0 | 22.0 |
| 3 | 3.0 | 0.3 | 3 | 52.8 | 4.6 | 3 | 102.6 | 9.0 | 3 | 152.4 | 13.3 | 3 | 202.2 | 17.7 | 3 | 252.0 | 22.1 |
| 4 | 4.0 | 0.3 | 4 | 53.8 | 4.7 | 4 | 103.6 | 9.1 | 4 | 153.4 | 13.4 | 4 | 203.2 | 17.8 | 4 | 253.0 | 22.1 |
| 5 | 5.0 | 0.4 | 5 | 54.8 | 4.8 | 5 | 104.6 | 9.2 | 5 | 154.4 | 13.5 | 5 | 204.2 | 17.9 | 5 | 254.0 | 22.2 |
| 6 | 6.0 | 0.5 | 6 | 55.8 | 4.9 | 6 | 105.6 | 9.2 | 6 | 155.4 | 13.6 | 6 | 205.2 | 18.0 | 6 | 255.0 | 22.3 |
| 7 | 7.0 | 0.6 | 7 | 56.8 | 5.0 | 7 | 106.6 | 9.3 | 7 | 156.4 | 13.7 | 7 | 206.2 | 18.0 | 7 | 256.0 | 22.4 |
| 8 | 8.0 | 0.7 | 8 | 57.8 | 5.1 | 8 | 107.6 | 9.4 | 8 | 157.4 | 13.8 | 8 | 207.2 | 18.1 | 8 | 257.0 | 22.5 |
| 9 | 9.0 | 0.8 | 9 | 58.8 | 5.1 | 9 | 108.6 | 9.5 | 9 | 158.4 | 13.9 | 9 | 208.2 | 18.2 | 9 | 258.0 | 22.6 |
| 10 | 10.0 | 0.9 | 60 | 59.8 | 5.2 | 110 | 109.6 | 9.6 | 160 | 159.4 | 13.9 | 210 | 209.2 | 18.3 | 260 | 259.0 | 22.7 |
| 1 | 11.0 | 1.0 | 1 | 60.8 | 5.3 | 1 | 110.6 | 9.7 | 1 | 160.4 | 14.0 | 1 | 210.2 | 18.4 | 1 | 260.0 | 22.7 |
| 2 | 12.0 | 1.0 | 2 | 61.8 | 5.4 | 2 | 111.6 | 9.8 | 2 | 161.4 | 14.1 | 2 | 211.2 | 18.5 | 2 | 261.0 | 22.8 |
| 3 | 13.0 | 1.1 | 3 | 62.8 | 5.5 | 3 | 112.6 | 9.8 | 3 | 162.4 | 14.2 | 3 | 212.2 | 18.6 | 3 | 262.0 | 22.9 |
| 4 | 13.9 | 1.2 | 4 | 63.8 | 5.6 | 4 | 113.6 | 9.9 | 4 | 163.4 | 14.3 | 4 | 213.2 | 18.7 | 4 | 263.0 | 23.0 |
| 5 | 14.9 | 1.3 | 5 | 64.8 | 5.7 | 5 | 114.6 | 10.0 | 5 | 164.4 | 14.4 | 5 | 214.2 | 18.7 | 5 | 264.0 | 23.1 |
| 6 | 15.9 | 1.4 | 6 | 65.7 | 5.8 | 6 | 115.6 | 10.1 | 6 | 165.4 | 14.5 | 6 | 215.2 | 18.8 | 6 | 265.0 | 23.2 |
| 7 | 16.9 | 1.5 | 7 | 66.7 | 5.8 | 7 | 116.6 | 10.2 | 7 | 166.4 | 14.6 | 7 | 216.2 | 18.9 | 7 | 266.0 | 23.3 |
| 8 | 17.9 | 1.6 | 8 | 67.7 | 5.9 | 8 | 117.6 | 10.3 | 8 | 167.4 | 14.6 | 8 | 217.2 | 19.0 | 8 | 267.0 | 23.4 |
| 9 | 18.9 | 1.7 | 9 | 68.7 | 6.0 | 9 | 118.5 | 10.4 | 9 | 168.4 | 14.7 | 9 | 218.2 | 19.1 | 9 | 268.0 | 23.4 |
| 20 | 19.9 | 1.7 | 70 | 69.7 | 6.1 | 120 | 119.5 | 10.5 | 170 | 169.4 | 14.8 | 220 | 219.2 | 19.2 | 270 | 269.0 | 23.5 |
| 1 | 20.9 | 1.8 | 1 | 70.7 | 6.2 | 1 | 120.5 | 10.5 | 1 | 170.3 | 14.9 | 1 | 220.2 | 19.3 | 1 | 270.0 | 23.6 |
| 2 | 21.9 | 1.9 | 2 | 71.7 | 6.3 | 2 | 121.5 | 10.6 | 2 | 171.3 | 15.0 | 2 | 221.2 | 19.3 | 2 | 271.0 | 23.7 |
| 3 | 22.9 | 2.0 | 3 | 72.7 | 6.4 | 3 | 122.5 | 10.7 | 3 | 172.3 | 15.1 | 3 | 222.2 | 19.4 | 3 | 272.0 | 23.8 |
| 4 | 23.9 | 2.1 | 4 | 73.7 | 6.4 | 4 | 123.5 | 10.8 | 4 | 173.3 | 15.2 | 4 | 223.1 | 19.5 | 4 | 273.0 | 23.9 |
| 5 | 24.9 | 2.2 | 5 | 74.7 | 6.5 | 5 | 124.5 | 10.9 | 5 | 174.3 | 15.3 | 5 | 224.1 | 19.6 | 5 | 274.0 | 24.0 |
| 6 | 25.9 | 2.3 | 6 | 75.7 | 6.6 | 6 | 125.5 | 11.0 | 6 | 175.3 | 15.3 | 6 | 225.1 | 19.7 | 6 | 274.9 | 24.1 |
| 7 | 26.9 | 2.4 | 7 | 76.7 | 6.7 | 7 | 126.5 | 11.1 | 7 | 176.3 | 15.4 | 7 | 226.1 | 19.8 | 7 | 275.9 | 24.1 |
| 8 | 27.9 | 2.4 | 8 | 77.7 | 6.8 | 8 | 127.5 | 11.2 | 8 | 177.3 | 15.5 | 8 | 227.1 | 19.9 | 8 | 276.9 | 24.2 |
| 9 | 28.9 | 2.5 | 9 | 78.7 | 6.9 | 9 | 128.5 | 11.2 | 9 | 178.3 | 15.6 | 9 | 228.1 | 20.0 | 9 | 277.9 | 24.3 |
| 30 | 29.9 | 2.6 | 80 | 79.7 | 7.0 | 130 | 129.5 | 11.3 | 180 | 179.3 | 15.7 | 230 | 229.1 | 20.0 | 280 | 278.9 | 24.4 |
| 1 | 30.9 | 2.7 | 1 | 80.7 | 7.1 | 1 | 130.5 | 11.4 | 1 | 180.3 | 15.8 | 1 | 230.1 | 20.1 | 1 | 279.9 | 24.5 |
| 2 | 31.9 | 2.8 | 2 | 81.7 | 7.1 | 2 | 131.5 | 11.5 | 2 | 181.3 | 15.9 | 2 | 231.1 | 20.2 | 2 | 280.9 | 24.6 |
| 3 | 32.9 | 2.9 | 3 | 82.7 | 7.2 | 3 | 132.5 | 11.6 | 3 | 182.3 | 15.9 | 3 | 232.1 | 20.3 | 3 | 281.9 | 24.7 |
| 4 | 33.9 | 3.0 | 4 | 83.7 | 7.3 | 4 | 133.5 | 11.7 | 4 | 183.3 | 16.0 | 4 | 233.1 | 20.4 | 4 | 282.9 | 24.8 |
| 5 | 34.9 | 3.1 | 5 | 84.7 | 7.4 | 5 | 134.5 | 11.8 | 5 | 184.3 | 16.1 | 5 | 234.1 | 20.5 | 5 | 283.9 | 24.8 |
| 6 | 35.9 | 3.1 | 6 | 85.7 | 7.5 | 6 | 135.5 | 11.9 | 6 | 185.3 | 16.2 | 6 | 235.1 | 20.6 | 6 | 284.9 | 24.9 |
| 7 | 36.9 | 3.2 | 7 | 86.7 | 7.6 | 7 | 136.5 | 11.9 | 7 | 186.3 | 16.3 | 7 | 236.1 | 20.7 | 7 | 285.9 | 25.0 |
| 8 | 37.9 | 3.3 | 8 | 87.7 | 7.7 | 8 | 137.5 | 12.0 | 8 | 187.3 | 16.4 | 8 | 237.1 | 20.7 | 8 | 286.9 | 25.1 |
| 9 | 38.9 | 3.4 | 9 | 88.7 | 7.8 | 9 | 138.5 | 12.1 | 9 | 188.3 | 16.5 | 9 | 238.1 | 20.8 | 9 | 287.9 | 25.2 |
| 40 | 39.8 | 3.5 | 90 | 89.7 | 7.8 | 140 | 139.5 | 12.2 | 190 | 189.3 | 16.6 | 240 | 239.1 | 20.9 | 290 | 288.9 | 25.3 |
| 1 | 40.8 | 3.6 | 1 | 90.7 | 7.9 | 1 | 140.5 | 12.3 | 1 | 190.3 | 16.6 | 1 | 240.1 | 21.0 | 1 | 289.9 | 25.4 |
| 2 | 41.8 | 3.7 | 2 | 91.6 | 8.0 | 2 | 141.5 | 12.4 | 2 | 191.3 | 16.7 | 2 | 241.1 | 21.1 | 2 | 290.9 | 25.4 |
| 3 | 42.8 | 3.7 | 3 | 92.6 | 8.1 | 3 | 142.5 | 12.5 | 3 | 192.3 | 16.8 | 3 | 242.1 | 21.2 | 3 | 291.9 | 25.5 |
| 4 | 43.8 | 3.8 | 4 | 93.6 | 8.2 | 4 | 143.5 | 12.6 | 4 | 193.3 | 16.9 | 4 | 243.1 | 21.3 | 4 | 292.9 | 25.6 |
| 5 | 44.8 | 3.9 | 5 | 94.6 | 8.3 | 5 | 144.4 | 12.6 | 5 | 194.3 | 17.0 | 5 | 244.1 | 21.4 | 5 | 293.9 | 25.7 |
| 6 | 45.8 | 4.0 | 6 | 95.6 | 8.4 | 6 | 145.4 | 12.7 | 6 | 195.3 | 17.1 | 6 | 245.1 | 21.4 | 6 | 294.9 | 25.8 |
| 7 | 46.8 | 4.1 | 7 | 96.6 | 8.5 | 7 | 146.4 | 12.8 | 7 | 196.3 | 17.2 | 7 | 246.1 | 21.5 | 7 | 295.9 | 25.9 |
| 8 | 47.8 | 4.2 | 8 | 97.6 | 8.5 | 8 | 147.4 | 12.9 | 8 | 197.2 | 17.3 | 8 | 247.1 | 21.6 | 8 | 296.9 | 26.0 |
| 9 | 48.8 | 4.3 | 9 | 98.6 | 8.6 | 9 | 148.4 | 13.0 | 9 | 198.2 | 17.3 | 9 | 248.1 | 21.7 | 9 | 297.9 | 26.1 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 275 315
269 265 225

R

089 085°
091 095 1

R ou φm

R

TABELA 1

R ou φm

359 355° 315
181 185 225

TÁBUAS DE CARTEAÇÃO

001 005 045
179 175 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 298.9 | 26.1 | 350 | 348.7 | 30.5 | 400 | 398.5 | 34.9 | 450 | 448.3 | 39.2 | 500 | 498.1 | 43.6 | 550 | 547.9 | 47.9 |
| 1 | 299.9 | 26.2 | 1 | 349.7 | 30.6 | 1 | 399.5 | 34.9 | 1 | 449.3 | 39.3 | 1 | 499.1 | 43.7 | 1 | 548.9 | 48.0 |
| 2 | 300.9 | 26.3 | 2 | 350.7 | 30.7 | 2 | 400.5 | 35.0 | 2 | 450.3 | 39.4 | 2 | 500.1 | 43.8 | 2 | 549.9 | 48.1 |
| 3 | 301.8 | 26.4 | 3 | 351.7 | 30.8 | 3 | 401.5 | 35.1 | 3 | 451.3 | 39.5 | 3 | 501.1 | 43.8 | 3 | 550.9 | 48.2 |
| 4 | 302.8 | 26.5 | 4 | 352.7 | 30.9 | 4 | 402.5 | 35.2 | 4 | 452.3 | 39.6 | 4 | 502.1 | 43.9 | 4 | 551.9 | 48.3 |
| 5 | 303.8 | 26.6 | 5 | 353.6 | 30.9 | 5 | 403.5 | 35.3 | 5 | 453.3 | 39.7 | 5 | 503.1 | 44.0 | 5 | 552.9 | 48.4 |
| 6 | 304.8 | 26.7 | 6 | 354.6 | 31.0 | 6 | 404.5 | 35.4 | 6 | 454.3 | 39.7 | 6 | 504.1 | 44.1 | 6 | 553.9 | 48.5 |
| 7 | 305.8 | 26.8 | 7 | 355.6 | 31.1 | 7 | 405.5 | 35.5 | 7 | 455.3 | 39.8 | 7 | 505.1 | 44.2 | 7 | 554.9 | 48.5 |
| 8 | 306.8 | 26.8 | 8 | 356.6 | 31.2 | 8 | 406.4 | 35.6 | 8 | 456.3 | 39.9 | 8 | 506.1 | 44.3 | 8 | 555.9 | 48.6 |
| 9 | 307.8 | 26.9 | 9 | 357.6 | 31.3 | 9 | 407.4 | 35.6 | 9 | 457.3 | 40.0 | 9 | 507.1 | 44.4 | 9 | 556.9 | 48.7 |
| 310 | 308.8 | 27.0 | 360 | 358.6 | 31.4 | 410 | 408.4 | 35.7 | 460 | 458.2 | 40.1 | 510 | 508.1 | 44.4 | 560 | 557.9 | 48.8 |
| 1 | 309.8 | 27.1 | 1 | 359.6 | 31.5 | 1 | 409.4 | 35.8 | 1 | 459.2 | 40.2 | 1 | 509.1 | 44.5 | 1 | 558.9 | 48.9 |
| 2 | 310.8 | 27.2 | 2 | 360.6 | 31.6 | 2 | 410.4 | 35.9 | 2 | 460.2 | 40.3 | 2 | 510.1 | 44.6 | 2 | 559.9 | 49.0 |
| 3 | 311.8 | 27.3 | 3 | 361.6 | 31.6 | 3 | 411.4 | 36.0 | 3 | 461.2 | 40.4 | 3 | 511.0 | 44.7 | 3 | 560.9 | 49.1 |
| 4 | 312.8 | 27.4 | 4 | 362.6 | 31.7 | 4 | 412.4 | 36.1 | 4 | 462.2 | 40.4 | 4 | 512.0 | 44.8 | 4 | 561.9 | 49.2 |
| 5 | 313.8 | 27.5 | 5 | 363.6 | 31.8 | 5 | 413.4 | 36.2 | 5 | 463.2 | 40.5 | 5 | 513.0 | 44.9 | 5 | 562.8 | 49.2 |
| 6 | 314.8 | 27.5 | 6 | 364.6 | 31.9 | 6 | 414.4 | 36.3 | 6 | 464.2 | 40.6 | 6 | 514.0 | 45.0 | 6 | 563.8 | 49.3 |
| 7 | 315.8 | 27.6 | 7 | 365.6 | 32.0 | 7 | 415.4 | 36.3 | 7 | 465.2 | 40.7 | 7 | 515.0 | 45.1 | 7 | 564.8 | 49.4 |
| 8 | 316.8 | 27.7 | 8 | 366.6 | 32.1 | 8 | 416.4 | 36.4 | 8 | 466.2 | 40.8 | 8 | 516.0 | 45.1 | 8 | 565.8 | 49.5 |
| 9 | 317.8 | 27.8 | 9 | 367.6 | 32.2 | 9 | 417.4 | 36.5 | 9 | 467.2 | 40.9 | 9 | 517.0 | 45.2 | 9 | 566.8 | 49.6 |
| 320 | 318.8 | 27.9 | 370 | 368.6 | 32.2 | 420 | 418.4 | 36.6 | 470 | 468.2 | 41.0 | 520 | 518.0 | 45.3 | 570 | 567.8 | 49.7 |
| 1 | 319.8 | 28.0 | 1 | 369.6 | 32.3 | 1 | 419.4 | 36.7 | 1 | 469.2 | 41.1 | 1 | 519.0 | 45.4 | 1 | 568.8 | 49.8 |
| 2 | 320.8 | 28.1 | 2 | 370.6 | 32.4 | 2 | 420.4 | 36.8 | 2 | 470.2 | 41.1 | 2 | 520.0 | 45.5 | 2 | 569.8 | 49.9 |
| 3 | 321.8 | 28.2 | 3 | 371.6 | 32.5 | 3 | 421.4 | 36.9 | 3 | 471.2 | 41.2 | 3 | 521.0 | 45.6 | 3 | 570.8 | 49.9 |
| 4 | 322.8 | 28.2 | 4 | 372.6 | 32.6 | 4 | 422.4 | 37.0 | 4 | 472.2 | 41.3 | 4 | 522.0 | 45.7 | 4 | 571.8 | 50.0 |
| 5 | 323.8 | 28.3 | 5 | 373.6 | 32.7 | 5 | 423.4 | 37.0 | 5 | 473.2 | 41.4 | 5 | 523.0 | 45.8 | 5 | 572.8 | 50.1 |
| 6 | 324.8 | 28.4 | 6 | 374.6 | 32.8 | 6 | 424.4 | 37.1 | 6 | 474.2 | 41.5 | 6 | 524.0 | 45.8 | 6 | 573.8 | 50.2 |
| 7 | 325.8 | 28.5 | 7 | 375.6 | 32.9 | 7 | 425.4 | 37.2 | 7 | 475.2 | 41.6 | 7 | 525.0 | 45.9 | 7 | 574.8 | 50.3 |
| 8 | 326.8 | 28.6 | 8 | 376.6 | 32.9 | 8 | 426.4 | 37.3 | 8 | 476.2 | 41.7 | 8 | 526.0 | 46.0 | 8 | 575.8 | 50.4 |
| 9 | 327.7 | 28.7 | 9 | 377.6 | 33.0 | 9 | 427.4 | 37.4 | 9 | 477.2 | 41.7 | 9 | 527.0 | 46.1 | 9 | 576.8 | 50.5 |
| 330 | 328.7 | 28.8 | 380 | 378.6 | 33.1 | 430 | 428.4 | 37.5 | 480 | 478.2 | 41.8 | 530 | 528.0 | 46.2 | 580 | 577.8 | 50.6 |
| 1 | 329.7 | 28.8 | 1 | 379.6 | 33.2 | 1 | 429.4 | 37.6 | 1 | 479.2 | 41.9 | 1 | 529.0 | 46.3 | 1 | 578.8 | 50.6 |
| 2 | 330.7 | 28.9 | 2 | 380.5 | 33.3 | 2 | 430.4 | 37.7 | 2 | 480.2 | 42.0 | 2 | 530.0 | 46.4 | 2 | 579.8 | 50.7 |
| 3 | 331.7 | 29.0 | 3 | 381.5 | 33.4 | 3 | 431.4 | 37.7 | 3 | 481.2 | 42.1 | 3 | 531.0 | 46.5 | 3 | 580.8 | 50.8 |
| 4 | 332.7 | 29.1 | 4 | 382.5 | 33.5 | 4 | 432.3 | 37.8 | 4 | 482.2 | 42.2 | 4 | 532.0 | 46.5 | 4 | 581.8 | 50.9 |
| 5 | 333.7 | 29.2 | 5 | 383.5 | 33.6 | 5 | 433.3 | 37.9 | 5 | 483.2 | 42.3 | 5 | 533.0 | 46.6 | 5 | 582.8 | 51.0 |
| 6 | 334.7 | 29.3 | 6 | 384.5 | 33.6 | 6 | 434.3 | 38.0 | 6 | 484.2 | 42.4 | 6 | 534.0 | 46.7 | 6 | 583.8 | 51.1 |
| 7 | 335.7 | 29.4 | 7 | 385.5 | 33.7 | 7 | 435.3 | 38.1 | 7 | 485.1 | 42.4 | 7 | 535.0 | 46.8 | 7 | 584.8 | 51.2 |
| 8 | 336.7 | 29.5 | 8 | 386.5 | 33.8 | 8 | 436.3 | 38.2 | 8 | 486.1 | 42.5 | 8 | 536.0 | 46.9 | 8 | 585.8 | 51.2 |
| 9 | 337.7 | 29.5 | 9 | 387.5 | 33.9 | 9 | 437.3 | 38.3 | 9 | 487.1 | 42.6 | 9 | 536.9 | 47.0 | 9 | 586.8 | 51.3 |
| 340 | 338.7 | 29.6 | 390 | 388.5 | 34.0 | 440 | 438.3 | 38.3 | 490 | 488.1 | 42.7 | 540 | 537.9 | 47.1 | 590 | 587.8 | 51.4 |
| 1 | 339.7 | 29.7 | 1 | 389.5 | 34.1 | 1 | 439.3 | 38.4 | 1 | 489.1 | 42.8 | 1 | 538.9 | 47.2 | 1 | 588.8 | 51.5 |
| 2 | 340.7 | 29.8 | 2 | 390.5 | 34.2 | 2 | 440.3 | 38.5 | 2 | 490.1 | 42.9 | 2 | 539.9 | 47.2 | 2 | 589.7 | 51.6 |
| 3 | 341.7 | 29.9 | 3 | 391.5 | 34.3 | 3 | 441.3 | 38.6 | 3 | 491.1 | 43.0 | 3 | 540.9 | 47.3 | 3 | 590.7 | 51.7 |
| 4 | 342.7 | 30.0 | 4 | 392.5 | 34.3 | 4 | 442.3 | 38.7 | 4 | 492.1 | 43.1 | 4 | 541.9 | 47.4 | 4 | 591.7 | 51.8 |
| 5 | 343.7 | 30.1 | 5 | 393.5 | 34.4 | 5 | 443.3 | 38.8 | 5 | 493.1 | 43.1 | 5 | 542.9 | 47.5 | 5 | 592.7 | 51.9 |
| 6 | 344.7 | 30.2 | 6 | 394.5 | 34.5 | 6 | 444.3 | 38.9 | 6 | 494.1 | 43.2 | 6 | 543.9 | 47.6 | 6 | 593.7 | 51.9 |
| 7 | 345.7 | 30.2 | 7 | 395.5 | 34.6 | 7 | 445.3 | 39.0 | 7 | 495.1 | 43.3 | 7 | 544.9 | 47.7 | 7 | 594.7 | 52.0 |
| 8 | 346.7 | 30.3 | 8 | 396.5 | 34.7 | 8 | 446.3 | 39.0 | 8 | 496.1 | 43.4 | 8 | 545.9 | 47.8 | 8 | 595.7 | 52.1 |
| 9 | 347.7 | 30.4 | 9 | 397.5 | 34.8 | 9 | 447.3 | 39.1 | 9 | 497.1 | 43.5 | 9 | 546.9 | 47.8 | 9 | 596.7 | 52.2 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 275 315
269 265 225

089 085° 045
091 095 135

R

R ou φm

R
359 354° 315
181 186 225

TABELA 1
TÁBUAS DE CARTEAÇÃO

R ou φm
001 006 045
179 174 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|-----|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 49.7 | 5.2 | 100 | 99.5 | 10.5 | 150 | 149.2 | 15.7 | 200 | 198.9 | 20.9 | 250 | 248.6 | 26.1 |
| 1 | 1.0 | 0.1 | 1 | 50.7 | 5.3 | 1 | 100.4 | 10.6 | 1 | 150.2 | 15.8 | 1 | 199.9 | 21.0 | 1 | 249.6 | 26.2 |
| 2 | 2.0 | 0.2 | 2 | 51.7 | 5.4 | 2 | 101.4 | 10.7 | 2 | 151.2 | 15.9 | 2 | 200.9 | 21.1 | 2 | 250.6 | 26.3 |
| 3 | 3.0 | 0.3 | 3 | 52.7 | 5.5 | 3 | 102.4 | 10.8 | 3 | 152.2 | 16.0 | 3 | 201.9 | 21.2 | 3 | 251.6 | 26.4 |
| 4 | 4.0 | 0.4 | 4 | 53.7 | 5.6 | 4 | 103.4 | 10.9 | 4 | 153.2 | 16.1 | 4 | 202.9 | 21.3 | 4 | 252.6 | 26.6 |
| 5 | 5.0 | 0.5 | 5 | 54.7 | 5.7 | 5 | 104.4 | 11.0 | 5 | 154.2 | 16.2 | 5 | 203.9 | 21.4 | 5 | 253.6 | 26.7 |
| 6 | 6.0 | 0.6 | 6 | 55.7 | 5.9 | 6 | 105.4 | 11.1 | 6 | 155.1 | 16.3 | 6 | 204.9 | 21.5 | 6 | 254.6 | 26.8 |
| 7 | 7.0 | 0.7 | 7 | 56.7 | 6.0 | 7 | 106.4 | 11.2 | 7 | 156.1 | 16.4 | 7 | 205.9 | 21.6 | 7 | 255.6 | 26.9 |
| 8 | 8.0 | 0.8 | 8 | 57.7 | 6.1 | 8 | 107.4 | 11.3 | 8 | 157.1 | 16.5 | 8 | 206.9 | 21.7 | 8 | 256.6 | 27.0 |
| 9 | 9.0 | 0.9 | 9 | 58.7 | 6.2 | 9 | 108.4 | 11.4 | 9 | 158.1 | 16.6 | 9 | 207.9 | 21.8 | 9 | 257.6 | 27.1 |
| 10 | 9.9 | 1.0 | 60 | 59.7 | 6.3 | 110 | 109.4 | 11.5 | 160 | 159.1 | 16.7 | 210 | 208.8 | 22.0 | 260 | 258.6 | 27.2 |
| 1 | 10.9 | 1.1 | 1 | 60.7 | 6.4 | 1 | 110.4 | 11.6 | 1 | 160.1 | 16.8 | 1 | 209.8 | 22.1 | 1 | 259.6 | 27.3 |
| 2 | 11.9 | 1.3 | 2 | 61.7 | 6.5 | 2 | 111.4 | 11.7 | 2 | 161.1 | 16.9 | 2 | 210.8 | 22.2 | 2 | 260.6 | 27.4 |
| 3 | 12.9 | 1.4 | 3 | 62.7 | 6.6 | 3 | 112.4 | 11.8 | 3 | 162.1 | 17.0 | 3 | 211.8 | 22.3 | 3 | 261.6 | 27.5 |
| 4 | 13.9 | 1.5 | 4 | 63.6 | 6.7 | 4 | 113.4 | 11.9 | 4 | 163.1 | 17.1 | 4 | 212.8 | 22.4 | 4 | 262.6 | 27.6 |
| 5 | 14.9 | 1.6 | 5 | 64.6 | 6.8 | 5 | 114.4 | 12.0 | 5 | 164.1 | 17.2 | 5 | 213.8 | 22.5 | 5 | 263.5 | 27.7 |
| 6 | 15.9 | 1.7 | 6 | 65.6 | 6.9 | 6 | 115.4 | 12.1 | 6 | 165.1 | 17.4 | 6 | 214.8 | 22.6 | 6 | 264.5 | 27.8 |
| 7 | 16.9 | 1.8 | 7 | 66.6 | 7.0 | 7 | 116.4 | 12.2 | 7 | 166.1 | 17.5 | 7 | 215.8 | 22.7 | 7 | 265.5 | 27.9 |
| 8 | 17.9 | 1.9 | 8 | 67.6 | 7.1 | 8 | 117.4 | 12.3 | 8 | 167.1 | 17.6 | 8 | 216.8 | 22.8 | 8 | 266.5 | 28.0 |
| 9 | 18.9 | 2.0 | 9 | 68.6 | 7.2 | 9 | 118.3 | 12.4 | 9 | 168.1 | 17.7 | 9 | 217.8 | 22.9 | 9 | 267.5 | 28.1 |
| 20 | 19.9 | 2.1 | 70 | 69.6 | 7.3 | 120 | 119.3 | 12.5 | 170 | 169.1 | 17.8 | 220 | 218.8 | 23.0 | 270 | 268.5 | 28.2 |
| 1 | 20.9 | 2.2 | 1 | 70.6 | 7.4 | 1 | 120.3 | 12.6 | 1 | 170.1 | 17.9 | 1 | 219.8 | 23.1 | 1 | 269.5 | 28.3 |
| 2 | 21.9 | 2.3 | 2 | 71.6 | 7.5 | 2 | 121.3 | 12.8 | 2 | 171.1 | 18.0 | 2 | 220.8 | 23.2 | 2 | 270.5 | 28.4 |
| 3 | 22.9 | 2.4 | 3 | 72.6 | 7.6 | 3 | 122.3 | 12.9 | 3 | 172.1 | 18.1 | 3 | 221.8 | 23.3 | 3 | 271.5 | 28.5 |
| 4 | 23.9 | 2.5 | 4 | 73.6 | 7.7 | 4 | 123.3 | 13.0 | 4 | 173.0 | 18.2 | 4 | 222.8 | 23.4 | 4 | 272.5 | 28.6 |
| 5 | 24.9 | 2.6 | 5 | 74.6 | 7.8 | 5 | 124.3 | 13.1 | 5 | 174.0 | 18.3 | 5 | 223.8 | 23.5 | 5 | 273.5 | 28.7 |
| 6 | 25.9 | 2.7 | 6 | 75.6 | 7.9 | 6 | 125.3 | 13.2 | 6 | 175.0 | 18.4 | 6 | 224.8 | 23.6 | 6 | 274.5 | 28.8 |
| 7 | 26.9 | 2.8 | 7 | 76.6 | 8.0 | 7 | 126.3 | 13.3 | 7 | 176.0 | 18.5 | 7 | 225.8 | 23.7 | 7 | 275.5 | 29.0 |
| 8 | 27.8 | 2.9 | 8 | 77.6 | 8.2 | 8 | 127.3 | 13.4 | 8 | 177.0 | 18.6 | 8 | 226.8 | 23.8 | 8 | 276.5 | 29.1 |
| 9 | 28.8 | 3.0 | 9 | 78.6 | 8.3 | 9 | 128.3 | 13.5 | 9 | 178.0 | 18.7 | 9 | 227.7 | 23.9 | 9 | 277.5 | 29.2 |
| 30 | 29.8 | 3.1 | 80 | 79.6 | 8.4 | 130 | 129.3 | 13.6 | 180 | 179.0 | 18.8 | 230 | 228.7 | 24.0 | 280 | 278.5 | 29.3 |
| 1 | 30.8 | 3.2 | 1 | 80.6 | 8.5 | 1 | 130.3 | 13.7 | 1 | 180.0 | 18.9 | 1 | 229.7 | 24.1 | 1 | 279.5 | 29.4 |
| 2 | 31.8 | 3.3 | 2 | 81.6 | 8.6 | 2 | 131.3 | 13.8 | 2 | 181.0 | 19.0 | 2 | 230.7 | 24.3 | 2 | 280.5 | 29.5 |
| 3 | 32.8 | 3.4 | 3 | 82.5 | 8.7 | 3 | 132.3 | 13.9 | 3 | 182.0 | 19.1 | 3 | 231.7 | 24.4 | 3 | 281.4 | 29.6 |
| 4 | 33.8 | 3.6 | 4 | 83.5 | 8.8 | 4 | 133.3 | 14.0 | 4 | 183.0 | 19.2 | 4 | 232.7 | 24.5 | 4 | 282.4 | 29.7 |
| 5 | 34.8 | 3.7 | 5 | 84.5 | 8.9 | 5 | 134.3 | 14.1 | 5 | 184.0 | 19.3 | 5 | 233.7 | 24.6 | 5 | 283.4 | 29.8 |
| 6 | 35.8 | 3.8 | 6 | 85.5 | 9.0 | 6 | 135.3 | 14.2 | 6 | 185.0 | 19.4 | 6 | 234.7 | 24.7 | 6 | 284.4 | 29.9 |
| 7 | 36.8 | 3.9 | 7 | 86.5 | 9.1 | 7 | 136.2 | 14.3 | 7 | 186.0 | 19.5 | 7 | 235.7 | 24.8 | 7 | 285.4 | 30.0 |
| 8 | 37.8 | 4.0 | 8 | 87.5 | 9.2 | 8 | 137.2 | 14.4 | 8 | 187.0 | 19.7 | 8 | 236.7 | 24.9 | 8 | 286.4 | 30.1 |
| 9 | 38.8 | 4.1 | 9 | 88.5 | 9.3 | 9 | 138.2 | 14.5 | 9 | 188.0 | 19.8 | 9 | 237.7 | 25.0 | 9 | 287.4 | 30.2 |
| 40 | 39.8 | 4.2 | 90 | 89.5 | 9.4 | 140 | 139.2 | 14.6 | 190 | 189.0 | 19.9 | 240 | 238.7 | 25.1 | 290 | 288.4 | 30.3 |
| 1 | 40.8 | 4.3 | 1 | 90.5 | 9.5 | 1 | 140.2 | 14.7 | 1 | 190.0 | 20.0 | 1 | 239.7 | 25.2 | 1 | 289.4 | 30.4 |
| 2 | 41.8 | 4.4 | 2 | 91.5 | 9.6 | 2 | 141.2 | 14.8 | 2 | 190.9 | 20.1 | 2 | 240.7 | 25.3 | 2 | 290.4 | 30.5 |
| 3 | 42.8 | 4.5 | 3 | 92.5 | 9.7 | 3 | 142.2 | 14.9 | 3 | 191.9 | 20.2 | 3 | 241.7 | 25.4 | 3 | 291.4 | 30.6 |
| 4 | 43.8 | 4.6 | 4 | 93.5 | 9.8 | 4 | 143.2 | 15.1 | 4 | 192.9 | 20.3 | 4 | 242.7 | 25.5 | 4 | 292.4 | 30.7 |
| 5 | 44.8 | 4.7 | 5 | 94.5 | 9.9 | 5 | 144.2 | 15.2 | 5 | 193.9 | 20.4 | 5 | 243.7 | 25.6 | 5 | 293.4 | 30.8 |
| 6 | 45.7 | 4.8 | 6 | 95.5 | 10.0 | 6 | 145.2 | 15.3 | 6 | 194.9 | 20.5 | 6 | 244.7 | 25.7 | 6 | 294.4 | 30.9 |
| 7 | 46.7 | 4.9 | 7 | 96.5 | 10.1 | 7 | 146.2 | 15.4 | 7 | 195.9 | 20.6 | 7 | 245.6 | 25.8 | 7 | 295.4 | 31.0 |
| 8 | 47.7 | 5.0 | 8 | 97.5 | 10.2 | 8 | 147.2 | 15.5 | 8 | 196.9 | 20.7 | 8 | 246.6 | 25.9 | 8 | 296.4 | 31.1 |
| 9 | 48.7 | 5.1 | 9 | 98.5 | 10.3 | 9 | 148.2 | 15.6 | 9 | 197.9 | 20.8 | 9 | 247.6 | 26.0 | 9 | 297.4 | 31.3 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 276 315
269 264 225
R

089 084° 045
091 096 135
R ou φm

R

TABELA 1

R ou φm

359 354° 315
181 186 225

TÁBUAS DE CARTEAÇÃO

001 006 045
179 174 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 298.4 | 31.4 | 350 | 348.1 | 36.6 | 400 | 397.8 | 41.8 | 450 | 447.5 | 47.0 | 500 | 497.3 | 52.3 | 550 | 547.0 | 57.5 |
| 1 | 299.4 | 31.5 | 1 | 349.1 | 36.7 | 1 | 398.8 | 41.9 | 1 | 448.5 | 47.1 | 1 | 498.3 | 52.4 | 1 | 548.0 | 57.6 |
| 2 | 300.3 | 31.6 | 2 | 350.1 | 36.8 | 2 | 399.8 | 42.0 | 2 | 449.5 | 47.2 | 2 | 499.2 | 52.5 | 2 | 549.0 | 57.7 |
| 3 | 301.3 | 31.7 | 3 | 351.1 | 36.9 | 3 | 400.8 | 42.1 | 3 | 450.5 | 47.4 | 3 | 500.2 | 52.6 | 3 | 550.0 | 57.8 |
| 4 | 302.3 | 31.8 | 4 | 352.1 | 37.0 | 4 | 401.8 | 42.2 | 4 | 451.5 | 47.5 | 4 | 501.2 | 52.7 | 4 | 551.0 | 57.9 |
| 5 | 303.3 | 31.9 | 5 | 353.1 | 37.1 | 5 | 402.8 | 42.3 | 5 | 452.5 | 47.6 | 5 | 502.2 | 52.8 | 5 | 552.0 | 58.0 |
| 6 | 304.3 | 32.0 | 6 | 354.0 | 37.2 | 6 | 403.8 | 42.4 | 6 | 453.5 | 47.7 | 6 | 503.2 | 52.9 | 6 | 553.0 | 58.1 |
| 7 | 305.3 | 32.1 | 7 | 355.0 | 37.3 | 7 | 404.8 | 42.5 | 7 | 454.5 | 47.8 | 7 | 504.2 | 53.0 | 7 | 553.9 | 58.2 |
| 8 | 306.3 | 32.2 | 8 | 356.0 | 37.4 | 8 | 405.8 | 42.6 | 8 | 455.5 | 47.9 | 8 | 505.2 | 53.1 | 8 | 554.9 | 58.3 |
| 9 | 307.3 | 32.3 | 9 | 357.0 | 37.5 | 9 | 406.8 | 42.8 | 9 | 456.5 | 48.0 | 9 | 506.2 | 53.2 | 9 | 555.9 | 58.4 |
| 310 | 308.3 | 32.4 | 360 | 358.0 | 37.6 | 410 | 407.8 | 42.9 | 460 | 457.5 | 48.1 | 510 | 507.2 | 53.3 | 560 | 556.9 | 58.5 |
| 1 | 309.3 | 32.5 | 1 | 359.0 | 37.7 | 1 | 408.7 | 43.0 | 1 | 458.5 | 48.2 | 1 | 508.2 | 53.4 | 1 | 557.9 | 58.6 |
| 2 | 310.3 | 32.6 | 2 | 360.0 | 37.8 | 2 | 409.7 | 43.1 | 2 | 459.5 | 48.3 | 2 | 509.2 | 53.5 | 2 | 558.9 | 58.7 |
| 3 | 311.3 | 32.7 | 3 | 361.0 | 37.9 | 3 | 410.7 | 43.2 | 3 | 460.5 | 48.4 | 3 | 510.2 | 53.6 | 3 | 559.9 | 58.8 |
| 4 | 312.3 | 32.8 | 4 | 362.0 | 38.0 | 4 | 411.7 | 43.3 | 4 | 461.5 | 48.5 | 4 | 511.2 | 53.7 | 4 | 560.9 | 59.0 |
| 5 | 313.3 | 32.9 | 5 | 363.0 | 38.2 | 5 | 412.7 | 43.4 | 5 | 462.5 | 48.6 | 5 | 512.2 | 53.8 | 5 | 561.9 | 59.1 |
| 6 | 314.3 | 33.0 | 6 | 364.0 | 38.3 | 6 | 413.7 | 43.5 | 6 | 463.4 | 48.7 | 6 | 513.2 | 53.9 | 6 | 562.9 | 59.2 |
| 7 | 315.3 | 33.1 | 7 | 365.0 | 38.4 | 7 | 414.7 | 43.6 | 7 | 464.4 | 48.8 | 7 | 514.2 | 54.0 | 7 | 563.9 | 59.3 |
| 8 | 316.3 | 33.2 | 8 | 366.0 | 38.5 | 8 | 415.7 | 43.7 | 8 | 465.4 | 48.9 | 8 | 515.2 | 54.1 | 8 | 564.9 | 59.4 |
| 9 | 317.3 | 33.3 | 9 | 367.0 | 38.6 | 9 | 416.7 | 43.8 | 9 | 466.4 | 49.0 | 9 | 516.2 | 54.3 | 9 | 565.9 | 59.5 |
| 320 | 318.2 | 33.4 | 370 | 368.0 | 38.7 | 420 | 417.7 | 43.9 | 470 | 467.4 | 49.1 | 520 | 517.2 | 54.4 | 570 | 566.9 | 59.6 |
| 1 | 319.2 | 33.6 | 1 | 369.0 | 38.8 | 1 | 418.7 | 44.0 | 1 | 468.4 | 49.2 | 1 | 518.1 | 54.5 | 1 | 567.9 | 59.7 |
| 2 | 320.2 | 33.7 | 2 | 370.0 | 38.9 | 2 | 419.7 | 44.1 | 2 | 469.4 | 49.3 | 2 | 519.1 | 54.6 | 2 | 568.9 | 59.8 |
| 3 | 321.2 | 33.8 | 3 | 371.0 | 39.0 | 3 | 420.7 | 44.2 | 3 | 470.4 | 49.4 | 3 | 520.1 | 54.7 | 3 | 569.9 | 59.9 |
| 4 | 322.2 | 33.9 | 4 | 372.0 | 39.1 | 4 | 421.7 | 44.3 | 4 | 471.4 | 49.5 | 4 | 521.1 | 54.8 | 4 | 570.9 | 60.0 |
| 5 | 323.2 | 34.0 | 5 | 372.9 | 39.2 | 5 | 422.7 | 44.4 | 5 | 472.4 | 49.7 | 5 | 522.1 | 54.9 | 5 | 571.8 | 60.1 |
| 6 | 324.2 | 34.1 | 6 | 373.9 | 39.3 | 6 | 423.7 | 44.5 | 6 | 473.4 | 49.8 | 6 | 523.1 | 55.0 | 6 | 572.8 | 60.2 |
| 7 | 325.2 | 34.2 | 7 | 374.9 | 39.4 | 7 | 424.7 | 44.6 | 7 | 474.4 | 49.9 | 7 | 524.1 | 55.1 | 7 | 573.8 | 60.3 |
| 8 | 326.2 | 34.3 | 8 | 375.9 | 39.5 | 8 | 425.7 | 44.7 | 8 | 475.4 | 50.0 | 8 | 525.1 | 55.2 | 8 | 574.8 | 60.4 |
| 9 | 327.2 | 34.4 | 9 | 376.9 | 39.6 | 9 | 426.6 | 44.8 | 9 | 476.4 | 50.1 | 9 | 526.1 | 55.3 | 9 | 575.8 | 60.5 |
| 330 | 328.2 | 34.5 | 380 | 377.9 | 39.7 | 430 | 427.6 | 44.9 | 480 | 477.4 | 50.2 | 530 | 527.1 | 55.4 | 580 | 576.8 | 60.6 |
| 1 | 329.2 | 34.6 | 1 | 378.9 | 39.8 | 1 | 428.6 | 45.1 | 1 | 478.4 | 50.3 | 1 | 528.1 | 55.5 | 1 | 577.8 | 60.7 |
| 2 | 330.2 | 34.7 | 2 | 379.9 | 39.9 | 2 | 429.6 | 45.2 | 2 | 479.4 | 50.4 | 2 | 529.1 | 55.6 | 2 | 578.8 | 60.8 |
| 3 | 331.2 | 34.8 | 3 | 380.9 | 40.0 | 3 | 430.6 | 45.3 | 3 | 480.4 | 50.5 | 3 | 530.1 | 55.7 | 3 | 579.8 | 60.9 |
| 4 | 332.2 | 34.9 | 4 | 381.9 | 40.1 | 4 | 431.6 | 45.4 | 4 | 481.3 | 50.6 | 4 | 531.1 | 55.8 | 4 | 580.8 | 61.0 |
| 5 | 333.2 | 35.0 | 5 | 382.9 | 40.2 | 5 | 432.6 | 45.5 | 5 | 482.3 | 50.7 | 5 | 532.1 | 55.9 | 5 | 581.8 | 61.1 |
| 6 | 334.2 | 35.1 | 6 | 383.9 | 40.3 | 6 | 433.6 | 45.6 | 6 | 483.3 | 50.8 | 6 | 533.1 | 56.0 | 6 | 582.8 | 61.3 |
| 7 | 335.2 | 35.2 | 7 | 384.9 | 40.5 | 7 | 434.6 | 45.7 | 7 | 484.3 | 50.9 | 7 | 534.1 | 56.1 | 7 | 583.8 | 61.4 |
| 8 | 336.1 | 35.3 | 8 | 385.9 | 40.6 | 8 | 435.6 | 45.8 | 8 | 485.3 | 51.0 | 8 | 535.1 | 56.2 | 8 | 584.8 | 61.5 |
| 9 | 337.1 | 35.4 | 9 | 386.9 | 40.7 | 9 | 436.6 | 45.9 | 9 | 486.3 | 51.1 | 9 | 536.0 | 56.3 | 9 | 585.8 | 61.6 |
| 340 | 338.1 | 35.5 | 390 | 387.9 | 40.8 | 440 | 437.6 | 46.0 | 490 | 487.3 | 51.2 | 540 | 537.0 | 56.4 | 590 | 586.8 | 61.7 |
| 1 | 339.1 | 35.6 | 1 | 388.9 | 40.9 | 1 | 438.6 | 46.1 | 1 | 488.3 | 51.3 | 1 | 538.0 | 56.5 | 1 | 587.8 | 61.8 |
| 2 | 340.1 | 35.7 | 2 | 389.9 | 41.0 | 2 | 439.6 | 46.2 | 2 | 489.3 | 51.4 | 2 | 539.0 | 56.7 | 2 | 588.8 | 61.9 |
| 3 | 341.1 | 35.9 | 3 | 390.8 | 41.1 | 3 | 440.6 | 46.3 | 3 | 490.3 | 51.5 | 3 | 540.0 | 56.8 | 3 | 589.8 | 62.0 |
| 4 | 342.1 | 36.0 | 4 | 391.8 | 41.2 | 4 | 441.6 | 46.4 | 4 | 491.3 | 51.6 | 4 | 541.0 | 56.9 | 4 | 590.7 | 62.1 |
| 5 | 343.1 | 36.1 | 5 | 392.8 | 41.3 | 5 | 442.6 | 46.5 | 5 | 492.3 | 51.7 | 5 | 542.0 | 57.0 | 5 | 591.7 | 62.2 |
| 6 | 344.1 | 36.2 | 6 | 393.8 | 41.4 | 6 | 443.6 | 46.6 | 6 | 493.3 | 51.8 | 6 | 543.0 | 57.1 | 6 | 592.7 | 62.3 |
| 7 | 345.1 | 36.3 | 7 | 394.8 | 41.5 | 7 | 444.6 | 46.7 | 7 | 494.3 | 52.0 | 7 | 544.0 | 57.2 | 7 | 593.7 | 62.4 |
| 8 | 346.1 | 36.4 | 8 | 395.8 | 41.6 | 8 | 445.5 | 46.8 | 8 | 495.3 | 52.1 | 8 | 545.0 | 57.3 | 8 | 594.7 | 62.5 |
| 9 | 347.1 | 36.5 | 9 | 396.8 | 41.7 | 9 | 446.5 | 46.9 | 9 | 496.3 | 52.2 | 9 | 546.0 | 57.4 | 9 | 595.7 | 62.6 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 276 315
269 264 225

R

089 084° 045
091 096 135

R ou φm

R

TABELA 1

R ou φm

359 353° 315
181 187 225

TÁBUAS DE CARTEAÇÃO

001 007 045
179 173 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|-----|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 49.6 | 6.1 | 100 | 99.3 | 12.2 | 150 | 148.9 | 18.3 | 200 | 198.5 | 24.4 | 250 | 248.1 | 30.5 |
| 1 | 1.0 | 0.1 | 1 | 50.6 | 6.2 | 1 | 100.2 | 12.3 | 1 | 149.9 | 18.4 | 1 | 199.5 | 24.5 | 1 | 249.1 | 30.6 |
| 2 | 2.0 | 0.2 | 2 | 51.6 | 6.3 | 2 | 101.2 | 12.4 | 2 | 150.9 | 18.5 | 2 | 200.5 | 24.6 | 2 | 250.1 | 30.7 |
| 3 | 3.0 | 0.4 | 3 | 52.6 | 6.5 | 3 | 102.2 | 12.6 | 3 | 151.9 | 18.6 | 3 | 201.5 | 24.7 | 3 | 251.1 | 30.8 |
| 4 | 4.0 | 0.5 | 4 | 53.6 | 6.6 | 4 | 103.2 | 12.7 | 4 | 152.9 | 18.8 | 4 | 202.5 | 24.9 | 4 | 252.1 | 31.0 |
| 5 | 5.0 | 0.6 | 5 | 54.6 | 6.7 | 5 | 104.2 | 12.8 | 5 | 153.8 | 18.9 | 5 | 203.5 | 25.0 | 5 | 253.1 | 31.1 |
| 6 | 6.0 | 0.7 | 6 | 55.6 | 6.8 | 6 | 105.2 | 12.9 | 6 | 154.8 | 19.0 | 6 | 204.5 | 25.1 | 6 | 254.1 | 31.2 |
| 7 | 6.9 | 0.9 | 7 | 56.6 | 6.9 | 7 | 106.2 | 13.0 | 7 | 155.8 | 19.1 | 7 | 205.5 | 25.2 | 7 | 255.1 | 31.3 |
| 8 | 7.9 | 1.0 | 8 | 57.6 | 7.1 | 8 | 107.2 | 13.2 | 8 | 156.8 | 19.3 | 8 | 206.4 | 25.3 | 8 | 256.1 | 31.4 |
| 9 | 8.9 | 1.1 | 9 | 58.6 | 7.2 | 9 | 108.2 | 13.3 | 9 | 157.8 | 19.4 | 9 | 207.4 | 25.5 | 9 | 257.1 | 31.6 |
| 10 | 9.9 | 1.2 | 60 | 59.6 | 7.3 | 110 | 109.2 | 13.4 | 160 | 158.8 | 19.5 | 210 | 208.4 | 25.6 | 260 | 258.1 | 31.7 |
| 1 | 10.9 | 1.3 | 1 | 60.5 | 7.4 | 1 | 110.2 | 13.5 | 1 | 159.8 | 19.6 | 1 | 209.4 | 25.7 | 1 | 259.1 | 31.8 |
| 2 | 11.9 | 1.5 | 2 | 61.5 | 7.6 | 2 | 111.2 | 13.6 | 2 | 160.8 | 19.7 | 2 | 210.4 | 25.8 | 2 | 260.0 | 31.9 |
| 3 | 12.9 | 1.6 | 3 | 62.5 | 7.7 | 3 | 112.2 | 13.8 | 3 | 161.8 | 19.9 | 3 | 211.4 | 26.0 | 3 | 261.0 | 32.1 |
| 4 | 13.9 | 1.7 | 4 | 63.5 | 7.8 | 4 | 113.2 | 13.9 | 4 | 162.8 | 20.0 | 4 | 212.4 | 26.1 | 4 | 262.0 | 32.2 |
| 5 | 14.9 | 1.8 | 5 | 64.5 | 7.9 | 5 | 114.1 | 14.0 | 5 | 163.8 | 20.1 | 5 | 213.4 | 26.2 | 5 | 263.0 | 32.3 |
| 6 | 15.9 | 1.9 | 6 | 65.5 | 8.0 | 6 | 115.1 | 14.1 | 6 | 164.8 | 20.2 | 6 | 214.4 | 26.3 | 6 | 264.0 | 32.4 |
| 7 | 16.9 | 2.1 | 7 | 66.5 | 8.2 | 7 | 116.1 | 14.3 | 7 | 165.8 | 20.4 | 7 | 215.4 | 26.4 | 7 | 265.0 | 32.5 |
| 8 | 17.9 | 2.2 | 8 | 67.5 | 8.3 | 8 | 117.1 | 14.4 | 8 | 166.7 | 20.5 | 8 | 216.4 | 26.6 | 8 | 266.0 | 32.7 |
| 9 | 18.9 | 2.3 | 9 | 68.5 | 8.4 | 9 | 118.1 | 14.5 | 9 | 167.7 | 20.6 | 9 | 217.4 | 26.7 | 9 | 267.0 | 32.8 |
| 20 | 19.9 | 2.4 | 70 | 69.5 | 8.5 | 120 | 119.1 | 14.6 | 170 | 168.7 | 20.7 | 220 | 218.4 | 26.8 | 270 | 268.0 | 32.9 |
| 1 | 20.8 | 2.6 | 1 | 70.5 | 8.7 | 1 | 120.1 | 14.7 | 1 | 169.7 | 20.8 | 1 | 219.4 | 26.9 | 1 | 269.0 | 33.0 |
| 2 | 21.8 | 2.7 | 2 | 71.5 | 8.8 | 2 | 121.1 | 14.9 | 2 | 170.7 | 21.0 | 2 | 220.3 | 27.1 | 2 | 270.0 | 33.1 |
| 3 | 22.8 | 2.8 | 3 | 72.5 | 8.9 | 3 | 122.1 | 15.0 | 3 | 171.7 | 21.1 | 3 | 221.3 | 27.2 | 3 | 271.0 | 33.3 |
| 4 | 23.8 | 2.9 | 4 | 73.4 | 9.0 | 4 | 123.1 | 15.1 | 4 | 172.7 | 21.2 | 4 | 222.3 | 27.3 | 4 | 272.0 | 33.4 |
| 5 | 24.8 | 3.0 | 5 | 74.4 | 9.1 | 5 | 124.1 | 15.2 | 5 | 173.7 | 21.3 | 5 | 223.3 | 27.4 | 5 | 272.9 | 33.5 |
| 6 | 25.8 | 3.2 | 6 | 75.4 | 9.3 | 6 | 125.1 | 15.4 | 6 | 174.7 | 21.4 | 6 | 224.3 | 27.5 | 6 | 273.9 | 33.6 |
| 7 | 26.8 | 3.3 | 7 | 76.4 | 9.4 | 7 | 126.1 | 15.5 | 7 | 175.7 | 21.6 | 7 | 225.3 | 27.7 | 7 | 274.9 | 33.8 |
| 8 | 27.8 | 3.4 | 8 | 77.4 | 9.5 | 8 | 127.0 | 15.6 | 8 | 176.7 | 21.7 | 8 | 226.3 | 27.8 | 8 | 275.9 | 33.9 |
| 9 | 28.8 | 3.5 | 9 | 78.4 | 9.6 | 9 | 128.0 | 15.7 | 9 | 177.7 | 21.8 | 9 | 227.3 | 27.9 | 9 | 276.9 | 34.0 |
| 30 | 29.8 | 3.7 | 80 | 79.4 | 9.7 | 130 | 129.0 | 15.8 | 180 | 178.7 | 21.9 | 230 | 228.3 | 28.0 | 280 | 277.9 | 34.1 |
| 1 | 30.8 | 3.8 | 1 | 80.4 | 9.9 | 1 | 130.0 | 16.0 | 1 | 179.7 | 22.1 | 1 | 229.3 | 28.2 | 1 | 278.9 | 34.2 |
| 2 | 31.8 | 3.9 | 2 | 81.4 | 10.0 | 2 | 131.0 | 16.1 | 2 | 180.6 | 22.2 | 2 | 230.3 | 28.3 | 2 | 279.9 | 34.4 |
| 3 | 32.8 | 4.0 | 3 | 82.4 | 10.1 | 3 | 132.0 | 16.2 | 3 | 181.6 | 22.3 | 3 | 231.3 | 28.4 | 3 | 280.9 | 34.5 |
| 4 | 33.7 | 4.1 | 4 | 83.4 | 10.2 | 4 | 133.0 | 16.3 | 4 | 182.6 | 22.4 | 4 | 232.3 | 28.5 | 4 | 281.9 | 34.6 |
| 5 | 34.7 | 4.3 | 5 | 84.4 | 10.4 | 5 | 134.0 | 16.5 | 5 | 183.6 | 22.5 | 5 | 233.2 | 28.6 | 5 | 282.9 | 34.7 |
| 6 | 35.7 | 4.4 | 6 | 85.4 | 10.5 | 6 | 135.0 | 16.6 | 6 | 184.6 | 22.7 | 6 | 234.2 | 28.8 | 6 | 283.9 | 34.9 |
| 7 | 36.7 | 4.5 | 7 | 86.4 | 10.6 | 7 | 136.0 | 16.7 | 7 | 185.6 | 22.8 | 7 | 235.2 | 28.9 | 7 | 284.9 | 35.0 |
| 8 | 37.7 | 4.6 | 8 | 87.3 | 10.7 | 8 | 137.0 | 16.8 | 8 | 186.6 | 22.9 | 8 | 236.2 | 29.0 | 8 | 285.9 | 35.1 |
| 9 | 38.7 | 4.8 | 9 | 88.3 | 10.8 | 9 | 138.0 | 16.9 | 9 | 187.6 | 23.0 | 9 | 237.2 | 29.1 | 9 | 286.8 | 35.2 |
| 40 | 39.7 | 4.9 | 90 | 89.3 | 11.0 | 140 | 139.0 | 17.1 | 190 | 188.6 | 23.2 | 240 | 238.2 | 29.2 | 290 | 287.8 | 35.3 |
| 1 | 40.7 | 5.0 | 1 | 90.3 | 11.1 | 1 | 139.9 | 17.2 | 1 | 189.6 | 23.3 | 1 | 239.2 | 29.4 | 1 | 288.8 | 35.5 |
| 2 | 41.7 | 5.1 | 2 | 91.3 | 11.2 | 2 | 140.9 | 17.3 | 2 | 190.6 | 23.4 | 2 | 240.2 | 29.5 | 2 | 289.8 | 35.6 |
| 3 | 42.7 | 5.2 | 3 | 92.3 | 11.3 | 3 | 141.9 | 17.4 | 3 | 191.6 | 23.5 | 3 | 241.2 | 29.6 | 3 | 290.8 | 35.7 |
| 4 | 43.7 | 5.4 | 4 | 93.3 | 11.5 | 4 | 142.9 | 17.5 | 4 | 192.6 | 23.6 | 4 | 242.2 | 29.7 | 4 | 291.8 | 35.8 |
| 5 | 44.7 | 5.5 | 5 | 94.3 | 11.6 | 5 | 143.9 | 17.7 | 5 | 193.5 | 23.8 | 5 | 243.2 | 29.9 | 5 | 292.8 | 36.0 |
| 6 | 45.7 | 5.6 | 6 | 95.3 | 11.7 | 6 | 144.9 | 17.8 | 6 | 194.5 | 23.9 | 6 | 244.2 | 30.0 | 6 | 293.8 | 36.1 |
| 7 | 46.6 | 5.7 | 7 | 96.3 | 11.8 | 7 | 145.9 | 17.9 | 7 | 195.5 | 24.0 | 7 | 245.2 | 30.1 | 7 | 294.8 | 36.2 |
| 8 | 47.6 | 5.8 | 8 | 97.3 | 11.9 | 8 | 146.9 | 18.0 | 8 | 196.5 | 24.1 | 8 | 246.2 | 30.2 | 8 | 295.8 | 36.3 |
| 9 | 48.6 | 6.0 | 9 | 98.3 | 12.1 | 9 | 147.9 | 18.2 | 9 | 197.5 | 24.3 | 9 | 247.1 | 30.3 | 9 | 296.8 | 36.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 277 315
269 263 225

R

089 083° 045
091 097 135

R ou φm

R

TABELA 1

R ou φm

359 353° 315
181 187 225

TÁBUAS DE CARTEAÇÃO

001 007 045
179 173 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 297.8 | 36.6 | 350 | 347.4 | 42.7 | 400 | 397.0 | 48.7 | 450 | 446.6 | 54.8 | 500 | 496.3 | 60.9 | 550 | 545.9 | 67.0 |
| 1 | 298.8 | 36.7 | 1 | 348.4 | 42.8 | 1 | 398.0 | 48.9 | 1 | 447.6 | 55.0 | 1 | 497.3 | 61.1 | 1 | 546.9 | 67.1 |
| 2 | 299.7 | 36.8 | 2 | 349.4 | 42.9 | 2 | 399.0 | 49.0 | 2 | 448.6 | 55.1 | 2 | 498.3 | 61.2 | 2 | 547.9 | 67.3 |
| 3 | 300.7 | 36.9 | 3 | 350.4 | 43.0 | 3 | 400.0 | 49.1 | 3 | 449.6 | 55.2 | 3 | 499.3 | 61.3 | 3 | 548.9 | 67.4 |
| 4 | 301.7 | 37.0 | 4 | 351.4 | 43.1 | 4 | 401.0 | 49.2 | 4 | 450.6 | 55.3 | 4 | 500.2 | 61.4 | 4 | 549.9 | 67.5 |
| 5 | 302.7 | 37.2 | 5 | 352.4 | 43.3 | 5 | 402.0 | 49.4 | 5 | 451.6 | 55.5 | 5 | 501.2 | 61.5 | 5 | 550.9 | 67.6 |
| 6 | 303.7 | 37.3 | 6 | 353.3 | 43.4 | 6 | 403.0 | 49.5 | 6 | 452.6 | 55.6 | 6 | 502.2 | 61.7 | 6 | 551.9 | 67.8 |
| 7 | 304.7 | 37.4 | 7 | 354.3 | 43.5 | 7 | 404.0 | 49.6 | 7 | 453.6 | 55.7 | 7 | 503.2 | 61.8 | 7 | 552.8 | 67.9 |
| 8 | 305.7 | 37.5 | 8 | 355.3 | 43.6 | 8 | 405.0 | 49.7 | 8 | 454.6 | 55.8 | 8 | 504.2 | 61.9 | 8 | 553.8 | 68.0 |
| 9 | 306.7 | 37.7 | 9 | 356.3 | 43.8 | 9 | 406.0 | 49.8 | 9 | 455.6 | 55.9 | 9 | 505.2 | 62.0 | 9 | 554.8 | 68.1 |
| 310 | 307.7 | 37.8 | 360 | 357.3 | 43.9 | 410 | 406.9 | 50.0 | 460 | 456.6 | 56.1 | 510 | 506.2 | 62.2 | 560 | 555.8 | 68.2 |
| 1 | 308.7 | 37.9 | 1 | 358.3 | 44.0 | 1 | 407.9 | 50.1 | 1 | 457.6 | 56.2 | 1 | 507.2 | 62.3 | 1 | 556.8 | 68.4 |
| 2 | 309.7 | 38.0 | 2 | 359.3 | 44.1 | 2 | 408.9 | 50.2 | 2 | 458.6 | 56.3 | 2 | 508.2 | 62.4 | 2 | 557.8 | 68.5 |
| 3 | 310.7 | 38.1 | 3 | 360.3 | 44.2 | 3 | 409.9 | 50.3 | 3 | 459.5 | 56.4 | 3 | 509.2 | 62.5 | 3 | 558.8 | 68.6 |
| 4 | 311.7 | 38.3 | 4 | 361.3 | 44.4 | 4 | 410.9 | 50.5 | 4 | 460.5 | 56.5 | 4 | 510.2 | 62.6 | 4 | 559.8 | 68.7 |
| 5 | 312.7 | 38.4 | 5 | 362.3 | 44.5 | 5 | 411.9 | 50.6 | 5 | 461.5 | 56.7 | 5 | 511.2 | 62.8 | 5 | 560.8 | 68.9 |
| 6 | 313.6 | 38.5 | 6 | 363.3 | 44.6 | 6 | 412.9 | 50.7 | 6 | 462.5 | 56.8 | 6 | 512.2 | 62.9 | 6 | 561.8 | 69.0 |
| 7 | 314.6 | 38.6 | 7 | 364.3 | 44.7 | 7 | 413.9 | 50.8 | 7 | 463.5 | 56.9 | 7 | 513.1 | 63.0 | 7 | 562.8 | 69.1 |
| 8 | 315.6 | 38.8 | 8 | 365.3 | 44.8 | 8 | 414.9 | 50.9 | 8 | 464.5 | 57.0 | 8 | 514.1 | 63.1 | 8 | 563.8 | 69.2 |
| 9 | 316.6 | 38.9 | 9 | 366.2 | 45.0 | 9 | 415.9 | 51.1 | 9 | 465.5 | 57.2 | 9 | 515.1 | 63.3 | 9 | 564.8 | 69.3 |
| 320 | 317.6 | 39.0 | 370 | 367.2 | 45.1 | 420 | 416.9 | 51.2 | 470 | 466.5 | 57.3 | 520 | 516.1 | 63.4 | 570 | 565.8 | 69.5 |
| 1 | 318.6 | 39.1 | 1 | 368.2 | 45.2 | 1 | 417.9 | 51.3 | 1 | 467.5 | 57.4 | 1 | 517.1 | 63.5 | 1 | 566.7 | 69.6 |
| 2 | 319.6 | 39.2 | 2 | 369.2 | 45.3 | 2 | 418.9 | 51.4 | 2 | 468.5 | 57.5 | 2 | 518.1 | 63.6 | 2 | 567.7 | 69.7 |
| 3 | 320.6 | 39.4 | 3 | 370.2 | 45.5 | 3 | 419.8 | 51.6 | 3 | 469.5 | 57.6 | 3 | 519.1 | 63.7 | 3 | 568.7 | 69.8 |
| 4 | 321.6 | 39.5 | 4 | 371.2 | 45.6 | 4 | 420.8 | 51.7 | 4 | 470.5 | 57.8 | 4 | 520.1 | 63.9 | 4 | 569.7 | 70.0 |
| 5 | 322.6 | 39.6 | 5 | 372.2 | 45.7 | 5 | 421.8 | 51.8 | 5 | 471.5 | 57.9 | 5 | 521.1 | 64.0 | 5 | 570.7 | 70.1 |
| 6 | 323.6 | 39.7 | 6 | 373.2 | 45.8 | 6 | 422.8 | 51.9 | 6 | 472.5 | 58.0 | 6 | 522.1 | 64.1 | 6 | 571.7 | 70.2 |
| 7 | 324.6 | 39.9 | 7 | 374.2 | 45.9 | 7 | 423.8 | 52.0 | 7 | 473.4 | 58.1 | 7 | 523.1 | 64.2 | 7 | 572.7 | 70.3 |
| 8 | 325.6 | 40.0 | 8 | 375.2 | 46.1 | 8 | 424.8 | 52.2 | 8 | 474.4 | 58.3 | 8 | 524.1 | 64.3 | 8 | 573.7 | 70.4 |
| 9 | 326.5 | 40.1 | 9 | 376.2 | 46.2 | 9 | 425.8 | 52.3 | 9 | 475.4 | 58.4 | 9 | 525.1 | 64.5 | 9 | 574.7 | 70.6 |
| 330 | 327.5 | 40.2 | 380 | 377.2 | 46.3 | 430 | 426.8 | 52.4 | 480 | 476.4 | 58.5 | 530 | 526.0 | 64.6 | 580 | 575.7 | 70.7 |
| 1 | 328.5 | 40.3 | 1 | 378.2 | 46.4 | 1 | 427.8 | 52.5 | 1 | 477.4 | 58.6 | 1 | 527.0 | 64.7 | 1 | 576.7 | 70.8 |
| 2 | 329.5 | 40.5 | 2 | 379.2 | 46.6 | 2 | 428.8 | 52.6 | 2 | 478.4 | 58.7 | 2 | 528.0 | 64.8 | 2 | 577.7 | 70.9 |
| 3 | 330.5 | 40.6 | 3 | 380.1 | 46.7 | 3 | 429.8 | 52.8 | 3 | 479.4 | 58.9 | 3 | 529.0 | 65.0 | 3 | 578.7 | 71.0 |
| 4 | 331.5 | 40.7 | 4 | 381.1 | 46.8 | 4 | 430.8 | 52.9 | 4 | 480.4 | 59.0 | 4 | 530.0 | 65.1 | 4 | 579.6 | 71.2 |
| 5 | 332.5 | 40.8 | 5 | 382.1 | 46.9 | 5 | 431.8 | 53.0 | 5 | 481.4 | 59.1 | 5 | 531.0 | 65.2 | 5 | 580.6 | 71.3 |
| 6 | 333.5 | 40.9 | 6 | 383.1 | 47.0 | 6 | 432.8 | 53.1 | 6 | 482.4 | 59.2 | 6 | 532.0 | 65.3 | 6 | 581.6 | 71.4 |
| 7 | 334.5 | 41.1 | 7 | 384.1 | 47.2 | 7 | 433.7 | 53.3 | 7 | 483.4 | 59.4 | 7 | 533.0 | 65.4 | 7 | 582.6 | 71.5 |
| 8 | 335.5 | 41.2 | 8 | 385.1 | 47.3 | 8 | 434.7 | 53.4 | 8 | 484.4 | 59.5 | 8 | 534.0 | 65.6 | 8 | 583.6 | 71.7 |
| 9 | 336.5 | 41.3 | 9 | 386.1 | 47.4 | 9 | 435.7 | 53.5 | 9 | 485.4 | 59.6 | 9 | 535.0 | 65.7 | 9 | 584.6 | 71.8 |
| 340 | 337.5 | 41.4 | 390 | 387.1 | 47.5 | 440 | 436.7 | 53.6 | 490 | 486.3 | 59.7 | 540 | 536.0 | 65.8 | 590 | 585.6 | 71.9 |
| 1 | 338.5 | 41.6 | 1 | 388.1 | 47.7 | 1 | 437.7 | 53.7 | 1 | 487.3 | 59.8 | 1 | 537.0 | 65.9 | 1 | 586.6 | 72.0 |
| 2 | 339.5 | 41.7 | 2 | 389.1 | 47.8 | 2 | 438.7 | 53.9 | 2 | 488.3 | 60.0 | 2 | 538.0 | 66.1 | 2 | 587.6 | 72.1 |
| 3 | 340.4 | 41.8 | 3 | 390.1 | 47.9 | 3 | 439.7 | 54.0 | 3 | 489.3 | 60.1 | 3 | 539.0 | 66.2 | 3 | 588.6 | 72.3 |
| 4 | 341.4 | 41.9 | 4 | 391.1 | 48.0 | 4 | 440.7 | 54.1 | 4 | 490.3 | 60.2 | 4 | 539.9 | 66.3 | 4 | 589.6 | 72.4 |
| 5 | 342.4 | 42.0 | 5 | 392.1 | 48.1 | 5 | 441.7 | 54.2 | 5 | 491.3 | 60.3 | 5 | 540.9 | 66.4 | 5 | 590.6 | 72.5 |
| 6 | 343.4 | 42.2 | 6 | 393.0 | 48.3 | 6 | 442.7 | 54.4 | 6 | 492.3 | 60.4 | 6 | 541.9 | 66.5 | 6 | 591.6 | 72.6 |
| 7 | 344.4 | 42.3 | 7 | 394.0 | 48.4 | 7 | 443.7 | 54.5 | 7 | 493.3 | 60.6 | 7 | 542.9 | 66.7 | 7 | 592.6 | 72.8 |
| 8 | 345.4 | 42.4 | 8 | 395.0 | 48.5 | 8 | 444.7 | 54.6 | 8 | 494.3 | 60.7 | 8 | 543.9 | 66.8 | 8 | 593.5 | 72.9 |
| 9 | 346.4 | 42.5 | 9 | 396.0 | 48.6 | 9 | 445.7 | 54.7 | 9 | 495.3 | 60.8 | 9 | 544.9 | 66.9 | 9 | 594.5 | 73.0 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 277 315
269 263 225

R

089 083° 045
091 097 135

R ou φm

R

TABELA 1

R ou φm

359 352° 315
181 188 225

TÁBUAS DE CARTEAÇÃO

001 008 045
179 172 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|-----|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 49.5 | 7.0 | 100 | 99.0 | 13.9 | 150 | 148.5 | 20.9 | 200 | 198.1 | 27.8 | 250 | 247.6 | 34.8 |
| 1 | 1.0 | 0.1 | 1 | 50.5 | 7.1 | 1 | 100.0 | 14.1 | 1 | 149.5 | 21.0 | 1 | 199.0 | 28.0 | 1 | 248.6 | 34.9 |
| 2 | 2.0 | 0.3 | 2 | 51.5 | 7.2 | 2 | 101.0 | 14.2 | 2 | 150.5 | 21.2 | 2 | 200.0 | 28.1 | 2 | 249.5 | 35.1 |
| 3 | 3.0 | 0.4 | 3 | 52.5 | 7.4 | 3 | 102.0 | 14.3 | 3 | 151.5 | 21.3 | 3 | 201.0 | 28.3 | 3 | 250.5 | 35.2 |
| 4 | 4.0 | 0.6 | 4 | 53.5 | 7.5 | 4 | 103.0 | 14.5 | 4 | 152.5 | 21.4 | 4 | 202.0 | 28.4 | 4 | 251.5 | 35.3 |
| 5 | 5.0 | 0.7 | 5 | 54.5 | 7.7 | 5 | 104.0 | 14.6 | 5 | 153.5 | 21.6 | 5 | 203.0 | 28.5 | 5 | 252.5 | 35.5 |
| 6 | 5.9 | 0.8 | 6 | 55.5 | 7.8 | 6 | 105.0 | 14.8 | 6 | 154.5 | 21.7 | 6 | 204.0 | 28.7 | 6 | 253.5 | 35.6 |
| 7 | 6.9 | 1.0 | 7 | 56.4 | 7.9 | 7 | 106.0 | 14.9 | 7 | 155.5 | 21.9 | 7 | 205.0 | 28.8 | 7 | 254.5 | 35.8 |
| 8 | 7.9 | 1.1 | 8 | 57.4 | 8.1 | 8 | 106.9 | 15.0 | 8 | 156.5 | 22.0 | 8 | 206.0 | 28.9 | 8 | 255.5 | 35.9 |
| 9 | 8.9 | 1.3 | 9 | 58.4 | 8.2 | 9 | 107.9 | 15.2 | 9 | 157.5 | 22.1 | 9 | 207.0 | 29.1 | 9 | 256.5 | 36.0 |
| 10 | 9.9 | 1.4 | 60 | 59.4 | 8.4 | 110 | 108.9 | 15.3 | 160 | 158.4 | 22.3 | 210 | 208.0 | 29.2 | 260 | 257.5 | 36.2 |
| 1 | 10.9 | 1.5 | 1 | 60.4 | 8.5 | 1 | 109.9 | 15.4 | 1 | 159.4 | 22.4 | 1 | 208.9 | 29.4 | 1 | 258.5 | 36.3 |
| 2 | 11.9 | 1.7 | 2 | 61.4 | 8.6 | 2 | 110.9 | 15.6 | 2 | 160.4 | 22.5 | 2 | 209.9 | 29.5 | 2 | 259.5 | 36.5 |
| 3 | 12.9 | 1.8 | 3 | 62.4 | 8.8 | 3 | 111.9 | 15.7 | 3 | 161.4 | 22.7 | 3 | 210.9 | 29.6 | 3 | 260.4 | 36.6 |
| 4 | 13.9 | 1.9 | 4 | 63.4 | 8.9 | 4 | 112.9 | 15.9 | 4 | 162.4 | 22.8 | 4 | 211.9 | 29.8 | 4 | 261.4 | 36.7 |
| 5 | 14.9 | 2.1 | 5 | 64.4 | 9.0 | 5 | 113.9 | 16.0 | 5 | 163.4 | 23.0 | 5 | 212.9 | 29.9 | 5 | 262.4 | 36.9 |
| 6 | 15.8 | 2.2 | 6 | 65.4 | 9.2 | 6 | 114.9 | 16.1 | 6 | 164.4 | 23.1 | 6 | 213.9 | 30.1 | 6 | 263.4 | 37.0 |
| 7 | 16.8 | 2.4 | 7 | 66.3 | 9.3 | 7 | 115.9 | 16.3 | 7 | 165.4 | 23.2 | 7 | 214.9 | 30.2 | 7 | 264.4 | 37.2 |
| 8 | 17.8 | 2.5 | 8 | 67.3 | 9.5 | 8 | 116.9 | 16.4 | 8 | 166.4 | 23.4 | 8 | 215.9 | 30.3 | 8 | 265.4 | 37.3 |
| 9 | 18.8 | 2.6 | 9 | 68.3 | 9.6 | 9 | 117.8 | 16.6 | 9 | 167.4 | 23.5 | 9 | 216.9 | 30.5 | 9 | 266.4 | 37.4 |
| 20 | 19.8 | 2.8 | 70 | 69.3 | 9.7 | 120 | 118.8 | 16.7 | 170 | 168.3 | 23.7 | 220 | 217.9 | 30.6 | 270 | 267.4 | 37.6 |
| 1 | 20.8 | 2.9 | 1 | 70.3 | 9.9 | 1 | 119.8 | 16.8 | 1 | 169.3 | 23.8 | 1 | 218.8 | 30.8 | 1 | 268.4 | 37.7 |
| 2 | 21.8 | 3.1 | 2 | 71.3 | 10.0 | 2 | 120.8 | 17.0 | 2 | 170.3 | 23.9 | 2 | 219.8 | 30.9 | 2 | 269.4 | 37.9 |
| 3 | 22.8 | 3.2 | 3 | 72.3 | 10.2 | 3 | 121.8 | 17.1 | 3 | 171.3 | 24.1 | 3 | 220.8 | 31.0 | 3 | 270.3 | 38.0 |
| 4 | 23.8 | 3.3 | 4 | 73.3 | 10.3 | 4 | 122.8 | 17.3 | 4 | 172.3 | 24.2 | 4 | 221.8 | 31.2 | 4 | 271.3 | 38.1 |
| 5 | 24.8 | 3.5 | 5 | 74.3 | 10.4 | 5 | 123.8 | 17.4 | 5 | 173.3 | 24.4 | 5 | 222.8 | 31.3 | 5 | 272.3 | 38.3 |
| 6 | 25.7 | 3.6 | 6 | 75.3 | 10.6 | 6 | 124.8 | 17.5 | 6 | 174.3 | 24.5 | 6 | 223.8 | 31.5 | 6 | 273.3 | 38.4 |
| 7 | 26.7 | 3.8 | 7 | 76.3 | 10.7 | 7 | 125.8 | 17.7 | 7 | 175.3 | 24.6 | 7 | 224.8 | 31.6 | 7 | 274.3 | 38.6 |
| 8 | 27.7 | 3.9 | 8 | 77.2 | 10.9 | 8 | 126.8 | 17.8 | 8 | 176.3 | 24.8 | 8 | 225.8 | 31.7 | 8 | 275.3 | 38.7 |
| 9 | 28.7 | 4.0 | 9 | 78.2 | 11.0 | 9 | 127.7 | 18.0 | 9 | 177.3 | 24.9 | 9 | 226.8 | 31.9 | 9 | 276.3 | 38.8 |
| 30 | 29.7 | 4.2 | 80 | 79.2 | 11.1 | 130 | 128.7 | 18.1 | 180 | 178.2 | 25.1 | 230 | 227.8 | 32.0 | 280 | 277.3 | 39.0 |
| 1 | 30.7 | 4.3 | 1 | 80.2 | 11.3 | 1 | 129.7 | 18.2 | 1 | 179.2 | 25.2 | 1 | 228.8 | 32.1 | 1 | 278.3 | 39.1 |
| 2 | 31.7 | 4.5 | 2 | 81.2 | 11.4 | 2 | 130.7 | 18.4 | 2 | 180.2 | 25.3 | 2 | 229.7 | 32.3 | 2 | 279.3 | 39.2 |
| 3 | 32.7 | 4.6 | 3 | 82.2 | 11.6 | 3 | 131.7 | 18.5 | 3 | 181.2 | 25.5 | 3 | 230.7 | 32.4 | 3 | 280.2 | 39.4 |
| 4 | 33.7 | 4.7 | 4 | 83.2 | 11.7 | 4 | 132.7 | 18.6 | 4 | 182.2 | 25.6 | 4 | 231.7 | 32.6 | 4 | 281.2 | 39.5 |
| 5 | 34.7 | 4.9 | 5 | 84.2 | 11.8 | 5 | 133.7 | 18.8 | 5 | 183.2 | 25.7 | 5 | 232.7 | 32.7 | 5 | 282.2 | 39.7 |
| 6 | 35.6 | 5.0 | 6 | 85.2 | 12.0 | 6 | 134.7 | 18.9 | 6 | 184.2 | 25.9 | 6 | 233.7 | 32.8 | 6 | 283.2 | 39.8 |
| 7 | 36.6 | 5.1 | 7 | 86.2 | 12.1 | 7 | 135.7 | 19.1 | 7 | 185.2 | 26.0 | 7 | 234.7 | 33.0 | 7 | 284.2 | 39.9 |
| 8 | 37.6 | 5.3 | 8 | 87.1 | 12.2 | 8 | 136.7 | 19.2 | 8 | 186.2 | 26.2 | 8 | 235.7 | 33.1 | 8 | 285.2 | 40.1 |
| 9 | 38.6 | 5.4 | 9 | 88.1 | 12.4 | 9 | 137.6 | 19.3 | 9 | 187.2 | 26.3 | 9 | 236.7 | 33.3 | 9 | 286.2 | 40.2 |
| 40 | 39.6 | 5.6 | 90 | 89.1 | 12.5 | 140 | 138.6 | 19.5 | 190 | 188.2 | 26.4 | 240 | 237.7 | 33.4 | 290 | 287.2 | 40.4 |
| 1 | 40.6 | 5.7 | 1 | 90.1 | 12.7 | 1 | 139.6 | 19.6 | 1 | 189.1 | 26.6 | 1 | 238.7 | 33.5 | 1 | 288.2 | 40.5 |
| 2 | 41.6 | 5.8 | 2 | 91.1 | 12.8 | 2 | 140.6 | 19.8 | 2 | 190.1 | 26.7 | 2 | 239.6 | 33.7 | 2 | 289.2 | 40.6 |
| 3 | 42.6 | 6.0 | 3 | 92.1 | 12.9 | 3 | 141.6 | 19.9 | 3 | 191.1 | 26.9 | 3 | 240.6 | 33.8 | 3 | 290.1 | 40.8 |
| 4 | 43.6 | 6.1 | 4 | 93.1 | 13.1 | 4 | 142.6 | 20.0 | 4 | 192.1 | 27.0 | 4 | 241.6 | 34.0 | 4 | 291.1 | 40.9 |
| 5 | 44.6 | 6.3 | 5 | 94.1 | 13.2 | 5 | 143.6 | 20.2 | 5 | 193.1 | 27.1 | 5 | 242.6 | 34.1 | 5 | 292.1 | 41.1 |
| 6 | 45.6 | 6.4 | 6 | 95.1 | 13.4 | 6 | 144.6 | 20.3 | 6 | 194.1 | 27.3 | 6 | 243.6 | 34.2 | 6 | 293.1 | 41.2 |
| 7 | 46.5 | 6.5 | 7 | 96.1 | 13.5 | 7 | 145.6 | 20.5 | 7 | 195.1 | 27.4 | 7 | 244.6 | 34.4 | 7 | 294.1 | 41.3 |
| 8 | 47.5 | 6.7 | 8 | 97.0 | 13.6 | 8 | 146.6 | 20.6 | 8 | 196.1 | 27.6 | 8 | 245.6 | 34.5 | 8 | 295.1 | 41.5 |
| 9 | 48.5 | 6.8 | 9 | 98.0 | 13.8 | 9 | 147.5 | 20.7 | 9 | 197.1 | 27.7 | 9 | 246.6 | 34.7 | 9 | 296.1 | 41.6 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 278 315
269 262 225

R

089 082° 045
091 098 135

R ou φm

R

TABELA 1

R ou φm

359 352° 315
181 188 225

TÁBUAS DE CARTEAÇÃO

001 008 045
179 172 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 297.1 | 41.8 | 350 | 346.6 | 48.7 | 400 | 396.1 | 55.7 | 450 | 445.6 | 62.6 | 500 | 495.1 | 69.6 | 550 | 544.6 | 76.5 |
| 1 | 298.1 | 41.9 | 1 | 347.6 | 48.8 | 1 | 397.1 | 55.8 | 1 | 446.6 | 62.8 | 1 | 496.1 | 69.7 | 1 | 545.6 | 76.7 |
| 2 | 299.1 | 42.0 | 2 | 348.6 | 49.0 | 2 | 398.1 | 55.9 | 2 | 447.6 | 62.9 | 2 | 497.1 | 69.9 | 2 | 546.6 | 76.8 |
| 3 | 300.1 | 42.2 | 3 | 349.6 | 49.1 | 3 | 399.1 | 56.1 | 3 | 448.6 | 63.0 | 3 | 498.1 | 70.0 | 3 | 547.6 | 77.0 |
| 4 | 301.0 | 42.3 | 4 | 350.6 | 49.3 | 4 | 400.1 | 56.2 | 4 | 449.6 | 63.2 | 4 | 499.1 | 70.1 | 4 | 548.6 | 77.1 |
| 5 | 302.0 | 42.4 | 5 | 351.5 | 49.4 | 5 | 401.1 | 56.4 | 5 | 450.6 | 63.3 | 5 | 500.1 | 70.3 | 5 | 549.6 | 77.2 |
| 6 | 303.0 | 42.6 | 6 | 352.5 | 49.5 | 6 | 402.0 | 56.5 | 6 | 451.6 | 63.5 | 6 | 501.1 | 70.4 | 6 | 550.6 | 77.4 |
| 7 | 304.0 | 42.7 | 7 | 353.5 | 49.7 | 7 | 403.0 | 56.6 | 7 | 452.6 | 63.6 | 7 | 502.1 | 70.6 | 7 | 551.6 | 77.5 |
| 8 | 305.0 | 42.9 | 8 | 354.5 | 49.8 | 8 | 404.0 | 56.8 | 8 | 453.5 | 63.7 | 8 | 503.1 | 70.7 | 8 | 552.6 | 77.7 |
| 9 | 306.0 | 43.0 | 9 | 355.5 | 50.0 | 9 | 405.0 | 56.9 | 9 | 454.5 | 63.9 | 9 | 504.0 | 70.8 | 9 | 553.6 | 77.8 |
| 310 | 307.0 | 43.1 | 360 | 356.5 | 50.1 | 410 | 406.0 | 57.1 | 460 | 455.5 | 64.0 | 510 | 505.0 | 71.0 | 560 | 554.6 | 77.9 |
| 1 | 308.0 | 43.3 | 1 | 357.5 | 50.2 | 1 | 407.0 | 57.2 | 1 | 456.5 | 64.2 | 1 | 506.0 | 71.1 | 1 | 555.5 | 78.1 |
| 2 | 309.0 | 43.4 | 2 | 358.5 | 50.4 | 2 | 408.0 | 57.3 | 2 | 457.5 | 64.3 | 2 | 507.0 | 71.3 | 2 | 556.5 | 78.2 |
| 3 | 310.0 | 43.6 | 3 | 359.5 | 50.5 | 3 | 409.0 | 57.5 | 3 | 458.5 | 64.4 | 3 | 508.0 | 71.4 | 3 | 557.5 | 78.4 |
| 4 | 310.9 | 43.7 | 4 | 360.5 | 50.7 | 4 | 410.0 | 57.6 | 4 | 459.5 | 64.6 | 4 | 509.0 | 71.5 | 4 | 558.5 | 78.5 |
| 5 | 311.9 | 43.8 | 5 | 361.4 | 50.8 | 5 | 411.0 | 57.8 | 5 | 460.5 | 64.7 | 5 | 510.0 | 71.7 | 5 | 559.5 | 78.6 |
| 6 | 312.9 | 44.0 | 6 | 362.4 | 50.9 | 6 | 412.0 | 57.9 | 6 | 461.5 | 64.9 | 6 | 511.0 | 71.8 | 6 | 560.5 | 78.8 |
| 7 | 313.9 | 44.1 | 7 | 363.4 | 51.1 | 7 | 412.9 | 58.0 | 7 | 462.5 | 65.0 | 7 | 512.0 | 72.0 | 7 | 561.5 | 78.9 |
| 8 | 314.9 | 44.3 | 8 | 364.4 | 51.2 | 8 | 413.9 | 58.2 | 8 | 463.4 | 65.1 | 8 | 513.0 | 72.1 | 8 | 562.5 | 79.1 |
| 9 | 315.9 | 44.4 | 9 | 365.4 | 51.4 | 9 | 414.9 | 58.3 | 9 | 464.4 | 65.3 | 9 | 513.9 | 72.2 | 9 | 563.5 | 79.2 |
| 320 | 316.9 | 44.5 | 370 | 366.4 | 51.5 | 420 | 415.9 | 58.5 | 470 | 465.4 | 65.4 | 520 | 514.9 | 72.4 | 570 | 564.5 | 79.3 |
| 1 | 317.9 | 44.7 | 1 | 367.4 | 51.6 | 1 | 416.9 | 58.6 | 1 | 466.4 | 65.6 | 1 | 515.9 | 72.5 | 1 | 565.4 | 79.5 |
| 2 | 318.9 | 44.8 | 2 | 368.4 | 51.8 | 2 | 417.9 | 58.7 | 2 | 467.4 | 65.7 | 2 | 516.9 | 72.6 | 2 | 566.4 | 79.6 |
| 3 | 319.9 | 45.0 | 3 | 369.4 | 51.9 | 3 | 418.9 | 58.9 | 3 | 468.4 | 65.8 | 3 | 517.9 | 72.8 | 3 | 567.4 | 79.7 |
| 4 | 320.8 | 45.1 | 4 | 370.4 | 52.1 | 4 | 419.9 | 59.0 | 4 | 469.4 | 66.0 | 4 | 518.9 | 72.9 | 4 | 568.4 | 79.9 |
| 5 | 321.8 | 45.2 | 5 | 371.4 | 52.2 | 5 | 420.9 | 59.1 | 5 | 470.4 | 66.1 | 5 | 519.9 | 73.1 | 5 | 569.4 | 80.0 |
| 6 | 322.8 | 45.4 | 6 | 372.3 | 52.3 | 6 | 421.9 | 59.3 | 6 | 471.4 | 66.2 | 6 | 520.9 | 73.2 | 6 | 570.4 | 80.2 |
| 7 | 323.8 | 45.5 | 7 | 373.3 | 52.5 | 7 | 422.8 | 59.4 | 7 | 472.4 | 66.4 | 7 | 521.9 | 73.3 | 7 | 571.4 | 80.3 |
| 8 | 324.8 | 45.6 | 8 | 374.3 | 52.6 | 8 | 423.8 | 59.6 | 8 | 473.3 | 66.5 | 8 | 522.9 | 73.5 | 8 | 572.4 | 80.4 |
| 9 | 325.8 | 45.8 | 9 | 375.3 | 52.7 | 9 | 424.8 | 59.7 | 9 | 474.3 | 66.7 | 9 | 523.9 | 73.6 | 9 | 573.4 | 80.6 |
| 330 | 326.8 | 45.9 | 380 | 376.3 | 52.9 | 430 | 425.8 | 59.8 | 480 | 475.3 | 66.8 | 530 | 524.8 | 73.8 | 580 | 574.4 | 80.7 |
| 1 | 327.8 | 46.1 | 1 | 377.3 | 53.0 | 1 | 426.8 | 60.0 | 1 | 476.3 | 66.9 | 1 | 525.8 | 73.9 | 1 | 575.3 | 80.9 |
| 2 | 328.8 | 46.2 | 2 | 378.3 | 53.2 | 2 | 427.8 | 60.1 | 2 | 477.3 | 67.1 | 2 | 526.8 | 74.0 | 2 | 576.3 | 81.0 |
| 3 | 329.8 | 46.3 | 3 | 379.3 | 53.3 | 3 | 428.8 | 60.3 | 3 | 478.3 | 67.2 | 3 | 527.8 | 74.2 | 3 | 577.3 | 81.1 |
| 4 | 330.7 | 46.5 | 4 | 380.3 | 53.4 | 4 | 429.8 | 60.4 | 4 | 479.3 | 67.4 | 4 | 528.8 | 74.3 | 4 | 578.3 | 81.3 |
| 5 | 331.7 | 46.6 | 5 | 381.3 | 53.6 | 5 | 430.8 | 60.5 | 5 | 480.3 | 67.5 | 5 | 529.8 | 74.5 | 5 | 579.3 | 81.4 |
| 6 | 332.7 | 46.8 | 6 | 382.2 | 53.7 | 6 | 431.8 | 60.7 | 6 | 481.3 | 67.6 | 6 | 530.8 | 74.6 | 6 | 580.3 | 81.6 |
| 7 | 333.7 | 46.9 | 7 | 383.2 | 53.9 | 7 | 432.7 | 60.8 | 7 | 482.3 | 67.8 | 7 | 531.8 | 74.7 | 7 | 581.3 | 81.7 |
| 8 | 334.7 | 47.0 | 8 | 384.2 | 54.0 | 8 | 433.7 | 61.0 | 8 | 483.3 | 67.9 | 8 | 532.8 | 74.9 | 8 | 582.3 | 81.8 |
| 9 | 335.7 | 47.2 | 9 | 385.2 | 54.1 | 9 | 434.7 | 61.1 | 9 | 484.2 | 68.1 | 9 | 533.8 | 75.0 | 9 | 583.3 | 82.0 |
| 340 | 336.7 | 47.3 | 390 | 386.2 | 54.3 | 440 | 435.7 | 61.2 | 490 | 485.2 | 68.2 | 540 | 534.7 | 75.2 | 590 | 584.3 | 82.1 |
| 1 | 337.7 | 47.5 | 1 | 387.2 | 54.4 | 1 | 436.7 | 61.4 | 1 | 486.2 | 68.3 | 1 | 535.7 | 75.3 | 1 | 585.2 | 82.3 |
| 2 | 338.7 | 47.6 | 2 | 388.2 | 54.6 | 2 | 437.7 | 61.5 | 2 | 487.2 | 68.5 | 2 | 536.7 | 75.4 | 2 | 586.2 | 82.4 |
| 3 | 339.7 | 47.7 | 3 | 389.2 | 54.7 | 3 | 438.7 | 61.7 | 3 | 488.2 | 68.6 | 3 | 537.7 | 75.6 | 3 | 587.2 | 82.5 |
| 4 | 340.7 | 47.9 | 4 | 390.2 | 54.8 | 4 | 439.7 | 61.8 | 4 | 489.2 | 68.8 | 4 | 538.7 | 75.7 | 4 | 588.2 | 82.7 |
| 5 | 341.6 | 48.0 | 5 | 391.2 | 55.0 | 5 | 440.7 | 61.9 | 5 | 490.2 | 68.9 | 5 | 539.7 | 75.8 | 5 | 589.2 | 82.8 |
| 6 | 342.6 | 48.2 | 6 | 392.1 | 55.1 | 6 | 441.7 | 62.1 | 6 | 491.2 | 69.0 | 6 | 540.7 | 76.0 | 6 | 590.2 | 82.9 |
| 7 | 343.6 | 48.3 | 7 | 393.1 | 55.3 | 7 | 442.6 | 62.2 | 7 | 492.2 | 69.2 | 7 | 541.7 | 76.1 | 7 | 591.2 | 83.1 |
| 8 | 344.6 | 48.4 | 8 | 394.1 | 55.4 | 8 | 443.6 | 62.3 | 8 | 493.2 | 69.3 | 8 | 542.7 | 76.3 | 8 | 592.2 | 83.2 |
| 9 | 345.6 | 48.6 | 9 | 395.1 | 55.5 | 9 | 444.6 | 62.5 | 9 | 494.1 | 69.4 | 9 | 543.7 | 76.4 | 9 | 593.2 | 83.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 278 315
269 262 225

R

089 082° 045
091 098 135

R ou φm

R

TABELA 1

R ou φm

359 351° 315
181 189 225

TÁBUAS DE CARTEAÇÃO

001 009 045
179 171 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|-----|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 49.4 | 7.8 | 100 | 98.8 | 15.6 | 150 | 148.2 | 23.5 | 200 | 197.5 | 31.3 | 250 | 246.9 | 39.1 |
| 1 | 1.0 | 0.2 | 1 | 50.4 | 8.0 | 1 | 99.8 | 15.8 | 1 | 149.1 | 23.6 | 1 | 198.5 | 31.4 | 1 | 247.9 | 39.3 |
| 2 | 2.0 | 0.3 | 2 | 51.4 | 8.1 | 2 | 100.7 | 16.0 | 2 | 150.1 | 23.8 | 2 | 199.5 | 31.6 | 2 | 248.9 | 39.4 |
| 3 | 3.0 | 0.5 | 3 | 52.3 | 8.3 | 3 | 101.7 | 16.1 | 3 | 151.1 | 23.9 | 3 | 200.5 | 31.8 | 3 | 249.9 | 39.6 |
| 4 | 4.0 | 0.6 | 4 | 53.3 | 8.4 | 4 | 102.7 | 16.3 | 4 | 152.1 | 24.1 | 4 | 201.5 | 31.9 | 4 | 250.9 | 39.7 |
| 5 | 4.9 | 0.8 | 5 | 54.3 | 8.6 | 5 | 103.7 | 16.4 | 5 | 153.1 | 24.2 | 5 | 202.5 | 32.1 | 5 | 251.9 | 39.9 |
| 6 | 5.9 | 0.9 | 6 | 55.3 | 8.8 | 6 | 104.7 | 16.6 | 6 | 154.1 | 24.4 | 6 | 203.5 | 32.2 | 6 | 252.8 | 40.0 |
| 7 | 6.9 | 1.1 | 7 | 56.3 | 8.9 | 7 | 105.7 | 16.7 | 7 | 155.1 | 24.6 | 7 | 204.5 | 32.4 | 7 | 253.8 | 40.2 |
| 8 | 7.9 | 1.3 | 8 | 57.3 | 9.1 | 8 | 106.7 | 16.9 | 8 | 156.1 | 24.7 | 8 | 205.4 | 32.5 | 8 | 254.8 | 40.4 |
| 9 | 8.9 | 1.4 | 9 | 58.3 | 9.2 | 9 | 107.7 | 17.1 | 9 | 157.0 | 24.9 | 9 | 206.4 | 32.7 | 9 | 255.8 | 40.5 |
| 10 | 9.9 | 1.6 | 60 | 59.3 | 9.4 | 110 | 108.6 | 17.2 | 160 | 158.0 | 25.0 | 210 | 207.4 | 32.9 | 260 | 256.8 | 40.7 |
| 1 | 10.9 | 1.7 | 1 | 60.2 | 9.5 | 1 | 109.6 | 17.4 | 1 | 159.0 | 25.2 | 1 | 208.4 | 33.0 | 1 | 257.8 | 40.8 |
| 2 | 11.9 | 1.9 | 2 | 61.2 | 9.7 | 2 | 110.6 | 17.5 | 2 | 160.0 | 25.3 | 2 | 209.4 | 33.2 | 2 | 258.8 | 41.0 |
| 3 | 12.8 | 2.0 | 3 | 62.2 | 9.9 | 3 | 111.6 | 17.7 | 3 | 161.0 | 25.5 | 3 | 210.4 | 33.3 | 3 | 259.8 | 41.1 |
| 4 | 13.8 | 2.2 | 4 | 63.2 | 10.0 | 4 | 112.6 | 17.8 | 4 | 162.0 | 25.7 | 4 | 211.4 | 33.5 | 4 | 260.7 | 41.3 |
| 5 | 14.8 | 2.3 | 5 | 64.2 | 10.2 | 5 | 113.6 | 18.0 | 5 | 163.0 | 25.8 | 5 | 212.4 | 33.6 | 5 | 261.7 | 41.5 |
| 6 | 15.8 | 2.5 | 6 | 65.2 | 10.3 | 6 | 114.6 | 18.1 | 6 | 164.0 | 26.0 | 6 | 213.3 | 33.8 | 6 | 262.7 | 41.6 |
| 7 | 16.8 | 2.7 | 7 | 66.2 | 10.5 | 7 | 115.6 | 18.3 | 7 | 164.9 | 26.1 | 7 | 214.3 | 33.9 | 7 | 263.7 | 41.8 |
| 8 | 17.8 | 2.8 | 8 | 67.2 | 10.6 | 8 | 116.5 | 18.5 | 8 | 165.9 | 26.3 | 8 | 215.3 | 34.1 | 8 | 264.7 | 41.9 |
| 9 | 18.8 | 3.0 | 9 | 68.2 | 10.8 | 9 | 117.5 | 18.6 | 9 | 166.9 | 26.4 | 9 | 216.3 | 34.3 | 9 | 265.7 | 42.1 |
| 20 | 19.8 | 3.1 | 70 | 69.1 | 11.0 | 120 | 118.5 | 18.8 | 170 | 167.9 | 26.6 | 220 | 217.3 | 34.4 | 270 | 266.7 | 42.2 |
| 1 | 20.7 | 3.3 | 1 | 70.1 | 11.1 | 1 | 119.5 | 18.9 | 1 | 168.9 | 26.8 | 1 | 218.3 | 34.6 | 1 | 267.7 | 42.4 |
| 2 | 21.7 | 3.4 | 2 | 71.1 | 11.3 | 2 | 120.5 | 19.1 | 2 | 169.9 | 26.9 | 2 | 219.3 | 34.7 | 2 | 268.7 | 42.6 |
| 3 | 22.7 | 3.6 | 3 | 72.1 | 11.4 | 3 | 121.5 | 19.2 | 3 | 170.9 | 27.1 | 3 | 220.3 | 34.9 | 3 | 269.6 | 42.7 |
| 4 | 23.7 | 3.8 | 4 | 73.1 | 11.6 | 4 | 122.5 | 19.4 | 4 | 171.9 | 27.2 | 4 | 221.2 | 35.0 | 4 | 270.6 | 42.9 |
| 5 | 24.7 | 3.9 | 5 | 74.1 | 11.7 | 5 | 123.5 | 19.6 | 5 | 172.8 | 27.4 | 5 | 222.2 | 35.2 | 5 | 271.6 | 43.0 |
| 6 | 25.7 | 4.1 | 6 | 75.1 | 11.9 | 6 | 124.4 | 19.7 | 6 | 173.8 | 27.5 | 6 | 223.2 | 35.4 | 6 | 272.6 | 43.2 |
| 7 | 26.7 | 4.2 | 7 | 76.1 | 12.0 | 7 | 125.4 | 19.9 | 7 | 174.8 | 27.7 | 7 | 224.2 | 35.5 | 7 | 273.6 | 43.3 |
| 8 | 27.7 | 4.4 | 8 | 77.0 | 12.2 | 8 | 126.4 | 20.0 | 8 | 175.8 | 27.8 | 8 | 225.2 | 35.7 | 8 | 274.6 | 43.5 |
| 9 | 28.6 | 4.5 | 9 | 78.0 | 12.4 | 9 | 127.4 | 20.2 | 9 | 176.8 | 28.0 | 9 | 226.2 | 35.8 | 9 | 275.6 | 43.6 |
| 30 | 29.6 | 4.7 | 80 | 79.0 | 12.5 | 130 | 128.4 | 20.3 | 180 | 177.8 | 28.2 | 230 | 227.2 | 36.0 | 280 | 276.6 | 43.8 |
| 1 | 30.6 | 4.8 | 1 | 80.0 | 12.7 | 1 | 129.4 | 20.5 | 1 | 178.8 | 28.3 | 1 | 228.2 | 36.1 | 1 | 277.5 | 44.0 |
| 2 | 31.6 | 5.0 | 2 | 81.0 | 12.8 | 2 | 130.4 | 20.6 | 2 | 179.8 | 28.5 | 2 | 229.1 | 36.3 | 2 | 278.5 | 44.1 |
| 3 | 32.6 | 5.2 | 3 | 82.0 | 13.0 | 3 | 131.4 | 20.8 | 3 | 180.7 | 28.6 | 3 | 230.1 | 36.4 | 3 | 279.5 | 44.3 |
| 4 | 33.6 | 5.3 | 4 | 83.0 | 13.1 | 4 | 132.4 | 21.0 | 4 | 181.7 | 28.8 | 4 | 231.1 | 36.6 | 4 | 280.5 | 44.4 |
| 5 | 34.6 | 5.5 | 5 | 84.0 | 13.3 | 5 | 133.3 | 21.1 | 5 | 182.7 | 28.9 | 5 | 232.1 | 36.8 | 5 | 281.5 | 44.6 |
| 6 | 35.6 | 5.6 | 6 | 84.9 | 13.5 | 6 | 134.3 | 21.3 | 6 | 183.7 | 29.1 | 6 | 233.1 | 36.9 | 6 | 282.5 | 44.7 |
| 7 | 36.5 | 5.8 | 7 | 85.9 | 13.6 | 7 | 135.3 | 21.4 | 7 | 184.7 | 29.3 | 7 | 234.1 | 37.1 | 7 | 283.5 | 44.9 |
| 8 | 37.5 | 5.9 | 8 | 86.9 | 13.8 | 8 | 136.3 | 21.6 | 8 | 185.7 | 29.4 | 8 | 235.1 | 37.2 | 8 | 284.5 | 45.1 |
| 9 | 38.5 | 6.1 | 9 | 87.9 | 13.9 | 9 | 137.3 | 21.7 | 9 | 186.7 | 29.6 | 9 | 236.1 | 37.4 | 9 | 285.4 | 45.2 |
| 40 | 39.5 | 6.3 | 90 | 88.9 | 14.1 | 140 | 138.3 | 21.9 | 190 | 187.7 | 29.7 | 240 | 237.0 | 37.5 | 290 | 286.4 | 45.4 |
| 1 | 40.5 | 6.4 | 1 | 89.9 | 14.2 | 1 | 139.3 | 22.1 | 1 | 188.6 | 29.9 | 1 | 238.0 | 37.7 | 1 | 287.4 | 45.5 |
| 2 | 41.5 | 6.6 | 2 | 90.9 | 14.4 | 2 | 140.3 | 22.2 | 2 | 189.6 | 30.0 | 2 | 239.0 | 37.9 | 2 | 288.4 | 45.7 |
| 3 | 42.5 | 6.7 | 3 | 91.9 | 14.5 | 3 | 141.2 | 22.4 | 3 | 190.6 | 30.2 | 3 | 240.0 | 38.0 | 3 | 289.4 | 45.8 |
| 4 | 43.5 | 6.9 | 4 | 92.8 | 14.7 | 4 | 142.2 | 22.5 | 4 | 191.6 | 30.3 | 4 | 241.0 | 38.2 | 4 | 290.4 | 46.0 |
| 5 | 44.4 | 7.0 | 5 | 93.8 | 14.9 | 5 | 143.2 | 22.7 | 5 | 192.6 | 30.5 | 5 | 242.0 | 38.3 | 5 | 291.4 | 46.1 |
| 6 | 45.4 | 7.2 | 6 | 94.8 | 15.0 | 6 | 144.2 | 22.8 | 6 | 193.6 | 30.7 | 6 | 243.0 | 38.5 | 6 | 292.4 | 46.3 |
| 7 | 46.4 | 7.4 | 7 | 95.8 | 15.2 | 7 | 145.2 | 23.0 | 7 | 194.6 | 30.8 | 7 | 244.0 | 38.6 | 7 | 293.3 | 46.5 |
| 8 | 47.4 | 7.5 | 8 | 96.8 | 15.3 | 8 | 146.2 | 23.2 | 8 | 195.6 | 31.0 | 8 | 244.9 | 38.8 | 8 | 294.3 | 46.6 |
| 9 | 48.4 | 7.7 | 9 | 97.8 | 15.5 | 9 | 147.2 | 23.3 | 9 | 196.5 | 31.1 | 9 | 245.9 | 39.0 | 9 | 295.3 | 46.8 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 279 315
269 261 225

R

089 081° 045
091 099 135

R ou φm

R

TABELA 1

R ou φm

359 351° 315
181 189 225

TÁBUAS DE CARTEAÇÃO

001 009 045
171 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 296.3 | 46.9 | 350 | 345.7 | 54.8 | 400 | 395.1 | 62.6 | 450 | 444.5 | 70.4 | 500 | 493.8 | 78.2 | 550 | 543.2 | 86.0 |
| 1 | 297.3 | 47.1 | 1 | 346.7 | 54.9 | 1 | 396.1 | 62.7 | 1 | 445.4 | 70.6 | 1 | 494.8 | 78.4 | 1 | 544.2 | 86.2 |
| 2 | 298.3 | 47.2 | 2 | 347.7 | 55.1 | 2 | 397.1 | 62.9 | 2 | 446.4 | 70.7 | 2 | 495.8 | 78.5 | 2 | 545.2 | 86.4 |
| 3 | 299.3 | 47.4 | 3 | 348.7 | 55.2 | 3 | 398.0 | 63.0 | 3 | 447.4 | 70.9 | 3 | 496.8 | 78.7 | 3 | 546.2 | 86.5 |
| 4 | 300.3 | 47.6 | 4 | 349.6 | 55.4 | 4 | 399.0 | 63.2 | 4 | 448.4 | 71.0 | 4 | 497.8 | 78.8 | 4 | 547.2 | 86.7 |
| 5 | 301.2 | 47.7 | 5 | 350.6 | 55.5 | 5 | 400.0 | 63.4 | 5 | 449.4 | 71.2 | 5 | 498.8 | 79.0 | 5 | 548.2 | 86.8 |
| 6 | 302.2 | 47.9 | 6 | 351.6 | 55.7 | 6 | 401.0 | 63.5 | 6 | 450.4 | 71.3 | 6 | 499.8 | 79.2 | 6 | 549.2 | 87.0 |
| 7 | 303.2 | 48.0 | 7 | 352.6 | 55.8 | 7 | 402.0 | 63.7 | 7 | 451.4 | 71.5 | 7 | 500.8 | 79.3 | 7 | 550.1 | 87.1 |
| 8 | 304.2 | 48.2 | 8 | 353.6 | 56.0 | 8 | 403.0 | 63.8 | 8 | 452.4 | 71.6 | 8 | 501.7 | 79.5 | 8 | 551.1 | 87.3 |
| 9 | 305.2 | 48.3 | 9 | 354.6 | 56.2 | 9 | 404.0 | 64.0 | 9 | 453.3 | 71.8 | 9 | 502.7 | 79.6 | 9 | 552.1 | 87.4 |
| 310 | 306.2 | 48.5 | 360 | 355.6 | 56.3 | 410 | 405.0 | 64.1 | 460 | 454.3 | 72.0 | 510 | 503.7 | 79.8 | 560 | 553.1 | 87.6 |
| 1 | 307.2 | 48.7 | 1 | 356.6 | 56.5 | 1 | 405.9 | 64.3 | 1 | 455.3 | 72.1 | 1 | 504.7 | 79.9 | 1 | 554.1 | 87.8 |
| 2 | 308.2 | 48.8 | 2 | 357.5 | 56.6 | 2 | 406.9 | 64.5 | 2 | 456.3 | 72.3 | 2 | 505.7 | 80.1 | 2 | 555.1 | 87.9 |
| 3 | 309.1 | 49.0 | 3 | 358.5 | 56.8 | 3 | 407.9 | 64.6 | 3 | 457.3 | 72.4 | 3 | 506.7 | 80.3 | 3 | 556.1 | 88.1 |
| 4 | 310.1 | 49.1 | 4 | 359.5 | 56.9 | 4 | 408.9 | 64.8 | 4 | 458.3 | 72.6 | 4 | 507.7 | 80.4 | 4 | 557.1 | 88.2 |
| 5 | 311.1 | 49.3 | 5 | 360.5 | 57.1 | 5 | 409.9 | 64.9 | 5 | 459.3 | 72.7 | 5 | 508.7 | 80.6 | 5 | 558.0 | 88.4 |
| 6 | 312.1 | 49.4 | 6 | 361.5 | 57.3 | 6 | 410.9 | 65.1 | 6 | 460.3 | 72.9 | 6 | 509.6 | 80.7 | 6 | 559.0 | 88.5 |
| 7 | 313.1 | 49.6 | 7 | 362.5 | 57.4 | 7 | 411.9 | 65.2 | 7 | 461.3 | 73.1 | 7 | 510.6 | 80.9 | 7 | 560.0 | 88.7 |
| 8 | 314.1 | 49.7 | 8 | 363.5 | 57.6 | 8 | 412.9 | 65.4 | 8 | 462.2 | 73.2 | 8 | 511.6 | 81.0 | 8 | 561.0 | 88.9 |
| 9 | 315.1 | 49.9 | 9 | 364.5 | 57.7 | 9 | 413.8 | 65.5 | 9 | 463.2 | 73.4 | 9 | 512.6 | 81.2 | 9 | 562.0 | 89.0 |
| 320 | 316.1 | 50.1 | 370 | 365.4 | 57.9 | 420 | 414.8 | 65.7 | 470 | 464.2 | 73.5 | 520 | 513.6 | 81.3 | 570 | 563.0 | 89.2 |
| 1 | 317.0 | 50.2 | 1 | 366.4 | 58.0 | 1 | 415.8 | 65.9 | 1 | 465.2 | 73.7 | 1 | 514.6 | 81.5 | 1 | 564.0 | 89.3 |
| 2 | 318.0 | 50.4 | 2 | 367.4 | 58.2 | 2 | 416.8 | 66.0 | 2 | 466.2 | 73.8 | 2 | 515.6 | 81.7 | 2 | 565.0 | 89.5 |
| 3 | 319.0 | 50.5 | 3 | 368.4 | 58.4 | 3 | 417.8 | 66.2 | 3 | 467.2 | 74.0 | 3 | 516.6 | 81.8 | 3 | 565.9 | 89.6 |
| 4 | 320.0 | 50.7 | 4 | 369.4 | 58.5 | 4 | 418.8 | 66.3 | 4 | 468.2 | 74.1 | 4 | 517.5 | 82.0 | 4 | 566.9 | 89.8 |
| 5 | 321.0 | 50.8 | 5 | 370.4 | 58.7 | 5 | 419.8 | 66.5 | 5 | 469.2 | 74.3 | 5 | 518.5 | 82.1 | 5 | 567.9 | 89.9 |
| 6 | 322.0 | 51.0 | 6 | 371.4 | 58.8 | 6 | 420.8 | 66.6 | 6 | 470.1 | 74.5 | 6 | 519.5 | 82.3 | 6 | 568.9 | 90.1 |
| 7 | 323.0 | 51.2 | 7 | 372.4 | 59.0 | 7 | 421.7 | 66.8 | 7 | 471.1 | 74.6 | 7 | 520.5 | 82.4 | 7 | 569.9 | 90.3 |
| 8 | 324.0 | 51.3 | 8 | 373.3 | 59.1 | 8 | 422.7 | 67.0 | 8 | 472.1 | 74.8 | 8 | 521.5 | 82.6 | 8 | 570.9 | 90.4 |
| 9 | 324.9 | 51.5 | 9 | 374.3 | 59.3 | 9 | 423.7 | 67.1 | 9 | 473.1 | 74.9 | 9 | 522.5 | 82.8 | 9 | 571.9 | 90.6 |
| 330 | 325.9 | 51.6 | 380 | 375.3 | 59.4 | 430 | 424.7 | 67.3 | 480 | 474.1 | 75.1 | 530 | 523.5 | 82.9 | 580 | 572.9 | 90.7 |
| 1 | 326.9 | 51.8 | 1 | 376.3 | 59.6 | 1 | 425.7 | 67.4 | 1 | 475.1 | 75.2 | 1 | 524.5 | 83.1 | 1 | 573.8 | 90.9 |
| 2 | 327.9 | 51.9 | 2 | 377.3 | 59.8 | 2 | 426.7 | 67.6 | 2 | 476.1 | 75.4 | 2 | 525.5 | 83.2 | 2 | 574.8 | 91.0 |
| 3 | 328.9 | 52.1 | 3 | 378.3 | 59.9 | 3 | 427.7 | 67.7 | 3 | 477.1 | 75.6 | 3 | 526.4 | 83.4 | 3 | 575.8 | 91.2 |
| 4 | 329.9 | 52.2 | 4 | 379.3 | 60.1 | 4 | 428.7 | 67.9 | 4 | 478.0 | 75.7 | 4 | 527.4 | 83.5 | 4 | 576.8 | 91.4 |
| 5 | 330.9 | 52.4 | 5 | 380.3 | 60.2 | 5 | 429.6 | 68.0 | 5 | 479.0 | 75.9 | 5 | 528.4 | 83.7 | 5 | 577.8 | 91.5 |
| 6 | 331.9 | 52.6 | 6 | 381.2 | 60.4 | 6 | 430.6 | 68.2 | 6 | 480.0 | 76.0 | 6 | 529.4 | 83.8 | 6 | 578.8 | 91.7 |
| 7 | 332.9 | 52.7 | 7 | 382.2 | 60.5 | 7 | 431.6 | 68.4 | 7 | 481.0 | 76.2 | 7 | 530.4 | 84.0 | 7 | 579.8 | 91.8 |
| 8 | 333.8 | 52.9 | 8 | 383.2 | 60.7 | 8 | 432.6 | 68.5 | 8 | 482.0 | 76.3 | 8 | 531.4 | 84.2 | 8 | 580.8 | 92.0 |
| 9 | 334.8 | 53.0 | 9 | 384.2 | 60.9 | 9 | 433.6 | 68.7 | 9 | 483.0 | 76.5 | 9 | 532.4 | 84.3 | 9 | 581.7 | 92.1 |
| 340 | 335.8 | 53.2 | 390 | 385.2 | 61.0 | 440 | 434.6 | 68.8 | 490 | 484.0 | 76.7 | 540 | 533.4 | 84.5 | 590 | 582.7 | 92.3 |
| 1 | 336.8 | 53.3 | 1 | 386.2 | 61.2 | 1 | 435.6 | 69.0 | 1 | 485.0 | 76.8 | 1 | 534.3 | 84.6 | 1 | 583.7 | 92.5 |
| 2 | 337.8 | 53.5 | 2 | 387.2 | 61.3 | 2 | 436.6 | 69.1 | 2 | 485.9 | 77.0 | 2 | 535.3 | 84.8 | 2 | 584.7 | 92.6 |
| 3 | 338.8 | 53.7 | 3 | 388.2 | 61.5 | 3 | 437.5 | 69.3 | 3 | 486.9 | 77.1 | 3 | 536.3 | 84.9 | 3 | 585.7 | 92.8 |
| 4 | 339.8 | 53.8 | 4 | 389.1 | 61.6 | 4 | 438.5 | 69.5 | 4 | 487.9 | 77.3 | 4 | 537.3 | 85.1 | 4 | 586.7 | 92.9 |
| 5 | 340.8 | 54.0 | 5 | 390.1 | 61.8 | 5 | 439.5 | 69.6 | 5 | 488.9 | 77.4 | 5 | 538.3 | 85.3 | 5 | 587.7 | 93.1 |
| 6 | 341.7 | 54.1 | 6 | 391.1 | 61.9 | 6 | 440.5 | 69.8 | 6 | 489.9 | 77.6 | 6 | 539.3 | 85.4 | 6 | 588.7 | 93.2 |
| 7 | 342.7 | 54.3 | 7 | 392.1 | 62.1 | 7 | 441.5 | 69.9 | 7 | 490.9 | 77.7 | 7 | 540.3 | 85.6 | 7 | 589.6 | 93.4 |
| 8 | 343.7 | 54.4 | 8 | 393.1 | 62.3 | 8 | 442.5 | 70.1 | 8 | 491.9 | 77.9 | 8 | 541.3 | 85.7 | 8 | 590.6 | 93.5 |
| 9 | 344.7 | 54.6 | 9 | 394.1 | 62.4 | 9 | 443.5 | 70.2 | 9 | 492.9 | 78.1 | 9 | 542.2 | 85.9 | 9 | 591.6 | 93.7 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 279 315
289 261 225

R

089 081° 045
091 099 135

R ou φm

R

TABELA 1

R ou φ m

359 350° 315
181 190 225

TÁBUAS DE CARTEAÇÃO

001 010 045
179 170 135

| ΔL | ap | $\Delta \varphi$ | ΔL | ap | $\Delta \varphi$ | ΔL | ap | $\Delta \varphi$ | ΔL | ap | $\Delta \varphi$ | ΔL | ap | $\Delta \varphi$ | ΔL | ap | $\Delta \varphi$ |
|------------|------|------------------|------------|------|------------------|------------|-------|------------------|------------|-------|------------------|------------|-------|------------------|------------|-------|------------------|
| D | | | D | | | D | | | D | | | D | | | D | | |
| 0 | 0.0 | 0.0 | 50 | 49.2 | 8.7 | 100 | 98.5 | 17.4 | 150 | 147.7 | 26.0 | 200 | 197.0 | 34.7 | 250 | 246.2 | 43.4 |
| 1 | 1.0 | 0.2 | 1 | 50.2 | 8.9 | 1 | 99.5 | 17.5 | 1 | 148.7 | 26.2 | 1 | 197.9 | 34.9 | 1 | 247.2 | 43.6 |
| 2 | 2.0 | 0.3 | 2 | 51.2 | 9.0 | 2 | 100.5 | 17.7 | 2 | 149.7 | 26.4 | 2 | 198.9 | 35.1 | 2 | 248.2 | 43.8 |
| 3 | 3.0 | 0.5 | 3 | 52.2 | 9.2 | 3 | 101.4 | 17.9 | 3 | 150.7 | 26.6 | 3 | 199.9 | 35.3 | 3 | 249.2 | 43.9 |
| 4 | 3.9 | 0.7 | 4 | 53.2 | 9.4 | 4 | 102.4 | 18.1 | 4 | 151.7 | 26.7 | 4 | 200.9 | 35.4 | 4 | 250.1 | 44.1 |
| 5 | 4.9 | 0.9 | 5 | 54.2 | 9.6 | 5 | 103.4 | 18.2 | 5 | 152.6 | 26.9 | 5 | 201.9 | 35.6 | 5 | 251.1 | 44.3 |
| 6 | 5.9 | 1.0 | 6 | 55.1 | 9.7 | 6 | 104.4 | 18.4 | 6 | 153.6 | 27.1 | 6 | 202.9 | 35.8 | 6 | 252.1 | 44.5 |
| 7 | 6.9 | 1.2 | 7 | 56.1 | 9.9 | 7 | 105.4 | 18.6 | 7 | 154.6 | 27.3 | 7 | 203.9 | 35.9 | 7 | 253.1 | 44.6 |
| 8 | 7.9 | 1.4 | 8 | 57.1 | 10.1 | 8 | 106.4 | 18.8 | 8 | 155.6 | 27.4 | 8 | 204.8 | 36.1 | 8 | 254.1 | 44.8 |
| 9 | 8.9 | 1.6 | 9 | 58.1 | 10.2 | 9 | 107.3 | 18.9 | 9 | 156.6 | 27.6 | 9 | 205.8 | 36.3 | 9 | 255.1 | 45.0 |
| 10 | 9.8 | 1.7 | 60 | 59.1 | 10.4 | 110 | 108.3 | 19.1 | 160 | 157.6 | 27.8 | 210 | 206.8 | 36.5 | 260 | 256.0 | 45.1 |
| 1 | 10.8 | 1.9 | 1 | 60.1 | 10.6 | 1 | 109.3 | 19.3 | 1 | 158.6 | 28.0 | 1 | 207.8 | 36.6 | 1 | 257.0 | 45.3 |
| 2 | 11.8 | 2.1 | 2 | 61.1 | 10.8 | 2 | 110.3 | 19.4 | 2 | 159.5 | 28.1 | 2 | 208.8 | 36.8 | 2 | 258.0 | 45.5 |
| 3 | 12.8 | 2.3 | 3 | 62.0 | 10.9 | 3 | 111.3 | 19.6 | 3 | 160.5 | 28.3 | 3 | 209.8 | 37.0 | 3 | 259.0 | 45.7 |
| 4 | 13.8 | 2.4 | 4 | 63.0 | 11.1 | 4 | 112.3 | 19.8 | 4 | 161.5 | 28.5 | 4 | 210.7 | 37.2 | 4 | 260.0 | 45.8 |
| 5 | 14.8 | 2.6 | 5 | 64.0 | 11.3 | 5 | 113.3 | 20.0 | 5 | 162.5 | 28.7 | 5 | 211.7 | 37.3 | 5 | 261.0 | 46.0 |
| 6 | 15.8 | 2.8 | 6 | 65.0 | 11.5 | 6 | 114.2 | 20.1 | 6 | 163.5 | 28.8 | 6 | 212.7 | 37.5 | 6 | 262.0 | 46.2 |
| 7 | 16.7 | 3.0 | 7 | 66.0 | 11.6 | 7 | 115.2 | 20.3 | 7 | 164.5 | 29.0 | 7 | 213.7 | 37.7 | 7 | 262.9 | 46.4 |
| 8 | 17.7 | 3.1 | 8 | 67.0 | 11.8 | 8 | 116.2 | 20.5 | 8 | 165.4 | 29.2 | 8 | 214.7 | 37.9 | 8 | 263.9 | 46.5 |
| 9 | 18.7 | 3.3 | 9 | 68.0 | 12.0 | 9 | 117.2 | 20.7 | 9 | 166.4 | 29.3 | 9 | 215.7 | 38.0 | 9 | 264.9 | 46.7 |
| 20 | 19.7 | 3.5 | 70 | 68.9 | 12.2 | 120 | 118.2 | 20.8 | 170 | 167.4 | 29.5 | 220 | 216.7 | 38.2 | 270 | 265.9 | 46.9 |
| 1 | 20.7 | 3.6 | 1 | 69.9 | 12.3 | 1 | 119.2 | 21.0 | 1 | 168.4 | 29.7 | 1 | 217.6 | 38.4 | 1 | 266.9 | 47.1 |
| 2 | 21.7 | 3.8 | 2 | 70.9 | 12.5 | 2 | 120.1 | 21.2 | 2 | 169.4 | 29.9 | 2 | 218.6 | 38.5 | 2 | 267.9 | 47.2 |
| 3 | 22.7 | 4.0 | 3 | 71.9 | 12.7 | 3 | 121.1 | 21.4 | 3 | 170.4 | 30.0 | 3 | 219.6 | 38.7 | 3 | 268.9 | 47.4 |
| 4 | 23.6 | 4.2 | 4 | 72.9 | 12.8 | 4 | 122.1 | 21.5 | 4 | 171.4 | 30.2 | 4 | 220.6 | 38.9 | 4 | 269.8 | 47.6 |
| 5 | 24.6 | 4.3 | 5 | 73.9 | 13.0 | 5 | 123.1 | 21.7 | 5 | 172.3 | 30.4 | 5 | 221.6 | 39.1 | 5 | 270.8 | 47.8 |
| 6 | 25.6 | 4.5 | 6 | 74.8 | 13.2 | 6 | 124.1 | 21.9 | 6 | 173.3 | 30.6 | 6 | 222.6 | 39.2 | 6 | 271.8 | 47.9 |
| 7 | 26.6 | 4.7 | 7 | 75.8 | 13.4 | 7 | 125.1 | 22.1 | 7 | 174.3 | 30.7 | 7 | 223.6 | 39.4 | 7 | 272.8 | 48.1 |
| 8 | 27.6 | 4.9 | 8 | 76.8 | 13.5 | 8 | 126.1 | 22.2 | 8 | 175.3 | 30.9 | 8 | 224.5 | 39.6 | 8 | 273.8 | 48.3 |
| 9 | 28.6 | 5.0 | 9 | 77.8 | 13.7 | 9 | 127.0 | 22.4 | 9 | 176.3 | 31.1 | 9 | 225.5 | 39.8 | 9 | 274.8 | 48.4 |
| 30 | 29.5 | 5.2 | 80 | 78.8 | 13.9 | 130 | 128.0 | 22.6 | 180 | 177.3 | 31.3 | 230 | 226.5 | 39.9 | 280 | 275.7 | 48.6 |
| 1 | 30.5 | 5.4 | 1 | 79.8 | 14.1 | 1 | 129.0 | 22.7 | 1 | 178.3 | 31.4 | 1 | 227.5 | 40.1 | 1 | 276.7 | 48.8 |
| 2 | 31.5 | 5.6 | 2 | 80.8 | 14.2 | 2 | 130.0 | 22.9 | 2 | 179.2 | 31.6 | 2 | 228.5 | 40.3 | 2 | 277.7 | 49.0 |
| 3 | 32.5 | 5.7 | 3 | 81.7 | 14.4 | 3 | 131.0 | 23.1 | 3 | 180.2 | 31.8 | 3 | 229.5 | 40.5 | 3 | 278.7 | 49.1 |
| 4 | 33.5 | 5.9 | 4 | 82.7 | 14.6 | 4 | 132.0 | 23.3 | 4 | 181.2 | 32.0 | 4 | 230.4 | 40.6 | 4 | 279.7 | 49.3 |
| 5 | 34.5 | 6.1 | 5 | 83.7 | 14.8 | 5 | 132.9 | 23.4 | 5 | 182.2 | 32.1 | 5 | 231.4 | 40.8 | 5 | 280.7 | 49.5 |
| 6 | 35.5 | 6.3 | 6 | 84.7 | 14.9 | 6 | 133.9 | 23.6 | 6 | 183.2 | 32.3 | 6 | 232.4 | 41.0 | 6 | 281.7 | 49.7 |
| 7 | 36.4 | 6.4 | 7 | 85.7 | 15.1 | 7 | 134.9 | 23.8 | 7 | 184.2 | 32.5 | 7 | 233.4 | 41.2 | 7 | 282.6 | 49.8 |
| 8 | 37.4 | 6.6 | 8 | 86.7 | 15.3 | 8 | 135.9 | 24.0 | 8 | 185.1 | 32.6 | 8 | 234.4 | 41.3 | 8 | 283.6 | 50.0 |
| 9 | 38.4 | 6.8 | 9 | 87.6 | 15.5 | 9 | 136.9 | 24.1 | 9 | 186.1 | 32.8 | 9 | 235.4 | 41.5 | 9 | 284.6 | 50.2 |
| 40 | 39.4 | 6.9 | 90 | 88.6 | 15.6 | 140 | 137.9 | 24.3 | 190 | 187.1 | 33.0 | 240 | 236.4 | 41.7 | 290 | 285.6 | 50.4 |
| 1 | 40.4 | 7.1 | 1 | 89.6 | 15.8 | 1 | 138.9 | 24.5 | 1 | 188.1 | 33.2 | 1 | 237.3 | 41.8 | 1 | 286.6 | 50.5 |
| 2 | 41.4 | 7.3 | 2 | 90.6 | 16.0 | 2 | 139.8 | 24.7 | 2 | 189.1 | 33.3 | 2 | 238.3 | 42.0 | 2 | 287.6 | 50.7 |
| 3 | 42.3 | 7.5 | 3 | 91.6 | 16.1 | 3 | 140.8 | 24.8 | 3 | 190.1 | 33.5 | 3 | 239.3 | 42.2 | 3 | 288.5 | 50.9 |
| 4 | 43.3 | 7.6 | 4 | 92.6 | 16.3 | 4 | 141.8 | 25.0 | 4 | 191.1 | 33.7 | 4 | 240.3 | 42.4 | 4 | 289.5 | 51.1 |
| 5 | 44.3 | 7.8 | 5 | 93.6 | 16.5 | 5 | 142.8 | 25.2 | 5 | 192.0 | 33.9 | 5 | 241.3 | 42.5 | 5 | 290.5 | 51.2 |
| 6 | 45.3 | 8.0 | 6 | 94.5 | 16.7 | 6 | 143.8 | 25.4 | 6 | 193.0 | 34.0 | 6 | 242.3 | 42.7 | 6 | 291.5 | 51.4 |
| 7 | 46.3 | 8.2 | 7 | 95.5 | 16.8 | 7 | 144.8 | 25.5 | 7 | 194.0 | 34.2 | 7 | 243.2 | 42.9 | 7 | 292.5 | 51.6 |
| 8 | 47.3 | 8.3 | 8 | 96.5 | 17.0 | 8 | 145.8 | 25.7 | 8 | 195.0 | 34.4 | 8 | 244.2 | 43.1 | 8 | 293.5 | 51.7 |
| 9 | 48.3 | 8.5 | 9 | 97.5 | 17.2 | 9 | 146.7 | 25.9 | 9 | 196.0 | 34.6 | 9 | 245.2 | 43.2 | 9 | 294.5 | 51.9 |
| D | ap | $\Delta \varphi$ | D | ap | $\Delta \varphi$ | D | ap | $\Delta \varphi$ | D | ap | $\Delta \varphi$ | D | ap | $\Delta \varphi$ | D | ap | $\Delta \varphi$ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 280 315
269 260 225

R

089 080° 045
091 100 135

R ou φ m

R

TABELA 1

R ou φm

359 350° 315
181 190 225

TÁBUAS DE CARTEAÇÃO

001 010 045
179 170 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 295.4 | 52.1 | 350 | 344.7 | 60.8 | 400 | 393.9 | 69.5 | 450 | 443.2 | 78.1 | 500 | 492.4 | 86.8 | 550 | 541.6 | 95.5 |
| 1 | 296.4 | 52.3 | 1 | 345.7 | 61.0 | 1 | 394.9 | 69.6 | 1 | 444.1 | 78.3 | 1 | 493.4 | 87.0 | 1 | 542.6 | 95.7 |
| 2 | 297.4 | 52.4 | 2 | 346.7 | 61.1 | 2 | 395.9 | 69.8 | 2 | 445.1 | 78.5 | 2 | 494.4 | 87.2 | 2 | 543.6 | 95.9 |
| 3 | 298.4 | 52.6 | 3 | 347.6 | 61.3 | 3 | 396.9 | 70.0 | 3 | 446.1 | 78.7 | 3 | 495.4 | 87.3 | 3 | 544.6 | 96.0 |
| 4 | 299.4 | 52.8 | 4 | 348.6 | 61.5 | 4 | 397.9 | 70.2 | 4 | 447.1 | 78.8 | 4 | 496.3 | 87.5 | 4 | 545.6 | 96.2 |
| 5 | 300.4 | 53.0 | 5 | 349.6 | 61.6 | 5 | 398.8 | 70.3 | 5 | 448.1 | 79.0 | 5 | 497.3 | 87.7 | 5 | 546.6 | 96.4 |
| 6 | 301.4 | 53.1 | 6 | 350.6 | 61.8 | 6 | 399.8 | 70.5 | 6 | 449.1 | 79.2 | 6 | 498.3 | 87.9 | 6 | 547.6 | 96.5 |
| 7 | 302.3 | 53.3 | 7 | 351.6 | 62.0 | 7 | 400.8 | 70.7 | 7 | 450.1 | 79.4 | 7 | 499.3 | 88.0 | 7 | 548.5 | 96.7 |
| 8 | 303.3 | 53.5 | 8 | 352.6 | 62.2 | 8 | 401.8 | 70.8 | 8 | 451.0 | 79.5 | 8 | 500.3 | 88.2 | 8 | 549.5 | 96.9 |
| 9 | 304.3 | 53.7 | 9 | 353.5 | 62.3 | 9 | 402.8 | 71.0 | 9 | 452.0 | 79.7 | 9 | 501.3 | 88.4 | 9 | 550.5 | 97.1 |
| 310 | 305.3 | 53.8 | 360 | 354.5 | 62.5 | 410 | 403.8 | 71.2 | 460 | 453.0 | 79.9 | 510 | 502.3 | 88.6 | 560 | 551.5 | 97.2 |
| 1 | 306.3 | 54.0 | 1 | 355.5 | 62.7 | 1 | 404.8 | 71.4 | 1 | 454.0 | 80.1 | 1 | 503.2 | 88.7 | 1 | 552.5 | 97.4 |
| 2 | 307.3 | 54.2 | 2 | 356.5 | 62.9 | 2 | 405.7 | 71.5 | 2 | 455.0 | 80.2 | 2 | 504.2 | 88.9 | 2 | 553.5 | 97.6 |
| 3 | 308.2 | 54.4 | 3 | 357.5 | 63.0 | 3 | 406.7 | 71.7 | 3 | 456.0 | 80.4 | 3 | 505.2 | 89.1 | 3 | 554.4 | 97.8 |
| 4 | 309.2 | 54.5 | 4 | 358.5 | 63.2 | 4 | 407.7 | 71.9 | 4 | 457.0 | 80.6 | 4 | 506.2 | 89.3 | 4 | 555.4 | 97.9 |
| 5 | 310.2 | 54.7 | 5 | 359.5 | 63.4 | 5 | 408.7 | 72.1 | 5 | 457.9 | 80.7 | 5 | 507.2 | 89.4 | 5 | 556.4 | 98.1 |
| 6 | 311.2 | 54.9 | 6 | 360.4 | 63.6 | 6 | 409.7 | 72.2 | 6 | 458.9 | 80.9 | 6 | 508.2 | 89.6 | 6 | 557.4 | 98.3 |
| 7 | 312.2 | 55.0 | 7 | 361.4 | 63.7 | 7 | 410.7 | 72.4 | 7 | 459.9 | 81.1 | 7 | 509.1 | 89.8 | 7 | 558.4 | 98.5 |
| 8 | 313.2 | 55.2 | 8 | 362.4 | 63.9 | 8 | 411.6 | 72.6 | 8 | 460.9 | 81.3 | 8 | 510.1 | 89.9 | 8 | 559.4 | 98.6 |
| 9 | 314.2 | 55.4 | 9 | 363.4 | 64.1 | 9 | 412.6 | 72.8 | 9 | 461.9 | 81.4 | 9 | 511.1 | 90.1 | 9 | 560.4 | 98.8 |
| 320 | 315.1 | 55.6 | 370 | 364.4 | 64.2 | 420 | 413.6 | 72.9 | 470 | 462.9 | 81.6 | 520 | 512.1 | 90.3 | 570 | 561.3 | 99.0 |
| 1 | 316.1 | 55.7 | 1 | 365.4 | 64.4 | 1 | 414.6 | 73.1 | 1 | 463.8 | 81.8 | 1 | 513.1 | 90.5 | 1 | 562.3 | 99.2 |
| 2 | 317.1 | 55.9 | 2 | 366.3 | 64.6 | 2 | 415.6 | 73.3 | 2 | 464.8 | 82.0 | 2 | 514.1 | 90.6 | 2 | 563.3 | 99.3 |
| 3 | 318.1 | 56.1 | 3 | 367.3 | 64.8 | 3 | 416.6 | 73.5 | 3 | 465.8 | 82.1 | 3 | 515.1 | 90.8 | 3 | 564.3 | 99.5 |
| 4 | 319.1 | 56.3 | 4 | 368.3 | 64.9 | 4 | 417.6 | 73.6 | 4 | 466.8 | 82.3 | 4 | 516.0 | 91.0 | 4 | 565.3 | 99.7 |
| 5 | 320.1 | 56.4 | 5 | 369.3 | 65.1 | 5 | 418.5 | 73.8 | 5 | 467.8 | 82.5 | 5 | 517.0 | 91.2 | 5 | 566.3 | 99.8 |
| 6 | 321.0 | 56.6 | 6 | 370.3 | 65.3 | 6 | 419.5 | 74.0 | 6 | 468.8 | 82.7 | 6 | 518.0 | 91.3 | 6 | 567.2 | 100.0 |
| 7 | 322.0 | 56.8 | 7 | 371.3 | 65.5 | 7 | 420.5 | 74.1 | 7 | 469.8 | 82.8 | 7 | 519.0 | 91.5 | 7 | 568.2 | 100.2 |
| 8 | 323.0 | 57.0 | 8 | 372.3 | 65.6 | 8 | 421.5 | 74.3 | 8 | 470.7 | 83.0 | 8 | 520.0 | 91.7 | 8 | 569.2 | 100.4 |
| 9 | 324.0 | 57.1 | 9 | 373.2 | 65.8 | 9 | 422.5 | 74.5 | 9 | 471.7 | 83.2 | 9 | 521.0 | 91.9 | 9 | 570.2 | 100.5 |
| 330 | 325.0 | 57.3 | 380 | 374.2 | 66.0 | 430 | 423.5 | 74.7 | 480 | 472.7 | 83.4 | 530 | 521.9 | 92.0 | 580 | 571.2 | 100.7 |
| 1 | 326.0 | 57.5 | 1 | 375.2 | 66.2 | 1 | 424.5 | 74.8 | 1 | 473.7 | 83.5 | 1 | 522.9 | 92.2 | 1 | 572.2 | 100.9 |
| 2 | 327.0 | 57.7 | 2 | 376.2 | 66.3 | 2 | 425.4 | 75.0 | 2 | 474.7 | 83.7 | 2 | 523.9 | 92.4 | 2 | 573.2 | 101.1 |
| 3 | 327.9 | 57.8 | 3 | 377.2 | 66.5 | 3 | 426.4 | 75.2 | 3 | 475.7 | 83.9 | 3 | 524.9 | 92.6 | 3 | 574.1 | 101.2 |
| 4 | 328.9 | 58.0 | 4 | 378.2 | 66.7 | 4 | 427.4 | 75.4 | 4 | 476.6 | 84.0 | 4 | 525.9 | 92.7 | 4 | 575.1 | 101.4 |
| 5 | 329.9 | 58.2 | 5 | 379.2 | 66.9 | 5 | 428.4 | 75.5 | 5 | 477.6 | 84.2 | 5 | 526.9 | 92.9 | 5 | 576.1 | 101.6 |
| 6 | 330.9 | 58.3 | 6 | 380.1 | 67.0 | 6 | 429.4 | 75.7 | 6 | 478.6 | 84.4 | 6 | 527.9 | 93.1 | 6 | 577.1 | 101.8 |
| 7 | 331.9 | 58.5 | 7 | 381.1 | 67.2 | 7 | 430.4 | 75.9 | 7 | 479.6 | 84.6 | 7 | 528.8 | 93.2 | 7 | 578.1 | 101.9 |
| 8 | 332.9 | 58.7 | 8 | 382.1 | 67.4 | 8 | 431.3 | 76.1 | 8 | 480.6 | 84.7 | 8 | 529.8 | 93.4 | 8 | 579.1 | 102.1 |
| 9 | 333.8 | 58.9 | 9 | 383.1 | 67.5 | 9 | 432.3 | 76.2 | 9 | 481.6 | 84.9 | 9 | 530.8 | 93.6 | 9 | 580.1 | 102.3 |
| 340 | 334.8 | 59.0 | 390 | 384.1 | 67.7 | 440 | 433.3 | 76.4 | 490 | 482.6 | 85.1 | 540 | 531.8 | 93.8 | 590 | 581.0 | 102.5 |
| 1 | 335.8 | 59.2 | 1 | 385.1 | 67.9 | 1 | 434.3 | 76.6 | 1 | 483.5 | 85.3 | 1 | 532.8 | 93.9 | 1 | 582.0 | 102.6 |
| 2 | 336.8 | 59.4 | 2 | 386.0 | 68.1 | 2 | 435.3 | 76.8 | 2 | 484.5 | 85.4 | 2 | 533.8 | 94.1 | 2 | 583.0 | 102.8 |
| 3 | 337.8 | 59.6 | 3 | 387.0 | 68.2 | 3 | 436.3 | 76.9 | 3 | 485.5 | 85.6 | 3 | 534.8 | 94.3 | 3 | 584.0 | 103.0 |
| 4 | 338.8 | 59.7 | 4 | 388.0 | 68.4 | 4 | 437.3 | 77.1 | 4 | 486.5 | 85.8 | 4 | 535.7 | 94.5 | 4 | 585.0 | 103.1 |
| 5 | 339.8 | 59.9 | 5 | 389.0 | 68.6 | 5 | 438.2 | 77.3 | 5 | 487.5 | 86.0 | 5 | 536.7 | 94.6 | 5 | 586.0 | 103.3 |
| 6 | 340.7 | 60.1 | 6 | 390.0 | 68.8 | 6 | 439.2 | 77.4 | 6 | 488.5 | 86.1 | 6 | 537.7 | 94.8 | 6 | 586.9 | 103.5 |
| 7 | 341.7 | 60.3 | 7 | 391.0 | 68.9 | 7 | 440.2 | 77.6 | 7 | 489.4 | 86.3 | 7 | 538.7 | 95.0 | 7 | 587.9 | 103.7 |
| 8 | 342.7 | 60.4 | 8 | 392.0 | 69.1 | 8 | 441.2 | 77.8 | 8 | 490.4 | 86.5 | 8 | 539.7 | 95.2 | 8 | 588.9 | 103.8 |
| 9 | 343.7 | 60.6 | 9 | 392.9 | 69.3 | 9 | 442.2 | 78.0 | 9 | 491.4 | 86.7 | 9 | 540.7 | 95.3 | 9 | 589.9 | 104.0 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 280 315
269 260 225

089 080° 045
091 100 135

R

R ou φm

R

TABELA 1

R ou φm

359 349° 315
181 191 225

TÁBUAS DE CARTEAÇÃO

001 011 045
179 169 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|-----|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 49.1 | 9.5 | 100 | 98.2 | 19.1 | 150 | 147.2 | 28.6 | 200 | 196.3 | 38.2 | 250 | 245.4 | 47.7 |
| 1 | 1.0 | 0.2 | 1 | 50.1 | 9.7 | 1 | 99.1 | 19.3 | 1 | 148.2 | 28.8 | 1 | 197.3 | 38.4 | 1 | 246.4 | 47.9 |
| 2 | 2.0 | 0.4 | 2 | 51.0 | 9.9 | 2 | 100.1 | 19.5 | 2 | 149.2 | 29.0 | 2 | 198.3 | 38.5 | 2 | 247.4 | 48.1 |
| 3 | 2.9 | 0.6 | 3 | 52.0 | 10.1 | 3 | 101.1 | 19.7 | 3 | 150.2 | 29.2 | 3 | 199.3 | 38.7 | 3 | 248.4 | 48.3 |
| 4 | 3.9 | 0.8 | 4 | 53.0 | 10.3 | 4 | 102.1 | 19.8 | 4 | 151.2 | 29.4 | 4 | 200.3 | 38.9 | 4 | 249.3 | 48.5 |
| 5 | 4.9 | 1.0 | 5 | 54.0 | 10.5 | 5 | 103.1 | 20.0 | 5 | 152.2 | 29.6 | 5 | 201.2 | 39.1 | 5 | 250.3 | 48.7 |
| 6 | 5.9 | 1.1 | 6 | 55.0 | 10.7 | 6 | 104.1 | 20.2 | 6 | 153.1 | 29.8 | 6 | 202.2 | 39.3 | 6 | 251.3 | 48.8 |
| 7 | 6.9 | 1.3 | 7 | 56.0 | 10.9 | 7 | 105.0 | 20.4 | 7 | 154.1 | 30.0 | 7 | 203.2 | 39.5 | 7 | 252.3 | 49.0 |
| 8 | 7.9 | 1.5 | 8 | 56.9 | 11.1 | 8 | 106.0 | 20.6 | 8 | 155.1 | 30.1 | 8 | 204.2 | 39.7 | 8 | 253.3 | 49.2 |
| 9 | 8.8 | 1.7 | 9 | 57.9 | 11.3 | 9 | 107.0 | 20.8 | 9 | 156.1 | 30.3 | 9 | 205.2 | 39.9 | 9 | 254.2 | 49.4 |
| 10 | 9.8 | 1.9 | 60 | 58.9 | 11.4 | 110 | 108.0 | 21.0 | 160 | 157.1 | 30.5 | 210 | 206.1 | 40.1 | 260 | 255.2 | 49.6 |
| 1 | 10.8 | 2.1 | 1 | 59.9 | 11.6 | 1 | 109.0 | 21.2 | 1 | 158.0 | 30.7 | 1 | 207.1 | 40.3 | 1 | 256.2 | 49.8 |
| 2 | 11.8 | 2.3 | 2 | 60.9 | 11.8 | 2 | 109.9 | 21.4 | 2 | 159.0 | 30.9 | 2 | 208.1 | 40.5 | 2 | 257.2 | 50.0 |
| 3 | 12.8 | 2.5 | 3 | 61.8 | 12.0 | 3 | 110.9 | 21.6 | 3 | 160.0 | 31.1 | 3 | 209.1 | 40.6 | 3 | 258.2 | 50.2 |
| 4 | 13.7 | 2.7 | 4 | 62.8 | 12.2 | 4 | 111.9 | 21.8 | 4 | 161.0 | 31.3 | 4 | 210.1 | 40.8 | 4 | 259.1 | 50.4 |
| 5 | 14.7 | 2.9 | 5 | 63.8 | 12.4 | 5 | 112.9 | 21.9 | 5 | 162.0 | 31.5 | 5 | 211.0 | 41.0 | 5 | 260.1 | 50.6 |
| 6 | 15.7 | 3.1 | 6 | 64.8 | 12.6 | 6 | 113.9 | 22.1 | 6 | 163.0 | 31.7 | 6 | 212.0 | 41.2 | 6 | 261.1 | 50.8 |
| 7 | 16.7 | 3.2 | 7 | 65.8 | 12.8 | 7 | 114.9 | 22.3 | 7 | 163.9 | 31.9 | 7 | 213.0 | 41.4 | 7 | 262.1 | 50.9 |
| 8 | 17.7 | 3.4 | 8 | 66.8 | 13.0 | 8 | 115.8 | 22.5 | 8 | 164.9 | 32.1 | 8 | 214.0 | 41.6 | 8 | 263.1 | 51.1 |
| 9 | 18.7 | 3.6 | 9 | 67.7 | 13.2 | 9 | 116.8 | 22.7 | 9 | 165.9 | 32.2 | 9 | 215.0 | 41.8 | 9 | 264.1 | 51.3 |
| 20 | 19.6 | 3.8 | 70 | 68.7 | 13.4 | 120 | 117.8 | 22.9 | 170 | 166.9 | 32.4 | 220 | 216.0 | 42.0 | 270 | 265.0 | 51.5 |
| 1 | 20.6 | 4.0 | 1 | 69.7 | 13.5 | 1 | 118.8 | 23.1 | 1 | 167.9 | 32.6 | 1 | 216.9 | 42.2 | 1 | 266.0 | 51.7 |
| 2 | 21.6 | 4.2 | 2 | 70.7 | 13.7 | 2 | 119.8 | 23.3 | 2 | 168.8 | 32.8 | 2 | 217.9 | 42.4 | 2 | 267.0 | 51.9 |
| 3 | 22.6 | 4.4 | 3 | 71.7 | 13.9 | 3 | 120.7 | 23.5 | 3 | 169.8 | 33.0 | 3 | 218.9 | 42.6 | 3 | 268.0 | 52.1 |
| 4 | 23.6 | 4.6 | 4 | 72.6 | 14.1 | 4 | 121.7 | 23.7 | 4 | 170.8 | 33.2 | 4 | 219.9 | 42.7 | 4 | 269.0 | 52.3 |
| 5 | 24.5 | 4.8 | 5 | 73.6 | 14.3 | 5 | 122.7 | 23.9 | 5 | 171.8 | 33.4 | 5 | 220.9 | 42.9 | 5 | 269.9 | 52.5 |
| 6 | 25.5 | 5.0 | 6 | 74.6 | 14.5 | 6 | 123.7 | 24.0 | 6 | 172.8 | 33.6 | 6 | 221.8 | 43.1 | 6 | 270.9 | 52.7 |
| 7 | 26.5 | 5.2 | 7 | 75.6 | 14.7 | 7 | 124.7 | 24.2 | 7 | 173.7 | 33.8 | 7 | 222.8 | 43.3 | 7 | 271.9 | 52.9 |
| 8 | 27.5 | 5.3 | 8 | 76.6 | 14.9 | 8 | 125.6 | 24.4 | 8 | 174.7 | 34.0 | 8 | 223.8 | 43.5 | 8 | 272.9 | 53.0 |
| 9 | 28.5 | 5.5 | 9 | 77.5 | 15.1 | 9 | 126.6 | 24.6 | 9 | 175.7 | 34.2 | 9 | 224.8 | 43.7 | 9 | 273.9 | 53.2 |
| 30 | 29.4 | 5.7 | 80 | 78.5 | 15.3 | 130 | 127.6 | 24.8 | 180 | 176.7 | 34.3 | 230 | 225.8 | 43.9 | 280 | 274.9 | 53.4 |
| 1 | 30.4 | 5.9 | 1 | 79.5 | 15.5 | 1 | 128.6 | 25.0 | 1 | 177.7 | 34.5 | 1 | 226.8 | 44.1 | 1 | 275.8 | 53.6 |
| 2 | 31.4 | 6.1 | 2 | 80.5 | 15.6 | 2 | 129.6 | 25.2 | 2 | 178.7 | 34.7 | 2 | 227.7 | 44.3 | 2 | 276.8 | 53.8 |
| 3 | 32.4 | 6.3 | 3 | 81.5 | 15.8 | 3 | 130.6 | 25.4 | 3 | 179.6 | 34.9 | 3 | 228.7 | 44.5 | 3 | 277.8 | 54.0 |
| 4 | 33.4 | 6.5 | 4 | 82.5 | 16.0 | 4 | 131.5 | 25.6 | 4 | 180.6 | 35.1 | 4 | 229.7 | 44.6 | 4 | 278.8 | 54.2 |
| 5 | 34.4 | 6.7 | 5 | 83.4 | 16.2 | 5 | 132.5 | 25.8 | 5 | 181.6 | 35.3 | 5 | 230.7 | 44.8 | 5 | 279.8 | 54.4 |
| 6 | 35.3 | 6.9 | 6 | 84.4 | 16.4 | 6 | 133.5 | 26.0 | 6 | 182.6 | 35.5 | 6 | 231.7 | 45.0 | 6 | 280.7 | 54.6 |
| 7 | 36.3 | 7.1 | 7 | 85.4 | 16.6 | 7 | 134.5 | 26.1 | 7 | 183.6 | 35.7 | 7 | 232.6 | 45.2 | 7 | 281.7 | 54.8 |
| 8 | 37.3 | 7.3 | 8 | 86.4 | 16.8 | 8 | 135.5 | 26.3 | 8 | 184.5 | 35.9 | 8 | 233.6 | 45.4 | 8 | 282.7 | 55.0 |
| 9 | 38.3 | 7.4 | 9 | 87.4 | 17.0 | 9 | 136.4 | 26.5 | 9 | 185.5 | 36.1 | 9 | 234.6 | 45.6 | 9 | 283.7 | 55.1 |
| 40 | 39.3 | 7.6 | 90 | 88.3 | 17.2 | 140 | 137.4 | 26.7 | 190 | 186.5 | 36.3 | 240 | 235.6 | 45.8 | 290 | 284.7 | 55.3 |
| 1 | 40.2 | 7.8 | 1 | 89.3 | 17.4 | 1 | 138.4 | 26.9 | 1 | 187.5 | 36.4 | 1 | 236.6 | 46.0 | 1 | 285.7 | 55.5 |
| 2 | 41.2 | 8.0 | 2 | 90.3 | 17.6 | 2 | 139.4 | 27.1 | 2 | 188.5 | 36.6 | 2 | 237.6 | 46.2 | 2 | 286.6 | 55.7 |
| 3 | 42.2 | 8.2 | 3 | 91.3 | 17.7 | 3 | 140.4 | 27.3 | 3 | 189.5 | 36.8 | 3 | 238.5 | 46.4 | 3 | 287.6 | 55.9 |
| 4 | 43.2 | 8.4 | 4 | 92.3 | 17.9 | 4 | 141.4 | 27.5 | 4 | 190.4 | 37.0 | 4 | 239.5 | 46.6 | 4 | 288.6 | 56.1 |
| 5 | 44.2 | 8.6 | 5 | 93.3 | 18.1 | 5 | 142.3 | 27.7 | 5 | 191.4 | 37.2 | 5 | 240.5 | 46.7 | 5 | 289.6 | 56.3 |
| 6 | 45.2 | 8.8 | 6 | 94.2 | 18.3 | 6 | 143.3 | 27.9 | 6 | 192.4 | 37.4 | 6 | 241.5 | 46.9 | 6 | 290.6 | 56.5 |
| 7 | 46.1 | 9.0 | 7 | 95.2 | 18.5 | 7 | 144.3 | 28.0 | 7 | 193.4 | 37.6 | 7 | 242.5 | 47.1 | 7 | 291.5 | 56.7 |
| 8 | 47.1 | 9.2 | 8 | 96.2 | 18.7 | 8 | 145.3 | 28.2 | 8 | 194.4 | 37.8 | 8 | 243.4 | 47.3 | 8 | 292.5 | 56.9 |
| 9 | 48.1 | 9.3 | 9 | 97.2 | 18.9 | 9 | 146.3 | 28.4 | 9 | 195.3 | 38.0 | 9 | 244.4 | 47.5 | 9 | 293.5 | 57.1 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 281 315
269 259 225

R

089 079° 045
091 101 135

R ou φm

R

TABELA 1

R ou φm

359 349° 315

181 191 225

TÁBUAS DE CARTEAÇÃO

001 011 045

179 169 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 294.5 | 57.2 | 350 | 343.6 | 66.8 | 400 | 392.7 | 76.3 | 450 | 441.7 | 85.9 | 500 | 490.8 | 95.4 | 550 | 539.9 | 104.9 |
| 1 | 295.5 | 57.4 | 1 | 344.6 | 67.0 | 1 | 393.6 | 76.5 | 1 | 442.7 | 86.1 | 1 | 491.8 | 95.6 | 1 | 540.9 | 105.1 |
| 2 | 296.5 | 57.6 | 2 | 345.5 | 67.2 | 2 | 394.6 | 76.7 | 2 | 443.7 | 86.2 | 2 | 492.8 | 95.8 | 2 | 541.9 | 105.3 |
| 3 | 297.4 | 57.8 | 3 | 346.5 | 67.4 | 3 | 395.6 | 76.9 | 3 | 444.7 | 86.4 | 3 | 493.8 | 96.0 | 3 | 542.8 | 105.5 |
| 4 | 298.4 | 58.0 | 4 | 347.5 | 67.5 | 4 | 396.6 | 77.1 | 4 | 445.7 | 86.6 | 4 | 494.7 | 96.2 | 4 | 543.8 | 105.7 |
| 5 | 299.4 | 58.2 | 5 | 348.5 | 67.7 | 5 | 397.6 | 77.3 | 5 | 446.6 | 86.8 | 5 | 495.7 | 96.4 | 5 | 544.8 | 105.9 |
| 6 | 300.4 | 58.4 | 6 | 349.5 | 67.9 | 6 | 398.5 | 77.5 | 6 | 447.6 | 87.0 | 6 | 496.7 | 96.5 | 6 | 545.8 | 106.1 |
| 7 | 301.4 | 58.6 | 7 | 350.4 | 68.1 | 7 | 399.5 | 77.7 | 7 | 448.6 | 87.2 | 7 | 497.7 | 96.7 | 7 | 546.8 | 106.3 |
| 8 | 302.3 | 58.8 | 8 | 351.4 | 68.3 | 8 | 400.5 | 77.9 | 8 | 449.6 | 87.4 | 8 | 498.7 | 96.9 | 8 | 547.7 | 106.5 |
| 9 | 303.3 | 59.0 | 9 | 352.4 | 68.5 | 9 | 401.5 | 78.0 | 9 | 450.6 | 87.6 | 9 | 499.6 | 97.1 | 9 | 548.7 | 106.7 |
| 310 | 304.3 | 59.2 | 360 | 353.4 | 68.7 | 410 | 402.5 | 78.2 | 460 | 451.5 | 87.8 | 510 | 500.6 | 97.3 | 560 | 549.7 | 106.9 |
| 1 | 305.3 | 59.3 | 1 | 354.4 | 68.9 | 1 | 403.4 | 78.4 | 1 | 452.5 | 88.0 | 1 | 501.6 | 97.5 | 1 | 550.7 | 107.0 |
| 2 | 306.3 | 59.5 | 2 | 355.3 | 69.1 | 2 | 404.4 | 78.6 | 2 | 453.5 | 88.2 | 2 | 502.6 | 97.7 | 2 | 551.7 | 107.2 |
| 3 | 307.2 | 59.7 | 3 | 356.3 | 69.3 | 3 | 405.4 | 78.8 | 3 | 454.5 | 88.3 | 3 | 503.6 | 97.9 | 3 | 552.7 | 107.4 |
| 4 | 308.2 | 59.9 | 4 | 357.3 | 69.5 | 4 | 406.4 | 79.0 | 4 | 455.5 | 88.5 | 4 | 504.6 | 98.1 | 4 | 553.6 | 107.6 |
| 5 | 309.2 | 60.1 | 5 | 358.3 | 69.6 | 5 | 407.4 | 79.2 | 5 | 456.5 | 88.7 | 5 | 505.5 | 98.3 | 5 | 554.6 | 107.8 |
| 6 | 310.2 | 60.3 | 6 | 359.3 | 69.8 | 6 | 408.4 | 79.4 | 6 | 457.4 | 88.9 | 6 | 506.5 | 98.5 | 6 | 555.6 | 108.0 |
| 7 | 311.2 | 60.5 | 7 | 360.3 | 70.0 | 7 | 409.3 | 79.6 | 7 | 458.4 | 89.1 | 7 | 507.5 | 98.6 | 7 | 556.6 | 108.2 |
| 8 | 312.2 | 60.7 | 8 | 361.2 | 70.2 | 8 | 410.3 | 79.8 | 8 | 459.4 | 89.3 | 8 | 508.5 | 98.8 | 8 | 557.6 | 108.4 |
| 9 | 313.1 | 60.9 | 9 | 362.2 | 70.4 | 9 | 411.3 | 79.9 | 9 | 460.4 | 89.5 | 9 | 509.5 | 99.0 | 9 | 558.5 | 108.6 |
| 320 | 314.1 | 61.1 | 370 | 363.2 | 70.6 | 420 | 412.3 | 80.1 | 470 | 461.4 | 89.7 | 520 | 510.4 | 99.2 | 570 | 559.5 | 108.8 |
| 1 | 315.1 | 61.2 | 1 | 364.2 | 70.8 | 1 | 413.3 | 80.3 | 1 | 462.3 | 89.9 | 1 | 511.4 | 99.4 | 1 | 560.5 | 109.0 |
| 2 | 316.1 | 61.4 | 2 | 365.2 | 71.0 | 2 | 414.2 | 80.5 | 2 | 463.3 | 90.1 | 2 | 512.4 | 99.6 | 2 | 561.5 | 109.1 |
| 3 | 317.1 | 61.6 | 3 | 366.1 | 71.2 | 3 | 415.2 | 80.7 | 3 | 464.3 | 90.3 | 3 | 513.4 | 99.8 | 3 | 562.5 | 109.3 |
| 4 | 318.0 | 61.8 | 4 | 367.1 | 71.4 | 4 | 416.2 | 80.9 | 4 | 465.3 | 90.4 | 4 | 514.4 | 100.0 | 4 | 563.5 | 109.5 |
| 5 | 319.0 | 62.0 | 5 | 368.1 | 71.6 | 5 | 417.2 | 81.1 | 5 | 466.3 | 90.6 | 5 | 515.4 | 100.2 | 5 | 564.4 | 109.7 |
| 6 | 320.0 | 62.2 | 6 | 369.1 | 71.7 | 6 | 418.2 | 81.3 | 6 | 467.3 | 90.8 | 6 | 516.3 | 100.4 | 6 | 565.4 | 109.9 |
| 7 | 321.0 | 62.4 | 7 | 370.1 | 71.9 | 7 | 419.2 | 81.5 | 7 | 468.2 | 91.0 | 7 | 517.3 | 100.6 | 7 | 566.4 | 110.1 |
| 8 | 322.0 | 62.6 | 8 | 371.1 | 72.1 | 8 | 420.1 | 81.7 | 8 | 469.2 | 91.2 | 8 | 518.3 | 100.7 | 8 | 567.4 | 110.3 |
| 9 | 323.0 | 62.8 | 9 | 372.0 | 72.3 | 9 | 421.1 | 81.9 | 9 | 470.2 | 91.4 | 9 | 519.3 | 100.9 | 9 | 568.4 | 110.5 |
| 330 | 323.9 | 63.0 | 380 | 373.0 | 72.5 | 430 | 422.1 | 82.0 | 480 | 471.2 | 91.6 | 530 | 520.3 | 101.1 | 580 | 569.3 | 110.7 |
| 1 | 324.9 | 63.2 | 1 | 374.0 | 72.7 | 1 | 423.1 | 82.2 | 1 | 472.2 | 91.8 | 1 | 521.2 | 101.3 | 1 | 570.3 | 110.9 |
| 2 | 325.9 | 63.3 | 2 | 375.0 | 72.9 | 2 | 424.1 | 82.4 | 2 | 473.1 | 92.0 | 2 | 522.2 | 101.5 | 2 | 571.3 | 111.1 |
| 3 | 326.9 | 63.5 | 3 | 376.0 | 73.1 | 3 | 425.0 | 82.6 | 3 | 474.1 | 92.2 | 3 | 523.2 | 101.7 | 3 | 572.3 | 111.2 |
| 4 | 327.9 | 63.7 | 4 | 376.9 | 73.3 | 4 | 426.0 | 82.8 | 4 | 475.1 | 92.4 | 4 | 524.2 | 101.9 | 4 | 573.3 | 111.4 |
| 5 | 328.8 | 63.9 | 5 | 377.9 | 73.5 | 5 | 427.0 | 83.0 | 5 | 476.1 | 92.5 | 5 | 525.2 | 102.1 | 5 | 574.3 | 111.6 |
| 6 | 329.8 | 64.1 | 6 | 378.9 | 73.7 | 6 | 428.0 | 83.2 | 6 | 477.1 | 92.7 | 6 | 526.2 | 102.3 | 6 | 575.2 | 111.8 |
| 7 | 330.8 | 64.3 | 7 | 379.9 | 73.8 | 7 | 429.0 | 83.4 | 7 | 478.1 | 92.9 | 7 | 527.1 | 102.5 | 7 | 576.2 | 112.0 |
| 8 | 331.8 | 64.5 | 8 | 380.9 | 74.0 | 8 | 430.0 | 83.6 | 8 | 479.0 | 93.1 | 8 | 528.1 | 102.7 | 8 | 577.2 | 112.2 |
| 9 | 332.8 | 64.7 | 9 | 381.9 | 74.2 | 9 | 430.9 | 83.8 | 9 | 480.0 | 93.3 | 9 | 529.1 | 102.8 | 9 | 578.2 | 112.4 |
| 340 | 333.8 | 64.9 | 390 | 382.8 | 74.4 | 440 | 431.9 | 84.0 | 490 | 481.0 | 93.5 | 540 | 530.1 | 103.0 | 590 | 579.2 | 112.6 |
| 1 | 334.7 | 65.1 | 1 | 383.8 | 74.6 | 1 | 432.9 | 84.1 | 1 | 482.0 | 93.7 | 1 | 531.1 | 103.2 | 1 | 580.1 | 112.8 |
| 2 | 335.7 | 65.3 | 2 | 384.8 | 74.8 | 2 | 433.9 | 84.3 | 2 | 483.0 | 93.9 | 2 | 532.0 | 103.4 | 2 | 581.1 | 113.0 |
| 3 | 336.7 | 65.4 | 3 | 385.8 | 75.0 | 3 | 434.9 | 84.5 | 3 | 483.9 | 94.1 | 3 | 533.0 | 103.6 | 3 | 582.1 | 113.1 |
| 4 | 337.7 | 65.6 | 4 | 386.8 | 75.2 | 4 | 435.8 | 84.7 | 4 | 484.9 | 94.3 | 4 | 534.0 | 103.8 | 4 | 583.1 | 113.3 |
| 5 | 338.7 | 65.8 | 5 | 387.7 | 75.4 | 5 | 436.8 | 84.9 | 5 | 485.9 | 94.5 | 5 | 535.0 | 104.0 | 5 | 584.1 | 113.5 |
| 6 | 339.6 | 66.0 | 6 | 388.7 | 75.6 | 6 | 437.8 | 85.1 | 6 | 486.9 | 94.6 | 6 | 536.0 | 104.2 | 6 | 585.0 | 113.7 |
| 7 | 340.6 | 66.2 | 7 | 389.7 | 75.8 | 7 | 438.8 | 85.3 | 7 | 487.9 | 94.8 | 7 | 536.9 | 104.4 | 7 | 586.0 | 113.9 |
| 8 | 341.6 | 66.4 | 8 | 390.7 | 75.9 | 8 | 439.8 | 85.5 | 8 | 488.9 | 95.0 | 8 | 537.9 | 104.6 | 8 | 587.0 | 114.1 |
| 9 | 342.6 | 66.6 | 9 | 391.7 | 76.1 | 9 | 440.8 | 85.7 | 9 | 489.8 | 95.2 | 9 | 538.9 | 104.8 | 9 | 588.0 | 114.3 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 281 315

269 259 225

R

089 079° 045

091 101 135

R ou φm

R

TABELA 1

R ou φm

359 348° 315
181 192 225

TÁBUAS DE CARTEAÇÃO

001 012 045
174 168 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 48.9 | 10.4 | 100 | 97.8 | 20.8 | 150 | 146.7 | 31.2 | 200 | 195.6 | 41.6 | 250 | 244.5 | 52.0 |
| 1 | 1.0 | 0.2 | 1 | 49.9 | 10.6 | 1 | 98.8 | 21.0 | 1 | 147.7 | 31.4 | 1 | 196.6 | 41.8 | 1 | 245.5 | 52.2 |
| 2 | 2.0 | 0.4 | 2 | 50.9 | 10.8 | 2 | 99.8 | 21.2 | 2 | 148.7 | 31.6 | 2 | 197.6 | 42.0 | 2 | 246.5 | 52.4 |
| 3 | 2.9 | 0.6 | 3 | 51.8 | 11.0 | 3 | 100.7 | 21.4 | 3 | 149.7 | 31.8 | 3 | 198.6 | 42.2 | 3 | 247.5 | 52.6 |
| 4 | 3.9 | 0.8 | 4 | 52.8 | 11.2 | 4 | 101.7 | 21.6 | 4 | 150.6 | 32.0 | 4 | 199.5 | 42.4 | 4 | 248.4 | 52.8 |
| 5 | 4.9 | 1.0 | 5 | 53.8 | 11.4 | 5 | 102.7 | 21.8 | 5 | 151.6 | 32.2 | 5 | 200.5 | 42.6 | 5 | 249.4 | 53.0 |
| 6 | 5.9 | 1.2 | 6 | 54.8 | 11.6 | 6 | 103.7 | 22.0 | 6 | 152.6 | 32.4 | 6 | 201.5 | 42.8 | 6 | 250.4 | 53.2 |
| 7 | 6.8 | 1.5 | 7 | 55.8 | 11.9 | 7 | 104.7 | 22.2 | 7 | 153.6 | 32.6 | 7 | 202.5 | 43.0 | 7 | 251.4 | 53.4 |
| 8 | 7.8 | 1.7 | 8 | 56.7 | 12.1 | 8 | 105.6 | 22.5 | 8 | 154.5 | 32.9 | 8 | 203.5 | 43.2 | 8 | 252.4 | 53.6 |
| 9 | 8.8 | 1.9 | 9 | 57.7 | 12.3 | 9 | 106.6 | 22.7 | 9 | 155.5 | 33.1 | 9 | 204.4 | 43.5 | 9 | 253.3 | 53.8 |
| 10 | 9.8 | 2.1 | 60 | 58.7 | 12.5 | 110 | 107.6 | 22.9 | 160 | 156.5 | 33.3 | 210 | 205.4 | 43.7 | 260 | 254.3 | 54.1 |
| 1 | 10.8 | 2.3 | 1 | 59.7 | 12.7 | 1 | 108.6 | 23.1 | 1 | 157.5 | 33.5 | 1 | 206.4 | 43.9 | 1 | 255.3 | 54.3 |
| 2 | 11.7 | 2.5 | 2 | 60.6 | 12.9 | 2 | 109.6 | 23.3 | 2 | 158.5 | 33.7 | 2 | 207.4 | 44.1 | 2 | 256.3 | 54.5 |
| 3 | 12.7 | 2.7 | 3 | 61.6 | 13.1 | 3 | 110.5 | 23.5 | 3 | 159.4 | 33.9 | 3 | 208.3 | 44.3 | 3 | 257.3 | 54.7 |
| 4 | 13.7 | 2.9 | 4 | 62.6 | 13.3 | 4 | 111.5 | 23.7 | 4 | 160.4 | 34.1 | 4 | 209.3 | 44.5 | 4 | 258.2 | 54.9 |
| 5 | 14.7 | 3.1 | 5 | 63.6 | 13.5 | 5 | 112.5 | 23.9 | 5 | 161.4 | 34.3 | 5 | 210.3 | 44.7 | 5 | 259.2 | 55.1 |
| 6 | 15.7 | 3.3 | 6 | 64.6 | 13.7 | 6 | 113.5 | 24.1 | 6 | 162.4 | 34.5 | 6 | 211.3 | 44.9 | 6 | 260.2 | 55.3 |
| 7 | 16.6 | 3.5 | 7 | 65.5 | 13.9 | 7 | 114.4 | 24.3 | 7 | 163.4 | 34.7 | 7 | 212.3 | 45.1 | 7 | 261.2 | 55.5 |
| 8 | 17.6 | 3.7 | 8 | 66.5 | 14.1 | 8 | 115.4 | 24.5 | 8 | 164.3 | 34.9 | 8 | 213.2 | 45.3 | 8 | 262.1 | 55.7 |
| 9 | 18.6 | 4.0 | 9 | 67.5 | 14.3 | 9 | 116.4 | 24.7 | 9 | 165.3 | 35.1 | 9 | 214.2 | 45.5 | 9 | 263.1 | 55.9 |
| 20 | 19.6 | 4.2 | 70 | 68.5 | 14.6 | 120 | 117.4 | 24.9 | 170 | 166.3 | 35.3 | 220 | 215.2 | 45.7 | 270 | 264.1 | 56.1 |
| 1 | 20.5 | 4.4 | 1 | 69.4 | 14.8 | 1 | 118.4 | 25.2 | 1 | 167.3 | 35.6 | 1 | 216.2 | 45.9 | 1 | 265.1 | 56.3 |
| 2 | 21.5 | 4.6 | 2 | 70.4 | 15.0 | 2 | 119.3 | 25.4 | 2 | 168.2 | 35.8 | 2 | 217.1 | 46.2 | 2 | 266.1 | 56.6 |
| 3 | 22.5 | 4.8 | 3 | 71.4 | 15.2 | 3 | 120.3 | 25.6 | 3 | 169.2 | 36.0 | 3 | 218.1 | 46.4 | 3 | 267.0 | 56.8 |
| 4 | 23.5 | 5.0 | 4 | 72.4 | 15.4 | 4 | 121.3 | 25.8 | 4 | 170.2 | 36.2 | 4 | 219.1 | 46.6 | 4 | 268.0 | 57.0 |
| 5 | 24.5 | 5.2 | 5 | 73.4 | 15.6 | 5 | 122.3 | 26.0 | 5 | 171.2 | 36.4 | 5 | 220.1 | 46.8 | 5 | 269.0 | 57.2 |
| 6 | 25.4 | 5.4 | 6 | 74.3 | 15.8 | 6 | 123.2 | 26.2 | 6 | 172.2 | 36.6 | 6 | 221.1 | 47.0 | 6 | 270.0 | 57.4 |
| 7 | 26.4 | 5.6 | 7 | 75.3 | 16.0 | 7 | 124.2 | 26.4 | 7 | 173.1 | 36.8 | 7 | 222.0 | 47.2 | 7 | 270.9 | 57.6 |
| 8 | 27.4 | 5.8 | 8 | 76.3 | 16.2 | 8 | 125.2 | 26.6 | 8 | 174.1 | 37.0 | 8 | 223.0 | 47.4 | 8 | 271.9 | 57.8 |
| 9 | 28.4 | 6.0 | 9 | 77.3 | 16.4 | 9 | 126.2 | 26.8 | 9 | 175.1 | 37.2 | 9 | 224.0 | 47.6 | 9 | 272.9 | 58.0 |
| 30 | 29.3 | 6.2 | 80 | 78.3 | 16.6 | 130 | 127.2 | 27.0 | 180 | 176.1 | 37.4 | 230 | 225.0 | 47.8 | 280 | 273.9 | 58.2 |
| 1 | 30.3 | 6.4 | 1 | 79.2 | 16.8 | 1 | 128.1 | 27.2 | 1 | 177.0 | 37.6 | 1 | 226.0 | 48.0 | 1 | 274.9 | 58.4 |
| 2 | 31.3 | 6.7 | 2 | 80.2 | 17.0 | 2 | 129.1 | 27.4 | 2 | 178.0 | 37.8 | 2 | 226.9 | 48.2 | 2 | 275.8 | 58.6 |
| 3 | 32.3 | 6.9 | 3 | 81.2 | 17.3 | 3 | 130.1 | 27.7 | 3 | 179.0 | 38.0 | 3 | 227.9 | 48.4 | 3 | 276.8 | 58.8 |
| 4 | 33.3 | 7.1 | 4 | 82.2 | 17.5 | 4 | 131.1 | 27.9 | 4 | 180.0 | 38.3 | 4 | 228.9 | 48.7 | 4 | 277.8 | 59.0 |
| 5 | 34.2 | 7.3 | 5 | 83.1 | 17.7 | 5 | 132.0 | 28.1 | 5 | 181.0 | 38.5 | 5 | 229.9 | 48.9 | 5 | 278.8 | 59.3 |
| 6 | 35.2 | 7.5 | 6 | 84.1 | 17.9 | 6 | 133.0 | 28.3 | 6 | 181.9 | 38.7 | 6 | 230.8 | 49.1 | 6 | 279.8 | 59.5 |
| 7 | 36.2 | 7.7 | 7 | 85.1 | 18.1 | 7 | 134.0 | 28.5 | 7 | 182.9 | 38.9 | 7 | 231.8 | 49.3 | 7 | 280.7 | 59.7 |
| 8 | 37.2 | 7.9 | 8 | 86.1 | 18.3 | 8 | 135.0 | 28.7 | 8 | 183.9 | 39.1 | 8 | 232.8 | 49.5 | 8 | 281.7 | 59.9 |
| 9 | 38.1 | 8.1 | 9 | 87.1 | 18.5 | 9 | 136.0 | 28.9 | 9 | 184.9 | 39.3 | 9 | 233.8 | 49.7 | 9 | 282.7 | 60.1 |
| 40 | 39.1 | 8.3 | 90 | 88.0 | 18.7 | 140 | 136.9 | 29.1 | 190 | 185.8 | 39.5 | 240 | 234.8 | 49.9 | 290 | 283.7 | 60.3 |
| 1 | 40.1 | 8.5 | 1 | 89.0 | 18.9 | 1 | 137.9 | 29.3 | 1 | 186.8 | 39.7 | 1 | 235.7 | 50.1 | 1 | 284.6 | 60.5 |
| 2 | 41.1 | 8.7 | 2 | 90.0 | 19.1 | 2 | 138.9 | 29.5 | 2 | 187.8 | 39.9 | 2 | 236.7 | 50.3 | 2 | 285.6 | 60.7 |
| 3 | 42.1 | 8.9 | 3 | 91.0 | 19.3 | 3 | 139.9 | 29.7 | 3 | 188.8 | 40.1 | 3 | 237.7 | 50.5 | 3 | 286.6 | 60.9 |
| 4 | 43.0 | 9.1 | 4 | 91.9 | 19.5 | 4 | 140.9 | 29.9 | 4 | 189.8 | 40.3 | 4 | 238.7 | 50.7 | 4 | 287.6 | 61.1 |
| 5 | 44.0 | 9.4 | 5 | 92.9 | 19.8 | 5 | 141.8 | 30.1 | 5 | 190.7 | 40.5 | 5 | 239.6 | 50.9 | 5 | 288.6 | 61.3 |
| 6 | 45.0 | 9.6 | 6 | 93.9 | 20.0 | 6 | 142.8 | 30.4 | 6 | 191.7 | 40.8 | 6 | 240.6 | 51.1 | 6 | 289.5 | 61.5 |
| 7 | 46.0 | 9.8 | 7 | 94.9 | 20.2 | 7 | 143.8 | 30.6 | 7 | 192.7 | 41.0 | 7 | 241.6 | 51.4 | 7 | 290.5 | 61.7 |
| 8 | 47.0 | 10.0 | 8 | 95.9 | 20.4 | 8 | 144.8 | 30.8 | 8 | 193.7 | 41.2 | 8 | 242.6 | 51.6 | 8 | 291.5 | 62.0 |
| 9 | 47.9 | 10.2 | 9 | 96.8 | 20.6 | 9 | 145.7 | 31.0 | 9 | 194.7 | 41.4 | 9 | 243.6 | 51.8 | 9 | 292.5 | 62.2 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 282 315
269 258 225

R

089 078° 045
091 102 135

R ou φm

R

TABELA 1

R ou φm

359 348° 315
181 192 225

TÁBUAS DE CARTEAÇÃO

001 012 045
179 168 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 293.4 | 62.4 | 350 | 342.4 | 72.8 | 400 | 391.3 | 83.2 | 450 | 440.2 | 93.6 | 500 | 489.1 | 104.0 | 550 | 538.0 | 114.4 |
| 1 | 294.4 | 62.6 | 1 | 343.3 | 73.0 | 1 | 392.2 | 83.4 | 1 | 441.1 | 93.8 | 1 | 490.1 | 104.2 | 1 | 539.0 | 114.6 |
| 2 | 295.4 | 62.8 | 2 | 344.3 | 73.2 | 2 | 393.2 | 83.6 | 2 | 442.1 | 94.0 | 2 | 491.0 | 104.4 | 2 | 539.9 | 114.8 |
| 3 | 296.4 | 63.0 | 3 | 345.3 | 73.4 | 3 | 394.2 | 83.8 | 3 | 443.1 | 94.2 | 3 | 492.0 | 104.6 | 3 | 540.9 | 115.0 |
| 4 | 297.4 | 63.2 | 4 | 346.3 | 73.6 | 4 | 395.2 | 84.0 | 4 | 444.1 | 94.4 | 4 | 493.0 | 104.8 | 4 | 541.9 | 115.2 |
| 5 | 298.3 | 63.4 | 5 | 347.2 | 73.8 | 5 | 396.1 | 84.2 | 5 | 445.1 | 94.6 | 5 | 494.0 | 105.0 | 5 | 542.9 | 115.4 |
| 6 | 299.3 | 63.6 | 6 | 348.2 | 74.0 | 6 | 397.1 | 84.4 | 6 | 446.0 | 94.8 | 6 | 494.9 | 105.2 | 6 | 543.8 | 115.6 |
| 7 | 300.3 | 63.8 | 7 | 349.2 | 74.2 | 7 | 398.1 | 84.6 | 7 | 447.0 | 95.0 | 7 | 495.9 | 105.4 | 7 | 544.8 | 115.8 |
| 8 | 301.3 | 64.0 | 8 | 350.2 | 74.4 | 8 | 399.1 | 84.8 | 8 | 448.0 | 95.2 | 8 | 496.9 | 105.6 | 8 | 545.8 | 116.0 |
| 9 | 302.2 | 64.2 | 9 | 351.2 | 74.6 | 9 | 400.1 | 85.0 | 9 | 449.0 | 95.4 | 9 | 497.9 | 105.8 | 9 | 546.8 | 116.2 |
| 310 | 303.2 | 64.5 | 360 | 352.1 | 74.8 | 410 | 401.0 | 85.2 | 460 | 449.9 | 95.6 | 510 | 498.9 | 106.0 | 560 | 547.8 | 116.4 |
| 1 | 304.2 | 64.7 | 1 | 353.1 | 75.1 | 1 | 402.0 | 85.5 | 1 | 450.9 | 95.8 | 1 | 499.8 | 106.2 | 1 | 548.7 | 116.6 |
| 2 | 305.2 | 64.9 | 2 | 354.1 | 75.3 | 2 | 403.0 | 85.7 | 2 | 451.9 | 96.1 | 2 | 500.8 | 106.5 | 2 | 549.7 | 116.8 |
| 3 | 306.2 | 65.1 | 3 | 355.1 | 75.5 | 3 | 404.0 | 85.9 | 3 | 452.9 | 96.3 | 3 | 501.8 | 106.7 | 3 | 550.7 | 117.1 |
| 4 | 307.1 | 65.3 | 4 | 356.0 | 75.7 | 4 | 405.0 | 86.1 | 4 | 453.9 | 96.5 | 4 | 502.8 | 106.9 | 4 | 551.7 | 117.3 |
| 5 | 308.1 | 65.5 | 5 | 357.0 | 75.9 | 5 | 405.9 | 86.3 | 5 | 454.8 | 96.7 | 5 | 503.7 | 107.1 | 5 | 552.7 | 117.5 |
| 6 | 309.1 | 65.7 | 6 | 358.0 | 76.1 | 6 | 406.9 | 86.5 | 6 | 455.8 | 96.9 | 6 | 504.7 | 107.3 | 6 | 553.6 | 117.7 |
| 7 | 310.1 | 65.9 | 7 | 359.0 | 76.3 | 7 | 407.9 | 86.7 | 7 | 456.8 | 97.1 | 7 | 505.7 | 107.5 | 7 | 554.6 | 117.9 |
| 8 | 311.1 | 66.1 | 8 | 360.0 | 76.5 | 8 | 408.9 | 86.9 | 8 | 457.8 | 97.3 | 8 | 506.7 | 107.7 | 8 | 555.6 | 118.1 |
| 9 | 312.0 | 66.3 | 9 | 360.9 | 76.7 | 9 | 409.8 | 87.1 | 9 | 458.8 | 97.5 | 9 | 507.7 | 107.9 | 9 | 556.6 | 118.3 |
| 320 | 313.0 | 66.5 | 370 | 361.9 | 76.9 | 420 | 410.8 | 87.3 | 470 | 459.7 | 97.7 | 520 | 508.6 | 108.1 | 570 | 557.5 | 118.5 |
| 1 | 314.0 | 66.7 | 1 | 362.9 | 77.1 | 1 | 411.8 | 87.5 | 1 | 460.7 | 97.9 | 1 | 509.6 | 108.3 | 1 | 558.5 | 118.7 |
| 2 | 315.0 | 66.9 | 2 | 363.9 | 77.3 | 2 | 412.8 | 87.7 | 2 | 461.7 | 98.1 | 2 | 510.6 | 108.5 | 2 | 559.5 | 118.9 |
| 3 | 315.9 | 67.2 | 3 | 364.8 | 77.6 | 3 | 413.8 | 87.9 | 3 | 462.7 | 98.3 | 3 | 511.6 | 108.7 | 3 | 560.5 | 119.1 |
| 4 | 316.9 | 67.4 | 4 | 365.8 | 77.8 | 4 | 414.7 | 88.2 | 4 | 463.6 | 98.6 | 4 | 512.5 | 108.9 | 4 | 561.5 | 119.3 |
| 5 | 317.9 | 67.6 | 5 | 366.8 | 78.0 | 5 | 415.7 | 88.4 | 5 | 464.6 | 98.8 | 5 | 513.5 | 109.2 | 5 | 562.4 | 119.5 |
| 6 | 318.9 | 67.8 | 6 | 367.8 | 78.2 | 6 | 416.7 | 88.6 | 6 | 465.6 | 99.0 | 6 | 514.5 | 109.4 | 6 | 563.4 | 119.8 |
| 7 | 319.9 | 68.0 | 7 | 368.8 | 78.4 | 7 | 417.7 | 88.8 | 7 | 466.6 | 99.2 | 7 | 515.5 | 109.6 | 7 | 564.4 | 120.0 |
| 8 | 320.8 | 68.2 | 8 | 369.7 | 78.6 | 8 | 418.6 | 89.0 | 8 | 467.6 | 99.4 | 8 | 516.5 | 109.8 | 8 | 565.4 | 120.2 |
| 9 | 321.8 | 68.4 | 9 | 370.7 | 78.8 | 9 | 419.6 | 89.2 | 9 | 468.5 | 99.6 | 9 | 517.4 | 110.0 | 9 | 566.3 | 120.4 |
| 330 | 322.8 | 68.6 | 380 | 371.7 | 79.0 | 530 | 420.6 | 89.4 | 480 | 469.5 | 99.8 | 430 | 518.4 | 110.2 | 580 | 567.3 | 120.6 |
| 1 | 323.8 | 68.8 | 1 | 372.7 | 79.2 | 1 | 421.6 | 89.6 | 1 | 470.5 | 100.0 | 1 | 519.4 | 110.4 | 1 | 568.3 | 120.8 |
| 2 | 324.7 | 69.0 | 2 | 373.7 | 79.4 | 2 | 422.6 | 89.8 | 2 | 471.5 | 100.2 | 2 | 520.4 | 110.6 | 2 | 569.3 | 121.0 |
| 3 | 325.7 | 69.2 | 3 | 374.6 | 79.6 | 3 | 423.5 | 90.0 | 3 | 472.4 | 100.4 | 3 | 521.4 | 110.8 | 3 | 570.3 | 121.2 |
| 4 | 326.7 | 69.4 | 4 | 375.6 | 79.8 | 4 | 424.5 | 90.2 | 4 | 473.4 | 100.6 | 4 | 522.3 | 111.0 | 4 | 571.2 | 121.4 |
| 5 | 327.7 | 69.7 | 5 | 376.6 | 80.0 | 5 | 425.5 | 90.4 | 5 | 474.4 | 100.8 | 5 | 523.3 | 111.2 | 5 | 572.2 | 121.6 |
| 6 | 328.7 | 69.9 | 6 | 377.6 | 80.3 | 6 | 426.5 | 90.6 | 6 | 475.4 | 101.0 | 6 | 524.3 | 111.4 | 6 | 573.2 | 121.8 |
| 7 | 329.6 | 70.1 | 7 | 378.5 | 80.5 | 7 | 427.5 | 90.9 | 7 | 476.4 | 101.3 | 7 | 525.3 | 111.6 | 7 | 574.2 | 122.0 |
| 8 | 330.6 | 70.3 | 8 | 379.5 | 80.7 | 8 | 428.4 | 91.1 | 8 | 477.3 | 101.5 | 8 | 526.2 | 111.9 | 8 | 575.2 | 122.3 |
| 9 | 331.6 | 70.5 | 9 | 380.5 | 80.9 | 9 | 429.4 | 91.3 | 9 | 478.3 | 101.7 | 9 | 527.2 | 112.1 | 9 | 576.1 | 122.5 |
| 340 | 332.6 | 70.7 | 390 | 381.5 | 81.1 | 440 | 430.4 | 91.5 | 490 | 479.3 | 101.9 | 540 | 528.2 | 112.3 | 590 | 577.1 | 122.7 |
| 1 | 333.5 | 70.9 | 1 | 382.5 | 81.3 | 1 | 431.4 | 91.7 | 1 | 480.3 | 102.1 | 1 | 529.2 | 112.5 | 1 | 578.1 | 122.9 |
| 2 | 334.5 | 71.1 | 2 | 383.4 | 81.5 | 2 | 432.3 | 91.9 | 2 | 481.2 | 102.3 | 2 | 530.2 | 112.7 | 2 | 579.1 | 123.1 |
| 3 | 335.5 | 71.3 | 3 | 384.4 | 81.7 | 3 | 433.3 | 92.1 | 3 | 482.2 | 102.5 | 3 | 531.1 | 112.9 | 3 | 580.0 | 123.3 |
| 4 | 336.5 | 71.5 | 4 | 385.4 | 81.9 | 4 | 434.3 | 92.3 | 4 | 483.2 | 102.7 | 4 | 532.1 | 113.1 | 4 | 581.0 | 123.5 |
| 5 | 337.5 | 71.7 | 5 | 386.4 | 82.1 | 5 | 435.3 | 92.5 | 5 | 484.2 | 102.9 | 5 | 533.1 | 113.3 | 5 | 582.0 | 123.7 |
| 6 | 338.4 | 71.9 | 6 | 387.3 | 82.3 | 6 | 436.3 | 92.7 | 6 | 485.2 | 103.1 | 6 | 534.1 | 113.5 | 6 | 583.0 | 123.9 |
| 7 | 339.4 | 72.1 | 7 | 388.3 | 82.5 | 7 | 437.2 | 92.9 | 7 | 486.1 | 103.3 | 7 | 535.0 | 113.7 | 7 | 584.0 | 124.1 |
| 8 | 340.4 | 72.4 | 8 | 389.3 | 82.7 | 8 | 438.2 | 93.1 | 8 | 487.1 | 103.5 | 8 | 536.0 | 113.9 | 8 | 584.9 | 124.3 |
| 9 | 341.4 | 72.6 | 9 | 390.3 | 83.0 | 9 | 439.2 | 93.4 | 9 | 488.1 | 103.7 | 9 | 537.0 | 114.1 | 9 | 585.9 | 124.5 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 282 315
269 258 225

R

089 078° 045
091 102 135

R ou φm

R

TABELA 1

R ou φm

359 347° 315
181 193 225

TÁBUAS DE CARTEAÇÃO

001 013 045
179 167 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 48.7 | 11.2 | 100 | 97.4 | 22.5 | 150 | 146.2 | 33.7 | 200 | 194.9 | 45.0 | 250 | 243.6 | 56.2 |
| 1 | 1.0 | 0.2 | 1 | 49.7 | 11.5 | 1 | 98.4 | 22.7 | 1 | 147.1 | 34.0 | 1 | 195.8 | 45.2 | 1 | 244.6 | 56.5 |
| 2 | 1.9 | 0.4 | 2 | 50.7 | 11.7 | 2 | 99.4 | 22.9 | 2 | 148.1 | 34.2 | 2 | 196.8 | 45.4 | 2 | 245.5 | 56.7 |
| 3 | 2.9 | 0.7 | 3 | 51.6 | 11.9 | 3 | 100.4 | 23.2 | 3 | 149.1 | 34.4 | 3 | 197.8 | 45.7 | 3 | 246.5 | 56.9 |
| 4 | 3.9 | 0.9 | 4 | 52.6 | 12.1 | 4 | 101.3 | 23.4 | 4 | 150.1 | 34.6 | 4 | 198.8 | 45.9 | 4 | 247.5 | 57.1 |
| 5 | 4.9 | 1.1 | 5 | 53.6 | 12.4 | 5 | 102.3 | 23.6 | 5 | 151.0 | 34.9 | 5 | 199.7 | 46.1 | 5 | 248.5 | 57.4 |
| 6 | 5.8 | 1.3 | 6 | 54.6 | 12.6 | 6 | 103.3 | 23.8 | 6 | 152.0 | 35.1 | 6 | 200.7 | 46.3 | 6 | 249.4 | 57.6 |
| 7 | 6.8 | 1.6 | 7 | 55.5 | 12.8 | 7 | 104.3 | 24.1 | 7 | 153.0 | 35.3 | 7 | 201.7 | 46.6 | 7 | 250.4 | 57.8 |
| 8 | 7.8 | 1.8 | 8 | 56.5 | 13.0 | 8 | 105.2 | 24.3 | 8 | 154.0 | 35.5 | 8 | 202.7 | 46.8 | 8 | 251.4 | 58.0 |
| 9 | 8.8 | 2.0 | 9 | 57.5 | 13.3 | 9 | 106.2 | 24.5 | 9 | 154.9 | 35.8 | 9 | 203.6 | 47.0 | 9 | 252.4 | 58.3 |
| 10 | 9.7 | 2.2 | 60 | 58.5 | 13.5 | 110 | 107.2 | 24.7 | 160 | 155.9 | 36.0 | 210 | 204.6 | 47.2 | 260 | 253.3 | 58.5 |
| 1 | 10.7 | 2.5 | 1 | 59.4 | 13.7 | 1 | 108.2 | 25.0 | 1 | 156.9 | 36.2 | 1 | 205.6 | 47.5 | 1 | 254.3 | 58.7 |
| 2 | 11.7 | 2.7 | 2 | 60.4 | 13.9 | 2 | 109.1 | 25.2 | 2 | 157.8 | 36.4 | 2 | 206.6 | 47.7 | 2 | 255.3 | 58.9 |
| 3 | 12.7 | 2.9 | 3 | 61.4 | 14.2 | 3 | 110.1 | 25.4 | 3 | 158.8 | 36.7 | 3 | 207.5 | 47.9 | 3 | 256.3 | 59.2 |
| 4 | 13.6 | 3.1 | 4 | 62.4 | 14.4 | 4 | 111.1 | 25.6 | 4 | 159.8 | 36.9 | 4 | 208.5 | 48.1 | 4 | 257.2 | 59.4 |
| 5 | 14.6 | 3.4 | 5 | 63.3 | 14.6 | 5 | 112.1 | 25.9 | 5 | 160.8 | 37.1 | 5 | 209.5 | 48.4 | 5 | 258.2 | 59.6 |
| 6 | 15.6 | 3.6 | 6 | 64.3 | 14.8 | 6 | 113.0 | 26.1 | 6 | 161.7 | 37.3 | 6 | 210.5 | 48.6 | 6 | 259.2 | 59.8 |
| 7 | 16.6 | 3.8 | 7 | 65.3 | 15.1 | 7 | 114.0 | 26.3 | 7 | 162.7 | 37.6 | 7 | 211.4 | 48.8 | 7 | 260.2 | 60.1 |
| 8 | 17.5 | 4.0 | 8 | 66.3 | 15.3 | 8 | 115.0 | 26.5 | 8 | 163.7 | 37.8 | 8 | 212.4 | 49.0 | 8 | 261.1 | 60.3 |
| 9 | 18.5 | 4.3 | 9 | 67.2 | 15.5 | 9 | 116.0 | 26.8 | 9 | 164.7 | 38.0 | 9 | 213.4 | 49.3 | 9 | 262.1 | 60.5 |
| 20 | 19.5 | 4.5 | 70 | 68.2 | 15.7 | 120 | 116.9 | 27.0 | 170 | 165.6 | 38.2 | 220 | 214.4 | 49.5 | 270 | 263.1 | 60.7 |
| 1 | 20.5 | 4.7 | 1 | 69.2 | 16.0 | 1 | 117.9 | 27.2 | 1 | 166.6 | 38.5 | 1 | 215.3 | 49.7 | 1 | 264.1 | 61.0 |
| 2 | 21.4 | 4.9 | 2 | 70.2 | 16.2 | 2 | 118.9 | 27.4 | 2 | 167.6 | 38.7 | 2 | 216.3 | 49.9 | 2 | 265.0 | 61.2 |
| 3 | 22.4 | 5.2 | 3 | 71.1 | 16.4 | 3 | 119.8 | 27.7 | 3 | 168.6 | 38.9 | 3 | 217.3 | 50.2 | 3 | 266.0 | 61.4 |
| 4 | 23.4 | 5.4 | 4 | 72.1 | 16.6 | 4 | 120.8 | 27.9 | 4 | 169.5 | 39.1 | 4 | 218.3 | 50.4 | 4 | 267.0 | 61.6 |
| 5 | 24.4 | 5.6 | 5 | 73.1 | 16.9 | 5 | 121.8 | 28.1 | 5 | 170.5 | 39.4 | 5 | 219.2 | 50.6 | 5 | 268.0 | 61.9 |
| 6 | 25.3 | 5.8 | 6 | 74.1 | 17.1 | 6 | 122.8 | 28.3 | 6 | 171.5 | 39.6 | 6 | 220.2 | 50.8 | 6 | 268.9 | 62.1 |
| 7 | 26.3 | 6.1 | 7 | 75.0 | 17.3 | 7 | 123.7 | 28.6 | 7 | 172.5 | 39.8 | 7 | 221.2 | 51.1 | 7 | 269.9 | 62.3 |
| 8 | 27.3 | 6.3 | 8 | 76.0 | 17.5 | 8 | 124.7 | 28.8 | 8 | 173.4 | 40.0 | 8 | 222.2 | 51.3 | 8 | 270.9 | 62.5 |
| 9 | 28.3 | 6.5 | 9 | 77.0 | 17.8 | 9 | 125.7 | 29.0 | 9 | 174.4 | 40.3 | 9 | 223.1 | 51.5 | 9 | 271.8 | 62.8 |
| 30 | 29.2 | 6.7 | 80 | 77.9 | 18.0 | 130 | 126.7 | 29.2 | 180 | 175.4 | 40.5 | 230 | 224.1 | 51.7 | 280 | 272.8 | 63.0 |
| 1 | 30.2 | 7.0 | 1 | 78.9 | 18.2 | 1 | 127.6 | 29.5 | 1 | 176.4 | 40.7 | 1 | 225.1 | 52.0 | 1 | 273.8 | 63.2 |
| 2 | 31.2 | 7.2 | 2 | 79.9 | 18.4 | 2 | 128.6 | 29.7 | 2 | 177.3 | 40.9 | 2 | 226.1 | 52.2 | 2 | 274.8 | 63.4 |
| 3 | 32.2 | 7.4 | 3 | 80.9 | 18.7 | 3 | 129.6 | 29.9 | 3 | 178.3 | 41.2 | 3 | 227.0 | 52.4 | 3 | 275.7 | 63.7 |
| 4 | 33.1 | 7.6 | 4 | 81.8 | 18.9 | 4 | 130.6 | 30.1 | 4 | 179.3 | 41.4 | 4 | 228.0 | 52.6 | 4 | 276.7 | 63.9 |
| 5 | 34.1 | 7.9 | 5 | 82.8 | 19.1 | 5 | 131.5 | 30.4 | 5 | 180.3 | 41.6 | 5 | 229.0 | 52.9 | 5 | 277.7 | 64.1 |
| 6 | 35.1 | 8.1 | 6 | 83.8 | 19.3 | 6 | 132.5 | 30.6 | 6 | 181.2 | 41.8 | 6 | 230.0 | 53.1 | 6 | 278.7 | 64.3 |
| 7 | 36.1 | 8.3 | 7 | 84.8 | 19.6 | 7 | 133.5 | 30.8 | 7 | 182.2 | 42.1 | 7 | 230.9 | 53.3 | 7 | 279.6 | 64.6 |
| 8 | 37.0 | 8.5 | 8 | 85.7 | 19.8 | 8 | 134.5 | 31.0 | 8 | 183.2 | 42.3 | 8 | 231.9 | 53.5 | 8 | 280.6 | 64.8 |
| 9 | 38.0 | 8.8 | 9 | 86.7 | 20.0 | 9 | 135.4 | 31.3 | 9 | 184.2 | 42.5 | 9 | 232.9 | 53.8 | 9 | 281.6 | 65.0 |
| 40 | 39.0 | 9.0 | 90 | 87.7 | 20.2 | 140 | 136.4 | 31.5 | 190 | 185.1 | 42.7 | 240 | 233.8 | 54.0 | 290 | 282.6 | 65.2 |
| 1 | 39.9 | 9.2 | 1 | 88.7 | 20.5 | 1 | 137.4 | 31.7 | 1 | 186.1 | 43.0 | 1 | 234.8 | 54.2 | 1 | 283.5 | 65.5 |
| 2 | 40.9 | 9.4 | 2 | 89.6 | 20.7 | 2 | 138.4 | 31.9 | 2 | 187.1 | 43.2 | 2 | 235.8 | 54.4 | 2 | 284.5 | 65.7 |
| 3 | 41.9 | 9.7 | 3 | 90.6 | 20.9 | 3 | 139.3 | 32.2 | 3 | 188.1 | 43.4 | 3 | 236.8 | 54.7 | 3 | 285.5 | 65.9 |
| 4 | 42.9 | 9.9 | 4 | 91.6 | 21.1 | 4 | 140.3 | 32.4 | 4 | 189.0 | 43.6 | 4 | 237.7 | 54.9 | 4 | 286.5 | 66.1 |
| 5 | 43.8 | 10.1 | 5 | 92.6 | 21.4 | 5 | 141.3 | 32.6 | 5 | 190.0 | 43.9 | 5 | 238.7 | 55.1 | 5 | 287.4 | 66.4 |
| 6 | 44.8 | 10.3 | 6 | 93.5 | 21.6 | 6 | 142.3 | 32.8 | 6 | 191.0 | 44.1 | 6 | 239.7 | 55.3 | 6 | 288.4 | 66.6 |
| 7 | 45.8 | 10.6 | 7 | 94.5 | 21.8 | 7 | 143.2 | 33.1 | 7 | 192.0 | 44.3 | 7 | 240.7 | 55.6 | 7 | 289.4 | 66.8 |
| 8 | 46.8 | 10.8 | 8 | 95.5 | 22.0 | 8 | 144.2 | 33.3 | 8 | 192.9 | 44.5 | 8 | 241.6 | 55.8 | 8 | 290.4 | 67.0 |
| 9 | 47.7 | 11.0 | 9 | 96.5 | 22.3 | 9 | 145.2 | 33.5 | 9 | 193.9 | 44.8 | 9 | 242.6 | 56.0 | 9 | 291.3 | 67.3 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 283 315
269 257 225

089 077° 045
091 103 135

R

R ou φm

R

TABELA 1

R ou φm

359 347° 315
181 193 225

TÁBUAS DE CARTEAÇÃO

001 013 045
179 167 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 292.3 | 67.5 | 350 | 341.0 | 78.7 | 400 | 389.7 | 90.0 | 450 | 438.5 | 101.2 | 500 | 487.2 | 112.5 | 550 | 535.9 | 123.7 |
| 1 | 293.3 | 67.7 | 1 | 342.0 | 79.0 | 1 | 390.7 | 90.2 | 1 | 439.4 | 101.5 | 1 | 488.2 | 112.7 | 1 | 536.9 | 123.9 |
| 2 | 294.3 | 67.9 | 2 | 343.0 | 79.2 | 2 | 391.7 | 90.4 | 2 | 440.4 | 101.7 | 2 | 489.1 | 112.9 | 2 | 537.9 | 124.2 |
| 3 | 295.2 | 68.2 | 3 | 344.0 | 79.4 | 3 | 392.7 | 90.7 | 3 | 441.4 | 101.9 | 3 | 490.1 | 113.2 | 3 | 538.8 | 124.4 |
| 4 | 296.2 | 68.4 | 4 | 344.9 | 79.6 | 4 | 393.6 | 90.9 | 4 | 442.4 | 102.1 | 4 | 491.1 | 113.4 | 4 | 539.8 | 124.6 |
| 5 | 297.2 | 68.6 | 5 | 345.9 | 79.9 | 5 | 394.6 | 91.1 | 5 | 443.3 | 102.4 | 5 | 492.1 | 113.6 | 5 | 540.8 | 124.8 |
| 6 | 298.2 | 68.8 | 6 | 346.9 | 80.1 | 6 | 395.6 | 91.3 | 6 | 444.3 | 102.6 | 6 | 493.0 | 113.8 | 6 | 541.7 | 125.1 |
| 7 | 299.1 | 69.1 | 7 | 347.9 | 80.3 | 7 | 396.6 | 91.6 | 7 | 445.3 | 102.8 | 7 | 494.0 | 114.1 | 7 | 542.7 | 125.3 |
| 8 | 300.1 | 69.3 | 8 | 348.8 | 80.5 | 8 | 397.5 | 91.8 | 8 | 446.3 | 103.0 | 8 | 495.0 | 114.3 | 8 | 543.7 | 125.5 |
| 9 | 301.1 | 69.5 | 9 | 349.8 | 80.8 | 9 | 398.5 | 92.0 | 9 | 447.2 | 103.3 | 9 | 496.0 | 114.5 | 9 | 544.7 | 125.7 |
| 310 | 302.1 | 69.7 | 360 | 350.8 | 81.0 | 410 | 399.5 | 92.2 | 460 | 448.2 | 103.5 | 510 | 496.9 | 114.7 | 560 | 545.6 | 126.0 |
| 1 | 303.0 | 70.0 | 1 | 351.7 | 81.2 | 1 | 400.5 | 92.5 | 1 | 449.2 | 103.7 | 1 | 497.9 | 114.9 | 1 | 546.6 | 126.2 |
| 2 | 304.0 | 70.2 | 2 | 352.7 | 81.4 | 2 | 401.4 | 92.7 | 2 | 450.2 | 103.9 | 2 | 498.9 | 115.2 | 2 | 547.6 | 126.4 |
| 3 | 305.0 | 70.4 | 3 | 353.7 | 81.7 | 3 | 402.4 | 92.9 | 3 | 451.1 | 104.2 | 3 | 499.9 | 115.4 | 3 | 548.6 | 126.6 |
| 4 | 306.0 | 70.6 | 4 | 354.7 | 81.9 | 4 | 403.4 | 93.1 | 4 | 452.1 | 104.4 | 4 | 500.8 | 115.6 | 4 | 549.5 | 126.9 |
| 5 | 306.9 | 70.9 | 5 | 355.6 | 82.1 | 5 | 404.4 | 93.4 | 5 | 453.1 | 104.6 | 5 | 501.8 | 115.8 | 5 | 550.5 | 127.1 |
| 6 | 307.9 | 71.1 | 6 | 356.6 | 82.3 | 6 | 405.3 | 93.6 | 6 | 454.1 | 104.8 | 6 | 502.8 | 116.1 | 6 | 551.5 | 127.3 |
| 7 | 308.9 | 71.3 | 7 | 357.6 | 82.6 | 7 | 406.3 | 93.8 | 7 | 455.0 | 105.1 | 7 | 503.7 | 116.3 | 7 | 552.5 | 127.5 |
| 8 | 309.8 | 71.5 | 8 | 358.6 | 82.8 | 8 | 407.3 | 94.0 | 8 | 456.0 | 105.3 | 8 | 504.7 | 116.5 | 8 | 553.4 | 127.8 |
| 9 | 310.8 | 71.8 | 9 | 359.5 | 83.0 | 9 | 408.3 | 94.3 | 9 | 457.0 | 105.5 | 9 | 505.7 | 116.7 | 9 | 554.4 | 128.0 |
| 320 | 311.8 | 72.0 | 370 | 360.5 | 83.2 | 420 | 409.2 | 94.5 | 470 | 458.0 | 105.7 | 520 | 506.7 | 117.0 | 570 | 555.4 | 128.2 |
| 1 | 312.8 | 72.2 | 1 | 361.5 | 83.5 | 1 | 410.2 | 94.7 | 1 | 458.9 | 106.0 | 1 | 507.6 | 117.2 | 1 | 556.4 | 128.4 |
| 2 | 313.7 | 72.4 | 2 | 362.5 | 83.7 | 2 | 411.2 | 94.9 | 2 | 459.9 | 106.2 | 2 | 508.6 | 117.4 | 2 | 557.3 | 128.7 |
| 3 | 314.7 | 72.7 | 3 | 363.4 | 83.9 | 3 | 412.2 | 95.2 | 3 | 460.9 | 106.4 | 3 | 509.6 | 117.6 | 3 | 558.3 | 128.9 |
| 4 | 315.7 | 72.9 | 4 | 364.4 | 84.1 | 4 | 413.1 | 95.4 | 4 | 461.9 | 106.6 | 4 | 510.6 | 117.9 | 4 | 559.3 | 129.1 |
| 5 | 316.7 | 73.1 | 5 | 365.4 | 84.4 | 5 | 414.1 | 95.6 | 5 | 462.8 | 106.9 | 5 | 511.5 | 118.1 | 5 | 560.3 | 129.3 |
| 6 | 317.6 | 73.3 | 6 | 366.4 | 84.6 | 6 | 415.1 | 95.8 | 6 | 463.8 | 107.1 | 6 | 512.5 | 118.3 | 6 | 561.2 | 129.6 |
| 7 | 318.6 | 73.6 | 7 | 367.3 | 84.8 | 7 | 416.1 | 96.1 | 7 | 464.8 | 107.3 | 7 | 513.5 | 118.5 | 7 | 562.2 | 129.8 |
| 8 | 319.6 | 73.8 | 8 | 368.3 | 85.0 | 8 | 417.0 | 96.3 | 8 | 465.7 | 107.5 | 8 | 514.5 | 118.8 | 8 | 563.2 | 130.0 |
| 9 | 320.6 | 74.0 | 9 | 369.3 | 85.3 | 9 | 418.0 | 96.5 | 9 | 466.7 | 107.8 | 9 | 515.4 | 119.0 | 9 | 564.2 | 130.2 |
| 330 | 321.5 | 74.2 | 380 | 370.3 | 85.5 | 430 | 419.0 | 96.7 | 480 | 467.7 | 108.0 | 530 | 516.4 | 119.2 | 580 | 565.1 | 130.5 |
| 1 | 322.5 | 74.5 | 1 | 371.2 | 85.7 | 1 | 420.0 | 97.0 | 1 | 468.7 | 108.2 | 1 | 517.4 | 119.4 | 1 | 566.1 | 130.7 |
| 2 | 323.5 | 74.7 | 2 | 372.2 | 85.9 | 2 | 420.9 | 97.2 | 2 | 469.6 | 108.4 | 2 | 518.4 | 119.7 | 2 | 567.1 | 130.9 |
| 3 | 324.5 | 74.9 | 3 | 373.2 | 86.2 | 3 | 421.9 | 97.4 | 3 | 470.6 | 108.7 | 3 | 519.3 | 119.9 | 3 | 568.1 | 131.1 |
| 4 | 325.4 | 75.1 | 4 | 374.2 | 86.4 | 4 | 422.9 | 97.6 | 4 | 471.6 | 108.9 | 4 | 520.3 | 120.1 | 4 | 569.0 | 131.4 |
| 5 | 326.4 | 75.4 | 5 | 375.1 | 86.6 | 5 | 423.9 | 97.9 | 5 | 472.6 | 109.1 | 5 | 521.3 | 120.3 | 5 | 570.0 | 131.6 |
| 6 | 327.4 | 75.6 | 6 | 376.1 | 86.8 | 6 | 424.8 | 98.1 | 6 | 473.5 | 109.3 | 6 | 522.3 | 120.6 | 6 | 571.0 | 131.8 |
| 7 | 328.4 | 75.8 | 7 | 377.1 | 87.1 | 7 | 425.8 | 98.3 | 7 | 474.5 | 109.6 | 7 | 523.2 | 120.8 | 7 | 572.0 | 132.0 |
| 8 | 329.3 | 76.0 | 8 | 378.1 | 87.3 | 8 | 426.8 | 98.5 | 8 | 475.5 | 109.8 | 8 | 524.2 | 121.0 | 8 | 572.9 | 132.3 |
| 9 | 330.3 | 76.3 | 9 | 379.0 | 87.5 | 9 | 427.7 | 98.8 | 9 | 476.5 | 110.0 | 9 | 525.2 | 121.2 | 9 | 573.9 | 132.5 |
| 340 | 331.3 | 76.5 | 390 | 380.0 | 87.7 | 440 | 428.7 | 99.0 | 490 | 477.4 | 110.2 | 540 | 526.2 | 121.5 | 590 | 574.9 | 132.7 |
| 1 | 332.3 | 76.7 | 1 | 381.0 | 88.0 | 1 | 429.7 | 99.2 | 1 | 478.4 | 110.5 | 1 | 527.1 | 121.7 | 1 | 575.9 | 132.9 |
| 2 | 333.2 | 76.9 | 2 | 382.0 | 88.2 | 2 | 430.7 | 99.4 | 2 | 479.4 | 110.7 | 2 | 528.1 | 121.9 | 2 | 576.8 | 133.2 |
| 3 | 334.2 | 77.2 | 3 | 382.9 | 88.4 | 3 | 431.6 | 99.7 | 3 | 480.4 | 110.9 | 3 | 529.1 | 122.1 | 3 | 577.8 | 133.4 |
| 4 | 335.2 | 77.4 | 4 | 383.9 | 88.6 | 4 | 432.6 | 99.9 | 4 | 481.3 | 111.1 | 4 | 530.1 | 122.4 | 4 | 578.8 | 133.6 |
| 5 | 336.2 | 77.6 | 5 | 384.9 | 88.9 | 5 | 433.6 | 100.1 | 5 | 482.3 | 111.4 | 5 | 531.0 | 122.6 | 5 | 579.8 | 133.8 |
| 6 | 337.1 | 77.8 | 6 | 385.9 | 89.1 | 6 | 434.6 | 100.3 | 6 | 483.3 | 111.6 | 6 | 532.0 | 122.8 | 6 | 580.7 | 134.1 |
| 7 | 338.1 | 78.1 | 7 | 386.8 | 89.3 | 7 | 435.5 | 100.6 | 7 | 484.3 | 111.8 | 7 | 533.0 | 123.0 | 7 | 581.7 | 134.3 |
| 8 | 339.1 | 78.3 | 8 | 387.8 | 89.5 | 8 | 436.5 | 100.8 | 8 | 485.2 | 112.0 | 8 | 534.0 | 123.3 | 8 | 582.7 | 134.5 |
| 9 | 340.1 | 78.5 | 9 | 388.8 | 89.8 | 9 | 437.5 | 101.0 | 9 | 486.2 | 112.3 | 9 | 534.9 | 123.5 | 9 | 583.6 | 134.7 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 283 315
269 257 225

R

089 077° 045
091 103 135

R ou φm

R

TABELA 1

R ou φm

359 346° 315
181 194 225

TÁBUAS DE CARTEAÇÃO

001 014 045
79 166 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 48.5 | 12.1 | 100 | 97.0 | 24.2 | 150 | 145.5 | 36.3 | 200 | 194.1 | 48.4 | 250 | 242.6 | 60.5 |
| 1 | 1.0 | 0.2 | 1 | 49.5 | 12.3 | 1 | 98.0 | 24.4 | 1 | 146.5 | 36.5 | 1 | 195.0 | 48.6 | 1 | 243.5 | 60.7 |
| 2 | 1.9 | 0.5 | 2 | 50.5 | 12.6 | 2 | 99.0 | 24.7 | 2 | 147.5 | 36.8 | 2 | 196.0 | 48.9 | 2 | 244.5 | 61.0 |
| 3 | 2.9 | 0.7 | 3 | 51.4 | 12.8 | 3 | 99.9 | 24.9 | 3 | 148.5 | 37.0 | 3 | 197.0 | 49.1 | 3 | 245.5 | 61.2 |
| 4 | 3.9 | 1.0 | 4 | 52.4 | 13.1 | 4 | 100.9 | 25.2 | 4 | 149.4 | 37.3 | 4 | 197.9 | 49.4 | 4 | 246.5 | 61.4 |
| 5 | 4.9 | 1.2 | 5 | 53.4 | 13.3 | 5 | 101.9 | 25.4 | 5 | 150.4 | 37.5 | 5 | 198.9 | 49.6 | 5 | 247.4 | 61.7 |
| 6 | 5.8 | 1.5 | 6 | 54.3 | 13.5 | 6 | 102.9 | 25.6 | 6 | 151.4 | 37.7 | 6 | 199.9 | 49.8 | 6 | 248.4 | 61.9 |
| 7 | 6.8 | 1.7 | 7 | 55.3 | 13.8 | 7 | 103.8 | 25.9 | 7 | 152.3 | 38.0 | 7 | 200.9 | 50.1 | 7 | 249.4 | 62.2 |
| 8 | 7.8 | 1.9 | 8 | 56.3 | 14.0 | 8 | 104.8 | 26.1 | 8 | 153.3 | 38.2 | 8 | 201.8 | 50.3 | 8 | 250.3 | 62.4 |
| 9 | 8.7 | 2.2 | 9 | 57.2 | 14.3 | 9 | 105.8 | 26.4 | 9 | 154.3 | 38.5 | 9 | 202.8 | 50.6 | 9 | 251.3 | 62.7 |
| 10 | 9.7 | 2.4 | 60 | 58.2 | 14.5 | 110 | 106.7 | 26.6 | 160 | 155.2 | 38.7 | 210 | 203.8 | 50.8 | 260 | 252.3 | 62.9 |
| 1 | 10.7 | 2.7 | 1 | 59.2 | 14.8 | 1 | 107.7 | 26.9 | 1 | 156.2 | 38.9 | 1 | 204.7 | 51.0 | 1 | 253.2 | 63.1 |
| 2 | 11.6 | 2.9 | 2 | 60.2 | 15.0 | 2 | 108.7 | 27.1 | 2 | 157.2 | 39.2 | 2 | 205.7 | 51.3 | 2 | 254.2 | 63.4 |
| 3 | 12.6 | 3.1 | 3 | 61.1 | 15.2 | 3 | 109.6 | 27.3 | 3 | 158.2 | 39.4 | 3 | 206.7 | 51.5 | 3 | 255.2 | 63.6 |
| 4 | 13.6 | 3.4 | 4 | 62.1 | 15.5 | 4 | 110.6 | 27.6 | 4 | 159.1 | 39.7 | 4 | 207.6 | 51.8 | 4 | 256.2 | 63.9 |
| 5 | 14.6 | 3.6 | 5 | 63.1 | 15.7 | 5 | 111.6 | 27.8 | 5 | 160.1 | 39.9 | 5 | 208.6 | 52.0 | 5 | 257.1 | 64.1 |
| 6 | 15.5 | 3.9 | 6 | 64.0 | 16.0 | 6 | 112.6 | 28.1 | 6 | 161.1 | 40.2 | 6 | 209.6 | 52.3 | 6 | 258.1 | 64.4 |
| 7 | 16.5 | 4.1 | 7 | 65.0 | 16.2 | 7 | 113.5 | 28.3 | 7 | 162.0 | 40.4 | 7 | 210.6 | 52.5 | 7 | 259.1 | 64.6 |
| 8 | 17.5 | 4.4 | 8 | 66.0 | 16.5 | 8 | 114.5 | 28.5 | 8 | 163.0 | 40.6 | 8 | 211.5 | 52.7 | 8 | 260.0 | 64.8 |
| 9 | 18.4 | 4.6 | 9 | 67.0 | 16.7 | 9 | 115.5 | 28.8 | 9 | 164.0 | 40.9 | 9 | 212.5 | 53.0 | 9 | 261.0 | 65.1 |
| 20 | 19.4 | 4.8 | 70 | 67.9 | 16.9 | 120 | 116.4 | 29.0 | 170 | 165.0 | 41.1 | 220 | 213.5 | 53.2 | 270 | 262.0 | 65.3 |
| 1 | 20.4 | 5.1 | 1 | 68.9 | 17.2 | 1 | 117.4 | 29.3 | 1 | 165.9 | 41.4 | 1 | 214.4 | 53.5 | 1 | 262.9 | 65.6 |
| 2 | 21.3 | 5.3 | 2 | 69.9 | 17.4 | 2 | 118.4 | 29.5 | 2 | 166.9 | 41.6 | 2 | 215.4 | 53.7 | 2 | 263.9 | 65.8 |
| 3 | 22.3 | 5.6 | 3 | 70.8 | 17.7 | 3 | 119.3 | 29.8 | 3 | 167.9 | 41.9 | 3 | 216.4 | 53.9 | 3 | 264.9 | 66.0 |
| 4 | 23.3 | 5.8 | 4 | 71.8 | 17.9 | 4 | 120.3 | 30.0 | 4 | 168.8 | 42.1 | 4 | 217.3 | 54.2 | 4 | 265.9 | 66.3 |
| 5 | 24.3 | 6.0 | 5 | 72.8 | 18.1 | 5 | 121.3 | 30.2 | 5 | 169.8 | 42.3 | 5 | 218.3 | 54.4 | 5 | 266.8 | 66.5 |
| 6 | 25.2 | 6.3 | 6 | 73.7 | 18.4 | 6 | 122.3 | 30.5 | 6 | 170.8 | 42.6 | 6 | 219.3 | 54.7 | 6 | 267.8 | 66.8 |
| 7 | 26.2 | 6.5 | 7 | 74.7 | 18.6 | 7 | 123.2 | 30.7 | 7 | 171.7 | 42.8 | 7 | 220.3 | 54.9 | 7 | 268.8 | 67.0 |
| 8 | 27.2 | 6.8 | 8 | 75.7 | 18.9 | 8 | 124.2 | 31.0 | 8 | 172.7 | 43.1 | 8 | 221.2 | 55.2 | 8 | 269.7 | 67.3 |
| 9 | 28.1 | 7.0 | 9 | 76.7 | 19.1 | 9 | 125.2 | 31.2 | 9 | 173.7 | 43.3 | 9 | 222.2 | 55.4 | 9 | 270.7 | 67.5 |
| 30 | 29.1 | 7.3 | 80 | 77.6 | 19.4 | 130 | 126.1 | 31.4 | 180 | 174.7 | 43.5 | 230 | 223.2 | 55.6 | 280 | 271.7 | 67.7 |
| 1 | 30.1 | 7.5 | 1 | 78.6 | 19.6 | 1 | 127.1 | 31.7 | 1 | 175.6 | 43.8 | 1 | 224.1 | 55.9 | 1 | 272.7 | 68.0 |
| 2 | 31.0 | 7.7 | 2 | 79.6 | 19.8 | 2 | 128.1 | 31.9 | 2 | 176.6 | 44.0 | 2 | 225.1 | 56.1 | 2 | 273.6 | 68.2 |
| 3 | 32.0 | 8.0 | 3 | 80.5 | 20.1 | 3 | 129.0 | 32.2 | 3 | 177.6 | 44.3 | 3 | 226.1 | 56.4 | 3 | 274.6 | 68.5 |
| 4 | 33.0 | 8.2 | 4 | 81.5 | 20.3 | 4 | 130.0 | 32.4 | 4 | 178.5 | 44.5 | 4 | 227.0 | 56.6 | 4 | 275.6 | 68.7 |
| 5 | 34.0 | 8.5 | 5 | 82.5 | 20.6 | 5 | 131.0 | 32.7 | 5 | 179.5 | 44.8 | 5 | 228.0 | 56.9 | 5 | 276.5 | 68.9 |
| 6 | 34.9 | 8.7 | 6 | 83.4 | 20.8 | 6 | 132.0 | 32.9 | 6 | 180.5 | 45.0 | 6 | 229.0 | 57.1 | 6 | 277.5 | 69.2 |
| 7 | 35.9 | 9.0 | 7 | 84.4 | 21.0 | 7 | 132.9 | 33.1 | 7 | 181.4 | 45.2 | 7 | 230.0 | 57.3 | 7 | 278.5 | 69.4 |
| 8 | 36.9 | 9.2 | 8 | 85.4 | 21.3 | 8 | 133.9 | 33.4 | 8 | 182.4 | 45.5 | 8 | 230.9 | 57.6 | 8 | 279.4 | 69.7 |
| 9 | 37.8 | 9.4 | 9 | 86.4 | 21.5 | 9 | 134.9 | 33.6 | 9 | 183.4 | 45.7 | 9 | 231.9 | 57.8 | 9 | 280.4 | 69.9 |
| 40 | 38.8 | 9.7 | 90 | 87.3 | 21.8 | 140 | 135.8 | 33.9 | 190 | 184.4 | 46.0 | 240 | 232.9 | 58.1 | 290 | 281.4 | 70.2 |
| 1 | 39.8 | 9.9 | 1 | 88.3 | 22.0 | 1 | 136.8 | 34.1 | 1 | 185.3 | 46.2 | 1 | 233.8 | 58.3 | 1 | 282.4 | 70.4 |
| 2 | 40.8 | 10.2 | 2 | 89.3 | 22.3 | 2 | 137.8 | 34.4 | 2 | 186.3 | 46.4 | 2 | 234.8 | 58.5 | 2 | 283.3 | 70.6 |
| 3 | 41.7 | 10.4 | 3 | 90.2 | 22.5 | 3 | 138.8 | 34.6 | 3 | 187.3 | 46.7 | 3 | 235.8 | 58.8 | 3 | 284.3 | 70.9 |
| 4 | 42.7 | 10.6 | 4 | 91.2 | 22.7 | 4 | 139.7 | 34.8 | 4 | 188.2 | 46.9 | 4 | 236.8 | 59.0 | 4 | 285.3 | 71.1 |
| 5 | 43.7 | 10.9 | 5 | 92.2 | 23.0 | 5 | 140.7 | 35.1 | 5 | 189.2 | 47.2 | 5 | 237.7 | 59.3 | 5 | 286.2 | 71.4 |
| 6 | 44.6 | 11.1 | 6 | 93.1 | 23.2 | 6 | 141.7 | 35.3 | 6 | 190.2 | 47.4 | 6 | 238.7 | 59.5 | 6 | 287.2 | 71.6 |
| 7 | 45.6 | 11.4 | 7 | 94.1 | 23.5 | 7 | 142.6 | 35.6 | 7 | 191.1 | 47.7 | 7 | 239.7 | 59.8 | 7 | 288.2 | 71.9 |
| 8 | 46.6 | 11.6 | 8 | 95.1 | 23.7 | 8 | 143.6 | 35.8 | 8 | 192.1 | 47.9 | 8 | 240.6 | 60.0 | 8 | 289.1 | 72.1 |
| 9 | 47.5 | 11.9 | 9 | 96.1 | 24.0 | 9 | 144.6 | 36.0 | 9 | 193.1 | 48.1 | 9 | 241.6 | 60.2 | 9 | 290.1 | 72.3 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 284 315
269 256 225

R

089 076° 045
091 104 135

R ou φm

R

TABELA 1

R ou φm

359 346° 315
181 194 225

TÁBUAS DE CARTEAÇÃO

001 014 045
179 166 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 291.1 | 72.6 | 350 | 339.6 | 84.7 | 400 | 388.1 | 96.8 | 450 | 436.6 | 108.9 | 500 | 485.1 | 121.0 | 550 | 533.7 | 133.1 |
| 1 | 292.1 | 72.8 | 1 | 340.6 | 84.9 | 1 | 389.1 | 97.0 | 1 | 437.6 | 109.1 | 1 | 486.1 | 121.2 | 1 | 534.6 | 133.3 |
| 2 | 293.0 | 73.1 | 2 | 341.5 | 85.2 | 2 | 390.1 | 97.3 | 2 | 438.6 | 109.3 | 2 | 487.1 | 121.4 | 2 | 535.6 | 133.5 |
| 3 | 294.0 | 73.3 | 3 | 342.5 | 85.4 | 3 | 391.0 | 97.5 | 3 | 439.5 | 109.6 | 3 | 488.1 | 121.7 | 3 | 536.6 | 133.8 |
| 4 | 295.0 | 73.5 | 4 | 343.5 | 85.6 | 4 | 392.0 | 97.7 | 4 | 440.5 | 109.8 | 4 | 489.0 | 121.9 | 4 | 537.5 | 134.0 |
| 5 | 295.9 | 73.8 | 5 | 344.5 | 85.9 | 5 | 393.0 | 98.0 | 5 | 441.5 | 110.1 | 5 | 490.0 | 122.2 | 5 | 538.5 | 134.3 |
| 6 | 296.9 | 74.0 | 6 | 345.4 | 86.1 | 6 | 393.9 | 98.2 | 6 | 442.5 | 110.3 | 6 | 491.0 | 122.4 | 6 | 539.5 | 134.5 |
| 7 | 297.9 | 74.3 | 7 | 346.4 | 86.4 | 7 | 394.9 | 98.5 | 7 | 443.4 | 110.6 | 7 | 491.9 | 122.7 | 7 | 540.5 | 134.8 |
| 8 | 298.9 | 74.5 | 8 | 347.4 | 86.6 | 8 | 395.9 | 98.7 | 8 | 444.4 | 110.8 | 8 | 492.9 | 122.9 | 8 | 541.4 | 135.0 |
| 9 | 299.8 | 74.8 | 9 | 348.3 | 86.8 | 9 | 396.9 | 98.9 | 9 | 445.4 | 111.0 | 9 | 493.9 | 123.1 | 9 | 542.4 | 135.2 |
| 310 | 300.8 | 75.0 | 360 | 349.3 | 87.1 | 410 | 397.8 | 99.2 | 460 | 446.3 | 111.3 | 510 | 494.9 | 123.4 | 560 | 543.4 | 135.5 |
| 1 | 301.8 | 75.2 | 1 | 350.3 | 87.3 | 1 | 398.8 | 99.4 | 1 | 447.3 | 111.5 | 1 | 495.8 | 123.6 | 1 | 544.3 | 135.7 |
| 2 | 302.7 | 75.5 | 2 | 351.2 | 87.6 | 2 | 399.8 | 99.7 | 2 | 448.3 | 111.8 | 2 | 496.8 | 123.9 | 2 | 545.3 | 136.0 |
| 3 | 303.7 | 75.7 | 3 | 352.2 | 87.8 | 3 | 400.7 | 99.9 | 3 | 449.2 | 112.0 | 3 | 497.8 | 124.1 | 3 | 546.3 | 136.2 |
| 4 | 304.7 | 76.0 | 4 | 353.2 | 88.1 | 4 | 401.7 | 100.2 | 4 | 450.2 | 112.3 | 4 | 498.7 | 124.3 | 4 | 547.2 | 136.4 |
| 5 | 305.6 | 76.2 | 5 | 354.2 | 88.3 | 5 | 402.7 | 100.4 | 5 | 451.2 | 112.5 | 5 | 499.7 | 124.6 | 5 | 548.2 | 136.7 |
| 6 | 306.6 | 76.4 | 6 | 355.1 | 88.5 | 6 | 403.6 | 100.6 | 6 | 452.2 | 112.7 | 6 | 500.7 | 124.8 | 6 | 549.2 | 136.9 |
| 7 | 307.6 | 76.7 | 7 | 356.1 | 88.8 | 7 | 404.6 | 100.9 | 7 | 453.1 | 113.0 | 7 | 501.6 | 125.1 | 7 | 550.2 | 137.2 |
| 8 | 308.6 | 76.9 | 8 | 357.1 | 89.0 | 8 | 405.6 | 101.1 | 8 | 454.1 | 113.2 | 8 | 502.6 | 125.3 | 8 | 551.1 | 137.4 |
| 9 | 309.5 | 77.2 | 9 | 358.0 | 89.3 | 9 | 406.6 | 101.4 | 9 | 455.1 | 113.5 | 9 | 503.6 | 125.6 | 9 | 552.1 | 137.7 |
| 320 | 310.5 | 77.4 | 370 | 359.0 | 89.5 | 420 | 407.5 | 101.6 | 470 | 456.0 | 113.7 | 520 | 504.6 | 125.8 | 570 | 553.1 | 137.9 |
| 1 | 311.5 | 77.7 | 1 | 360.0 | 89.8 | 1 | 408.5 | 101.8 | 1 | 457.0 | 113.9 | 1 | 505.5 | 126.0 | 1 | 554.0 | 138.1 |
| 2 | 312.4 | 77.9 | 2 | 360.9 | 90.0 | 2 | 409.5 | 102.1 | 2 | 458.0 | 114.2 | 2 | 506.5 | 126.3 | 2 | 555.0 | 138.4 |
| 3 | 313.4 | 78.1 | 3 | 361.9 | 90.2 | 3 | 410.4 | 102.3 | 3 | 458.9 | 114.4 | 3 | 507.5 | 126.5 | 3 | 556.0 | 138.6 |
| 4 | 314.4 | 78.4 | 4 | 362.9 | 90.5 | 4 | 411.4 | 102.6 | 4 | 459.9 | 114.7 | 4 | 508.4 | 126.8 | 4 | 556.9 | 138.9 |
| 5 | 315.3 | 78.6 | 5 | 363.9 | 90.7 | 5 | 412.4 | 102.8 | 5 | 460.9 | 114.9 | 5 | 509.4 | 127.0 | 5 | 557.9 | 139.1 |
| 6 | 316.3 | 78.9 | 6 | 364.8 | 91.0 | 6 | 413.3 | 103.1 | 6 | 461.9 | 115.2 | 6 | 510.4 | 127.3 | 6 | 558.9 | 139.3 |
| 7 | 317.3 | 79.1 | 7 | 365.8 | 91.2 | 7 | 414.3 | 103.3 | 7 | 462.8 | 115.4 | 7 | 511.3 | 127.5 | 7 | 559.9 | 139.6 |
| 8 | 318.3 | 79.4 | 8 | 366.8 | 91.4 | 8 | 415.3 | 103.5 | 8 | 463.8 | 115.6 | 8 | 512.3 | 127.7 | 8 | 560.8 | 139.8 |
| 9 | 319.2 | 79.6 | 9 | 367.7 | 91.7 | 9 | 416.3 | 103.8 | 9 | 464.8 | 115.9 | 9 | 513.3 | 128.0 | 9 | 561.8 | 140.1 |
| 330 | 320.2 | 79.8 | 380 | 368.7 | 91.9 | 430 | 417.2 | 104.0 | 480 | 465.7 | 116.1 | 530 | 514.3 | 128.2 | 580 | 562.8 | 140.3 |
| 1 | 321.2 | 80.1 | 1 | 369.7 | 92.2 | 1 | 418.2 | 104.3 | 1 | 466.7 | 116.4 | 1 | 515.2 | 128.5 | 1 | 563.7 | 140.6 |
| 2 | 322.1 | 80.3 | 2 | 370.7 | 92.4 | 2 | 419.2 | 104.5 | 2 | 467.7 | 116.6 | 2 | 516.2 | 128.7 | 2 | 564.7 | 140.8 |
| 3 | 323.1 | 80.6 | 3 | 371.6 | 92.7 | 3 | 420.1 | 104.8 | 3 | 468.7 | 116.8 | 3 | 517.2 | 128.9 | 3 | 565.7 | 141.0 |
| 4 | 324.1 | 80.8 | 4 | 372.6 | 92.9 | 4 | 421.1 | 105.0 | 4 | 469.6 | 117.1 | 4 | 518.1 | 129.2 | 4 | 566.7 | 141.3 |
| 5 | 325.0 | 81.0 | 5 | 373.6 | 93.1 | 5 | 422.1 | 105.2 | 5 | 470.6 | 117.3 | 5 | 519.1 | 129.4 | 5 | 567.6 | 141.5 |
| 6 | 326.0 | 81.3 | 6 | 374.5 | 93.4 | 6 | 423.0 | 105.5 | 6 | 471.6 | 117.6 | 6 | 520.1 | 129.7 | 6 | 568.6 | 141.8 |
| 7 | 327.0 | 81.5 | 7 | 375.5 | 93.6 | 7 | 424.0 | 105.7 | 7 | 472.5 | 117.8 | 7 | 521.0 | 129.9 | 7 | 569.6 | 142.0 |
| 8 | 328.0 | 81.8 | 8 | 376.5 | 93.9 | 8 | 425.0 | 106.0 | 8 | 473.5 | 118.1 | 8 | 522.0 | 130.2 | 8 | 570.5 | 142.3 |
| 9 | 328.9 | 82.0 | 9 | 377.4 | 94.1 | 9 | 426.0 | 106.2 | 9 | 474.5 | 118.3 | 9 | 523.0 | 130.4 | 9 | 571.5 | 142.5 |
| 340 | 329.9 | 82.3 | 390 | 378.4 | 94.3 | 440 | 426.9 | 106.4 | 490 | 475.4 | 118.5 | 540 | 524.0 | 130.6 | 590 | 572.5 | 142.7 |
| 1 | 330.9 | 82.5 | 1 | 379.4 | 94.6 | 1 | 427.9 | 106.7 | 1 | 476.4 | 118.8 | 1 | 524.9 | 130.9 | 1 | 573.4 | 143.0 |
| 2 | 331.8 | 82.7 | 2 | 380.4 | 94.8 | 2 | 428.9 | 106.9 | 2 | 477.4 | 119.0 | 2 | 525.9 | 131.1 | 2 | 574.4 | 143.2 |
| 3 | 332.8 | 83.0 | 3 | 381.3 | 95.1 | 3 | 429.8 | 107.2 | 3 | 478.4 | 119.3 | 3 | 526.9 | 131.4 | 3 | 575.4 | 143.5 |
| 4 | 333.8 | 83.2 | 4 | 382.3 | 95.3 | 4 | 430.8 | 107.4 | 4 | 479.3 | 119.5 | 4 | 527.8 | 131.6 | 4 | 576.4 | 143.7 |
| 5 | 334.8 | 83.5 | 5 | 383.3 | 95.6 | 5 | 431.8 | 107.7 | 5 | 480.3 | 119.8 | 5 | 528.8 | 131.8 | 5 | 577.3 | 143.9 |
| 6 | 335.7 | 83.7 | 6 | 384.2 | 95.8 | 6 | 432.8 | 107.9 | 6 | 481.3 | 120.0 | 6 | 529.8 | 132.1 | 6 | 578.3 | 144.2 |
| 7 | 336.7 | 83.9 | 7 | 385.2 | 96.0 | 7 | 433.7 | 108.1 | 7 | 482.2 | 120.2 | 7 | 530.8 | 132.3 | 7 | 579.3 | 144.4 |
| 8 | 337.7 | 84.2 | 8 | 386.2 | 96.3 | 8 | 434.7 | 108.4 | 8 | 483.2 | 120.5 | 8 | 531.7 | 132.6 | 8 | 580.2 | 144.7 |
| 9 | 338.6 | 84.4 | 9 | 387.1 | 96.5 | 9 | 435.7 | 108.6 | 9 | 484.2 | 120.7 | 9 | 532.7 | 132.8 | 9 | 581.2 | 144.9 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 284 315
269 256 225

R

089 076° 045
091 104 135

R ou φm

R

TABELA 1

R ou φm

359 345° 315
181 195 225

TÁBUAS DE CARTEAÇÃO

001 015 045
179 165 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 48.3 | 12.9 | 100 | 96.6 | 25.9 | 150 | 144.9 | 38.8 | 200 | 193.2 | 51.8 | 250 | 241.5 | 64.7 |
| 1 | 1.0 | 0.3 | 1 | 49.3 | 13.2 | 1 | 97.6 | 26.1 | 1 | 145.9 | 39.1 | 1 | 194.2 | 52.0 | 1 | 242.4 | 65.0 |
| 2 | 1.9 | 0.5 | 2 | 50.2 | 13.5 | 2 | 98.5 | 26.4 | 2 | 146.8 | 39.3 | 2 | 195.1 | 52.3 | 2 | 243.4 | 65.2 |
| 3 | 2.9 | 0.8 | 3 | 51.2 | 13.7 | 3 | 99.5 | 26.7 | 3 | 147.8 | 39.6 | 3 | 196.1 | 52.5 | 3 | 244.4 | 65.5 |
| 4 | 3.9 | 1.0 | 4 | 52.2 | 14.0 | 4 | 100.5 | 26.9 | 4 | 148.8 | 39.9 | 4 | 197.0 | 52.8 | 4 | 245.3 | 65.7 |
| 5 | 4.8 | 1.3 | 5 | 53.1 | 14.2 | 5 | 101.4 | 27.2 | 5 | 149.7 | 40.1 | 5 | 198.0 | 53.1 | 5 | 246.3 | 66.0 |
| 6 | 5.8 | 1.6 | 6 | 54.1 | 14.5 | 6 | 102.4 | 27.4 | 6 | 150.7 | 40.4 | 6 | 199.0 | 53.3 | 6 | 247.3 | 66.3 |
| 7 | 6.8 | 1.8 | 7 | 55.1 | 14.8 | 7 | 103.4 | 27.7 | 7 | 151.7 | 40.6 | 7 | 199.9 | 53.6 | 7 | 248.2 | 66.5 |
| 8 | 7.7 | 2.1 | 8 | 56.0 | 15.0 | 8 | 104.3 | 28.0 | 8 | 152.6 | 40.9 | 8 | 200.9 | 53.8 | 8 | 249.2 | 66.8 |
| 9 | 8.7 | 2.3 | 9 | 57.0 | 15.3 | 9 | 105.3 | 28.2 | 9 | 153.6 | 41.2 | 9 | 201.9 | 54.1 | 9 | 250.2 | 67.0 |
| 10 | 9.7 | 2.6 | 60 | 58.0 | 15.5 | 110 | 106.3 | 28.5 | 160 | 154.5 | 41.4 | 210 | 202.8 | 54.4 | 260 | 251.1 | 67.3 |
| 1 | 10.6 | 2.8 | 1 | 58.9 | 15.8 | 1 | 107.2 | 28.7 | 1 | 155.5 | 41.7 | 1 | 203.8 | 54.6 | 1 | 252.1 | 67.6 |
| 2 | 11.6 | 3.1 | 2 | 59.9 | 16.0 | 2 | 108.2 | 29.0 | 2 | 156.5 | 41.9 | 2 | 204.8 | 54.9 | 2 | 253.1 | 67.8 |
| 3 | 12.6 | 3.4 | 3 | 60.9 | 16.3 | 3 | 109.1 | 29.2 | 3 | 157.4 | 42.2 | 3 | 205.7 | 55.1 | 3 | 254.0 | 68.1 |
| 4 | 13.5 | 3.6 | 4 | 61.8 | 16.6 | 4 | 110.1 | 29.5 | 4 | 158.4 | 42.4 | 4 | 206.7 | 55.4 | 4 | 255.0 | 68.3 |
| 5 | 14.5 | 3.9 | 5 | 62.8 | 16.8 | 5 | 111.1 | 29.8 | 5 | 159.4 | 42.7 | 5 | 207.7 | 55.6 | 5 | 256.0 | 68.6 |
| 6 | 15.5 | 4.1 | 6 | 63.8 | 17.1 | 6 | 112.0 | 30.0 | 6 | 160.3 | 43.0 | 6 | 208.6 | 55.9 | 6 | 256.9 | 68.8 |
| 7 | 16.4 | 4.4 | 7 | 64.7 | 17.3 | 7 | 113.0 | 30.3 | 7 | 161.3 | 43.2 | 7 | 209.6 | 56.2 | 7 | 257.9 | 69.1 |
| 8 | 17.4 | 4.7 | 8 | 65.7 | 17.6 | 8 | 114.0 | 30.5 | 8 | 162.3 | 43.5 | 8 | 210.6 | 56.4 | 8 | 258.9 | 69.4 |
| 9 | 18.4 | 4.9 | 9 | 66.6 | 17.9 | 9 | 114.9 | 30.8 | 9 | 163.2 | 43.7 | 9 | 211.5 | 56.7 | 9 | 259.8 | 69.6 |
| 20 | 19.3 | 5.2 | 70 | 67.6 | 18.1 | 120 | 115.9 | 31.1 | 170 | 164.2 | 44.0 | 220 | 212.5 | 56.9 | 270 | 260.8 | 69.9 |
| 1 | 20.3 | 5.4 | 1 | 68.6 | 18.4 | 1 | 116.9 | 31.3 | 1 | 165.2 | 44.3 | 1 | 213.5 | 57.2 | 1 | 261.8 | 70.1 |
| 2 | 21.3 | 5.7 | 2 | 69.5 | 18.6 | 2 | 117.8 | 31.6 | 2 | 166.1 | 44.5 | 2 | 214.4 | 57.5 | 2 | 262.7 | 70.4 |
| 3 | 22.2 | 6.0 | 3 | 70.5 | 18.9 | 3 | 118.8 | 31.8 | 3 | 167.1 | 44.8 | 3 | 215.4 | 57.7 | 3 | 263.7 | 70.7 |
| 4 | 23.2 | 6.2 | 4 | 71.5 | 19.2 | 4 | 119.8 | 32.1 | 4 | 168.1 | 45.0 | 4 | 216.4 | 58.0 | 4 | 264.7 | 70.9 |
| 5 | 24.1 | 6.5 | 5 | 72.4 | 19.4 | 5 | 120.7 | 32.4 | 5 | 169.0 | 45.3 | 5 | 217.3 | 58.2 | 5 | 265.6 | 71.2 |
| 6 | 25.1 | 6.7 | 6 | 73.4 | 19.7 | 6 | 121.7 | 32.6 | 6 | 170.0 | 45.6 | 6 | 218.3 | 58.5 | 6 | 266.6 | 71.4 |
| 7 | 26.1 | 7.0 | 7 | 74.4 | 19.9 | 7 | 122.7 | 32.9 | 7 | 171.0 | 45.8 | 7 | 219.3 | 58.8 | 7 | 267.6 | 71.7 |
| 8 | 27.0 | 7.2 | 8 | 75.3 | 20.2 | 8 | 123.6 | 33.1 | 8 | 171.9 | 46.1 | 8 | 220.2 | 59.0 | 8 | 268.5 | 72.0 |
| 9 | 28.0 | 7.5 | 9 | 76.3 | 20.4 | 9 | 124.6 | 33.4 | 9 | 172.9 | 46.3 | 9 | 221.2 | 59.3 | 9 | 269.5 | 72.2 |
| 30 | 29.0 | 7.8 | 80 | 77.3 | 20.7 | 130 | 125.6 | 33.6 | 180 | 173.9 | 46.6 | 230 | 222.2 | 59.5 | 280 | 270.5 | 72.5 |
| 1 | 29.9 | 8.0 | 1 | 78.2 | 21.0 | 1 | 126.5 | 33.9 | 1 | 174.8 | 46.8 | 1 | 223.1 | 59.8 | 1 | 271.4 | 72.7 |
| 2 | 30.9 | 8.3 | 2 | 79.2 | 21.2 | 2 | 127.5 | 34.2 | 2 | 175.8 | 47.1 | 2 | 224.1 | 60.0 | 2 | 272.4 | 73.0 |
| 3 | 31.9 | 8.5 | 3 | 80.2 | 21.5 | 3 | 128.5 | 34.4 | 3 | 176.8 | 47.4 | 3 | 225.1 | 60.3 | 3 | 273.4 | 73.2 |
| 4 | 32.8 | 8.8 | 4 | 81.1 | 21.7 | 4 | 129.4 | 34.7 | 4 | 177.7 | 47.6 | 4 | 226.0 | 60.6 | 4 | 274.3 | 73.5 |
| 5 | 33.8 | 9.1 | 5 | 82.1 | 22.0 | 5 | 130.4 | 34.9 | 5 | 178.7 | 47.9 | 5 | 227.0 | 60.8 | 5 | 275.3 | 73.8 |
| 6 | 34.8 | 9.3 | 6 | 83.1 | 22.3 | 6 | 131.4 | 35.2 | 6 | 179.7 | 48.1 | 6 | 228.0 | 61.1 | 6 | 276.3 | 74.0 |
| 7 | 35.7 | 9.6 | 7 | 84.0 | 22.5 | 7 | 132.3 | 35.5 | 7 | 180.6 | 48.4 | 7 | 228.9 | 61.3 | 7 | 277.2 | 74.3 |
| 8 | 36.7 | 9.8 | 8 | 85.0 | 22.8 | 8 | 133.3 | 35.7 | 8 | 181.6 | 48.7 | 8 | 229.9 | 61.6 | 8 | 278.2 | 74.5 |
| 9 | 37.7 | 10.1 | 9 | 86.0 | 23.0 | 9 | 134.3 | 36.0 | 9 | 182.6 | 48.9 | 9 | 230.9 | 61.9 | 9 | 279.2 | 74.8 |
| 40 | 38.6 | 10.4 | 90 | 86.9 | 23.3 | 140 | 135.2 | 36.2 | 190 | 183.5 | 49.2 | 240 | 231.8 | 62.1 | 290 | 280.1 | 75.1 |
| 1 | 39.6 | 10.6 | 1 | 87.9 | 23.6 | 1 | 136.2 | 36.5 | 1 | 184.5 | 49.4 | 1 | 232.8 | 62.4 | 1 | 281.1 | 75.3 |
| 2 | 40.6 | 10.9 | 2 | 88.9 | 23.8 | 2 | 137.2 | 36.8 | 2 | 185.5 | 49.7 | 2 | 233.8 | 62.6 | 2 | 282.1 | 75.6 |
| 3 | 41.5 | 11.1 | 3 | 89.8 | 24.1 | 3 | 138.1 | 37.0 | 3 | 186.4 | 50.0 | 3 | 234.7 | 62.9 | 3 | 283.0 | 75.8 |
| 4 | 42.5 | 11.4 | 4 | 90.8 | 24.3 | 4 | 139.1 | 37.3 | 4 | 187.4 | 50.2 | 4 | 235.7 | 63.2 | 4 | 284.0 | 76.1 |
| 5 | 43.5 | 11.6 | 5 | 91.8 | 24.6 | 5 | 140.1 | 37.5 | 5 | 188.4 | 50.5 | 5 | 236.7 | 63.4 | 5 | 284.9 | 76.4 |
| 6 | 44.4 | 11.9 | 6 | 92.7 | 24.8 | 6 | 141.0 | 37.8 | 6 | 189.3 | 50.7 | 6 | 237.6 | 63.7 | 6 | 285.9 | 76.6 |
| 7 | 45.4 | 12.2 | 7 | 93.7 | 25.1 | 7 | 142.0 | 38.0 | 7 | 190.3 | 51.0 | 7 | 238.6 | 63.9 | 7 | 286.9 | 76.9 |
| 8 | 46.4 | 12.4 | 8 | 94.7 | 25.4 | 8 | 143.0 | 38.3 | 8 | 191.3 | 51.2 | 8 | 239.5 | 64.2 | 8 | 287.8 | 77.1 |
| 9 | 47.3 | 12.7 | 9 | 95.6 | 25.6 | 9 | 143.9 | 38.6 | 9 | 192.2 | 51.5 | 9 | 240.5 | 64.4 | 9 | 288.8 | 77.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 285 315
269 255 225

R

089 075° 045
091 105 135

R ou φm

R

TABELA 1

R ou φm

359 345° 315
181 195 225

TÁBUAS DE CARTEAÇÃO

001 015 045
179 165 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 289.8 | 77.6 | 350 | 338.1 | 90.6 | 400 | 386.4 | 103.5 | 450 | 434.7 | 116.5 | 500 | 483.0 | 129.4 | 550 | 531.3 | 142.4 |
| 1 | 290.7 | 77.9 | 1 | 339.0 | 90.8 | 1 | 387.3 | 103.8 | 1 | 435.6 | 116.7 | 1 | 483.9 | 129.7 | 1 | 532.2 | 142.6 |
| 2 | 291.7 | 78.2 | 2 | 340.0 | 91.1 | 2 | 388.3 | 104.0 | 2 | 436.6 | 117.0 | 2 | 484.9 | 129.9 | 2 | 533.2 | 142.9 |
| 3 | 292.7 | 78.4 | 3 | 341.0 | 91.4 | 3 | 389.3 | 104.3 | 3 | 437.6 | 117.2 | 3 | 485.9 | 130.2 | 3 | 534.2 | 143.1 |
| 4 | 293.6 | 78.7 | 4 | 341.9 | 91.6 | 4 | 390.2 | 104.6 | 4 | 438.5 | 117.5 | 4 | 486.8 | 130.4 | 4 | 535.1 | 143.4 |
| 5 | 294.6 | 78.9 | 5 | 342.9 | 91.9 | 5 | 391.2 | 104.8 | 5 | 439.5 | 117.8 | 5 | 487.8 | 130.7 | 5 | 536.1 | 143.6 |
| 6 | 295.6 | 79.2 | 6 | 343.9 | 92.1 | 6 | 392.2 | 105.1 | 6 | 440.5 | 118.0 | 6 | 488.8 | 131.0 | 6 | 537.1 | 143.9 |
| 7 | 296.5 | 79.5 | 7 | 344.8 | 92.4 | 7 | 393.1 | 105.3 | 7 | 441.4 | 118.3 | 7 | 489.7 | 131.2 | 7 | 538.0 | 144.2 |
| 8 | 297.5 | 79.7 | 8 | 345.8 | 92.7 | 8 | 394.1 | 105.6 | 8 | 442.4 | 118.5 | 8 | 490.7 | 131.5 | 8 | 539.0 | 144.4 |
| 9 | 298.5 | 80.0 | 9 | 346.8 | 92.9 | 9 | 395.1 | 105.9 | 9 | 443.4 | 118.8 | 9 | 491.7 | 131.7 | 9 | 540.0 | 144.7 |
| 310 | 299.4 | 80.2 | 360 | 347.7 | 93.2 | 410 | 396.0 | 106.1 | 460 | 444.3 | 119.1 | 510 | 492.6 | 132.0 | 560 | 540.9 | 144.9 |
| 1 | 300.4 | 80.5 | 1 | 348.7 | 93.4 | 1 | 397.0 | 106.4 | 1 | 445.3 | 119.3 | 1 | 493.6 | 132.3 | 1 | 541.9 | 145.2 |
| 2 | 301.4 | 80.8 | 2 | 349.7 | 93.7 | 2 | 398.0 | 106.6 | 2 | 446.3 | 119.6 | 2 | 494.6 | 132.5 | 2 | 542.9 | 145.5 |
| 3 | 302.3 | 81.0 | 3 | 350.6 | 94.0 | 3 | 398.9 | 106.9 | 3 | 447.2 | 119.8 | 3 | 495.5 | 132.8 | 3 | 543.8 | 145.7 |
| 4 | 303.3 | 81.3 | 4 | 351.6 | 94.2 | 4 | 399.9 | 107.2 | 4 | 448.2 | 120.1 | 4 | 496.5 | 133.0 | 4 | 544.8 | 146.0 |
| 5 | 304.3 | 81.5 | 5 | 352.6 | 94.5 | 5 | 400.9 | 107.4 | 5 | 449.2 | 120.4 | 5 | 497.5 | 133.3 | 5 | 545.7 | 146.2 |
| 6 | 305.2 | 81.8 | 6 | 353.5 | 94.7 | 6 | 401.8 | 107.7 | 6 | 450.1 | 120.6 | 6 | 498.4 | 133.6 | 6 | 546.7 | 146.5 |
| 7 | 306.2 | 82.0 | 7 | 354.5 | 95.0 | 7 | 402.8 | 107.9 | 7 | 451.1 | 120.9 | 7 | 499.4 | 133.8 | 7 | 547.7 | 146.8 |
| 8 | 307.2 | 82.3 | 8 | 355.5 | 95.2 | 8 | 403.8 | 108.2 | 8 | 452.1 | 121.1 | 8 | 500.3 | 134.1 | 8 | 548.6 | 147.0 |
| 9 | 308.1 | 82.6 | 9 | 356.4 | 95.5 | 9 | 404.7 | 108.4 | 9 | 453.0 | 121.4 | 9 | 501.3 | 134.3 | 9 | 549.6 | 147.3 |
| 320 | 309.1 | 82.8 | 370 | 357.4 | 95.8 | 420 | 405.7 | 108.7 | 470 | 454.0 | 121.6 | 520 | 502.3 | 134.6 | 570 | 550.6 | 147.5 |
| 1 | 310.1 | 83.1 | 1 | 358.4 | 96.0 | 1 | 406.7 | 109.0 | 1 | 455.0 | 121.9 | 1 | 503.2 | 134.8 | 1 | 551.5 | 147.8 |
| 2 | 311.0 | 83.3 | 2 | 359.3 | 96.3 | 2 | 407.6 | 109.2 | 2 | 455.9 | 122.2 | 2 | 504.2 | 135.1 | 2 | 552.5 | 148.0 |
| 3 | 312.0 | 83.6 | 3 | 360.3 | 96.5 | 3 | 408.6 | 109.5 | 3 | 456.9 | 122.4 | 3 | 505.2 | 135.4 | 3 | 553.5 | 148.3 |
| 4 | 313.0 | 83.9 | 4 | 361.3 | 96.8 | 4 | 409.6 | 109.7 | 4 | 457.8 | 122.7 | 4 | 506.1 | 135.6 | 4 | 554.4 | 148.6 |
| 5 | 313.9 | 84.1 | 5 | 362.2 | 97.1 | 5 | 410.5 | 110.0 | 5 | 458.8 | 122.9 | 5 | 507.1 | 135.9 | 5 | 555.4 | 148.8 |
| 6 | 314.9 | 84.4 | 6 | 363.2 | 97.3 | 6 | 411.5 | 110.3 | 6 | 459.8 | 123.2 | 6 | 508.1 | 136.1 | 6 | 556.4 | 149.1 |
| 7 | 315.9 | 84.6 | 7 | 364.2 | 97.6 | 7 | 412.5 | 110.5 | 7 | 460.7 | 123.5 | 7 | 509.0 | 136.4 | 7 | 557.3 | 149.3 |
| 8 | 316.8 | 84.9 | 8 | 365.1 | 97.8 | 8 | 413.4 | 110.8 | 8 | 461.7 | 123.7 | 8 | 510.0 | 136.7 | 8 | 558.3 | 149.6 |
| 9 | 317.8 | 85.2 | 9 | 366.1 | 98.1 | 9 | 414.4 | 111.0 | 9 | 462.7 | 124.0 | 9 | 511.0 | 136.9 | 9 | 559.3 | 149.9 |
| 330 | 318.8 | 85.4 | 380 | 367.1 | 98.4 | 430 | 415.3 | 111.3 | 480 | 463.6 | 124.2 | 530 | 511.9 | 137.2 | 580 | 560.2 | 150.1 |
| 1 | 319.7 | 85.7 | 1 | 368.0 | 98.6 | 1 | 416.3 | 111.6 | 1 | 464.6 | 124.5 | 1 | 512.9 | 137.4 | 1 | 561.2 | 150.4 |
| 2 | 320.7 | 85.9 | 2 | 369.0 | 98.9 | 2 | 417.3 | 111.8 | 2 | 465.6 | 124.8 | 2 | 513.9 | 137.7 | 2 | 562.2 | 150.6 |
| 3 | 321.7 | 86.2 | 3 | 369.9 | 99.1 | 3 | 418.2 | 112.1 | 3 | 466.5 | 125.0 | 3 | 514.8 | 138.0 | 3 | 563.1 | 150.9 |
| 4 | 322.6 | 86.4 | 4 | 370.9 | 99.4 | 4 | 419.2 | 112.3 | 4 | 467.5 | 125.3 | 4 | 515.8 | 138.2 | 4 | 564.1 | 151.2 |
| 5 | 323.6 | 86.7 | 5 | 371.9 | 99.6 | 5 | 420.2 | 112.6 | 5 | 468.5 | 125.5 | 5 | 516.8 | 138.5 | 5 | 565.1 | 151.4 |
| 6 | 324.6 | 87.0 | 6 | 372.8 | 99.9 | 6 | 421.1 | 112.8 | 6 | 469.4 | 125.8 | 6 | 517.7 | 138.7 | 6 | 566.0 | 151.7 |
| 7 | 325.5 | 87.2 | 7 | 373.8 | 100.2 | 7 | 422.1 | 113.1 | 7 | 470.4 | 126.0 | 7 | 518.7 | 139.0 | 7 | 567.0 | 151.9 |
| 8 | 326.5 | 87.5 | 8 | 374.8 | 100.4 | 8 | 423.1 | 113.4 | 8 | 471.4 | 126.3 | 8 | 519.7 | 139.2 | 8 | 568.0 | 152.2 |
| 9 | 327.4 | 87.7 | 9 | 375.7 | 100.7 | 9 | 424.0 | 113.6 | 9 | 472.3 | 126.6 | 9 | 520.6 | 139.5 | 9 | 568.9 | 152.4 |
| 340 | 328.4 | 88.0 | 390 | 376.7 | 100.9 | 440 | 425.0 | 113.9 | 490 | 473.3 | 126.8 | 540 | 521.6 | 139.8 | 590 | 569.9 | 152.7 |
| 1 | 329.4 | 88.3 | 1 | 377.7 | 101.2 | 1 | 426.0 | 114.1 | 1 | 474.3 | 127.1 | 1 | 522.6 | 140.0 | 1 | 570.9 | 153.0 |
| 2 | 330.3 | 88.5 | 2 | 378.6 | 101.5 | 2 | 426.9 | 114.4 | 2 | 475.2 | 127.3 | 2 | 523.5 | 140.3 | 2 | 571.8 | 153.2 |
| 3 | 331.3 | 88.8 | 3 | 379.6 | 101.7 | 3 | 427.9 | 114.7 | 3 | 476.2 | 127.6 | 3 | 524.5 | 140.5 | 3 | 572.8 | 153.5 |
| 4 | 332.3 | 89.0 | 4 | 380.6 | 102.0 | 4 | 428.9 | 114.9 | 4 | 477.2 | 127.9 | 4 | 525.5 | 140.8 | 4 | 573.8 | 153.7 |
| 5 | 333.2 | 89.3 | 5 | 381.5 | 102.2 | 5 | 429.8 | 115.2 | 5 | 478.1 | 128.1 | 5 | 526.4 | 141.1 | 5 | 574.7 | 154.0 |
| 6 | 334.2 | 89.6 | 6 | 382.5 | 102.5 | 6 | 430.8 | 115.4 | 6 | 479.1 | 128.4 | 6 | 527.4 | 141.3 | 6 | 575.7 | 154.3 |
| 7 | 335.2 | 89.8 | 7 | 383.5 | 102.8 | 7 | 431.8 | 115.7 | 7 | 480.1 | 128.6 | 7 | 528.4 | 141.6 | 7 | 576.7 | 154.5 |
| 8 | 336.1 | 90.1 | 8 | 384.4 | 103.0 | 8 | 432.7 | 116.0 | 8 | 481.0 | 128.9 | 8 | 529.3 | 141.8 | 8 | 577.6 | 154.8 |
| 9 | 337.1 | 90.3 | 9 | 385.4 | 103.3 | 9 | 433.7 | 116.2 | 9 | 482.0 | 129.2 | 9 | 530.3 | 142.1 | 9 | 578.6 | 155.0 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 285 315
289 255 225

R

089 075° 045
091 105 135

R ou φm

R

TABELA 1

R ou φm

359 344° 315
181 196 225

TÁBUAS DE CARTEAÇÃO

001 016 045
179 164 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 48.1 | 13.8 | 100 | 96.1 | 27.6 | 150 | 144.2 | 41.3 | 200 | 192.3 | 55.1 | 250 | 240.3 | 68.9 |
| 1 | 1.0 | 0.3 | 1 | 49.0 | 14.1 | 1 | 97.1 | 27.8 | 1 | 145.2 | 41.6 | 1 | 193.2 | 55.4 | 1 | 241.3 | 69.2 |
| 2 | 1.9 | 0.6 | 2 | 50.0 | 14.3 | 2 | 98.0 | 28.1 | 2 | 146.1 | 41.9 | 2 | 194.2 | 55.7 | 2 | 242.2 | 69.5 |
| 3 | 2.9 | 0.8 | 3 | 50.9 | 14.6 | 3 | 99.0 | 28.4 | 3 | 147.1 | 42.2 | 3 | 195.1 | 56.0 | 3 | 243.2 | 69.7 |
| 4 | 3.8 | 1.1 | 4 | 51.9 | 14.9 | 4 | 100.0 | 28.7 | 4 | 148.0 | 42.4 | 4 | 196.1 | 56.2 | 4 | 244.2 | 70.0 |
| 5 | 4.8 | 1.4 | 5 | 52.9 | 15.2 | 5 | 100.9 | 28.9 | 5 | 149.0 | 42.7 | 5 | 197.1 | 56.5 | 5 | 245.1 | 70.3 |
| 6 | 5.8 | 1.7 | 6 | 53.8 | 15.4 | 6 | 101.9 | 29.2 | 6 | 150.0 | 43.0 | 6 | 198.0 | 56.8 | 6 | 246.1 | 70.6 |
| 7 | 6.7 | 1.9 | 7 | 54.8 | 15.7 | 7 | 102.9 | 29.5 | 7 | 150.9 | 43.3 | 7 | 199.0 | 57.1 | 7 | 247.0 | 70.8 |
| 8 | 7.7 | 2.2 | 8 | 55.8 | 16.0 | 8 | 103.8 | 29.8 | 8 | 151.9 | 43.6 | 8 | 199.9 | 57.3 | 8 | 248.0 | 71.1 |
| 9 | 8.7 | 2.5 | 9 | 56.7 | 16.3 | 9 | 104.8 | 30.0 | 9 | 152.8 | 43.8 | 9 | 200.9 | 57.6 | 9 | 249.0 | 71.4 |
| 10 | 9.6 | 2.8 | 60 | 57.7 | 16.5 | 110 | 105.7 | 30.3 | 160 | 153.8 | 44.1 | 210 | 201.9 | 57.9 | 260 | 249.9 | 71.7 |
| 1 | 10.6 | 3.0 | 1 | 58.6 | 16.8 | 1 | 106.7 | 30.6 | 1 | 154.8 | 44.4 | 1 | 202.8 | 58.2 | 1 | 250.9 | 71.9 |
| 2 | 11.5 | 3.3 | 2 | 59.6 | 17.1 | 2 | 107.7 | 30.9 | 2 | 155.7 | 44.7 | 2 | 203.8 | 58.4 | 2 | 251.9 | 72.2 |
| 3 | 12.5 | 3.6 | 3 | 60.6 | 17.4 | 3 | 108.6 | 31.1 | 3 | 156.7 | 44.9 | 3 | 204.7 | 58.7 | 3 | 252.8 | 72.5 |
| 4 | 13.5 | 3.9 | 4 | 61.5 | 17.6 | 4 | 109.6 | 31.4 | 4 | 157.6 | 45.2 | 4 | 205.7 | 59.0 | 4 | 253.8 | 72.8 |
| 5 | 14.4 | 4.1 | 5 | 62.5 | 17.9 | 5 | 110.5 | 31.7 | 5 | 158.6 | 45.5 | 5 | 206.7 | 59.3 | 5 | 254.7 | 73.0 |
| 6 | 15.4 | 4.4 | 6 | 63.4 | 18.2 | 6 | 111.5 | 32.0 | 6 | 159.6 | 45.8 | 6 | 207.6 | 59.5 | 6 | 255.7 | 73.3 |
| 7 | 16.3 | 4.7 | 7 | 64.4 | 18.5 | 7 | 112.5 | 32.2 | 7 | 160.5 | 46.0 | 7 | 208.6 | 59.8 | 7 | 256.7 | 73.6 |
| 8 | 17.3 | 5.0 | 8 | 65.4 | 18.7 | 8 | 113.4 | 32.5 | 8 | 161.5 | 46.3 | 8 | 209.6 | 60.1 | 8 | 257.6 | 73.9 |
| 9 | 18.3 | 5.2 | 9 | 66.3 | 19.0 | 9 | 114.4 | 32.8 | 9 | 162.5 | 46.6 | 9 | 210.5 | 60.4 | 9 | 258.6 | 74.1 |
| 20 | 19.2 | 5.5 | 70 | 67.3 | 19.3 | 120 | 115.4 | 33.1 | 170 | 163.4 | 46.9 | 220 | 211.5 | 60.6 | 270 | 259.5 | 74.4 |
| 1 | 20.2 | 5.8 | 1 | 68.2 | 19.6 | 1 | 116.3 | 33.4 | 1 | 164.4 | 47.1 | 1 | 212.4 | 60.9 | 1 | 260.5 | 74.7 |
| 2 | 21.1 | 6.1 | 2 | 69.2 | 19.8 | 2 | 117.3 | 33.6 | 2 | 165.3 | 47.4 | 2 | 213.4 | 61.2 | 2 | 261.5 | 75.0 |
| 3 | 22.1 | 6.3 | 3 | 70.2 | 20.1 | 3 | 118.2 | 33.9 | 3 | 166.3 | 47.7 | 3 | 214.4 | 61.5 | 3 | 262.4 | 75.2 |
| 4 | 23.1 | 6.6 | 4 | 71.1 | 20.4 | 4 | 119.2 | 34.2 | 4 | 167.3 | 48.0 | 4 | 215.3 | 61.7 | 4 | 263.4 | 75.5 |
| 5 | 24.0 | 6.9 | 5 | 72.1 | 20.7 | 5 | 120.2 | 34.5 | 5 | 168.2 | 48.2 | 5 | 216.3 | 62.0 | 5 | 264.3 | 75.8 |
| 6 | 25.0 | 7.2 | 6 | 73.1 | 20.9 | 6 | 121.1 | 34.7 | 6 | 169.2 | 48.5 | 6 | 217.2 | 62.3 | 6 | 265.3 | 76.1 |
| 7 | 26.0 | 7.4 | 7 | 74.0 | 21.2 | 7 | 122.1 | 35.0 | 7 | 170.1 | 48.8 | 7 | 218.2 | 62.6 | 7 | 266.3 | 76.4 |
| 8 | 26.9 | 7.7 | 8 | 75.0 | 21.5 | 8 | 123.0 | 35.3 | 8 | 171.1 | 49.1 | 8 | 219.2 | 62.8 | 8 | 267.2 | 76.6 |
| 9 | 27.9 | 8.0 | 9 | 75.9 | 21.8 | 9 | 124.0 | 35.6 | 9 | 172.1 | 49.3 | 9 | 220.1 | 63.1 | 9 | 268.2 | 76.9 |
| 30 | 28.8 | 8.3 | 80 | 76.9 | 22.1 | 130 | 125.0 | 35.8 | 180 | 173.0 | 49.6 | 230 | 221.1 | 63.4 | 280 | 269.2 | 77.2 |
| 1 | 29.8 | 8.5 | 1 | 77.9 | 22.3 | 1 | 125.9 | 36.1 | 1 | 174.0 | 49.9 | 1 | 222.1 | 63.7 | 1 | 270.1 | 77.5 |
| 2 | 30.8 | 8.8 | 2 | 78.8 | 22.6 | 2 | 126.9 | 36.4 | 2 | 174.9 | 50.2 | 2 | 223.0 | 63.9 | 2 | 271.1 | 77.7 |
| 3 | 31.7 | 9.1 | 3 | 79.8 | 22.9 | 3 | 127.8 | 36.7 | 3 | 175.9 | 50.4 | 3 | 224.0 | 64.2 | 3 | 272.0 | 78.0 |
| 4 | 32.7 | 9.4 | 4 | 80.7 | 23.2 | 4 | 128.8 | 36.9 | 4 | 176.9 | 50.7 | 4 | 224.9 | 64.5 | 4 | 273.0 | 78.3 |
| 5 | 33.6 | 9.6 | 5 | 81.7 | 23.4 | 5 | 129.8 | 37.2 | 5 | 177.8 | 51.0 | 5 | 225.9 | 64.8 | 5 | 274.0 | 78.6 |
| 6 | 34.6 | 9.9 | 6 | 82.7 | 23.7 | 6 | 130.7 | 37.5 | 6 | 178.8 | 51.3 | 6 | 226.9 | 65.1 | 6 | 274.9 | 78.8 |
| 7 | 35.6 | 10.2 | 7 | 83.6 | 24.0 | 7 | 131.7 | 37.8 | 7 | 179.8 | 51.5 | 7 | 227.8 | 65.3 | 7 | 275.9 | 79.1 |
| 8 | 36.5 | 10.5 | 8 | 84.6 | 24.3 | 8 | 132.7 | 38.0 | 8 | 180.7 | 51.8 | 8 | 228.8 | 65.6 | 8 | 276.8 | 79.4 |
| 9 | 37.5 | 10.7 | 9 | 85.6 | 24.5 | 9 | 133.6 | 38.3 | 9 | 181.7 | 52.1 | 9 | 229.7 | 65.9 | 9 | 277.8 | 79.7 |
| 40 | 38.5 | 11.0 | 90 | 86.5 | 24.8 | 140 | 134.6 | 38.6 | 190 | 182.6 | 52.4 | 240 | 230.7 | 66.2 | 290 | 278.8 | 79.9 |
| 1 | 39.4 | 11.3 | 1 | 87.5 | 25.1 | 1 | 135.5 | 38.9 | 1 | 183.6 | 52.6 | 1 | 231.7 | 66.4 | 1 | 279.7 | 80.2 |
| 2 | 40.4 | 11.6 | 2 | 88.4 | 25.4 | 2 | 136.5 | 39.1 | 2 | 184.6 | 52.9 | 2 | 232.6 | 66.7 | 2 | 280.7 | 80.5 |
| 3 | 41.3 | 11.9 | 3 | 89.4 | 25.6 | 3 | 137.5 | 39.4 | 3 | 185.5 | 53.2 | 3 | 233.6 | 67.0 | 3 | 281.6 | 80.8 |
| 4 | 42.3 | 12.1 | 4 | 90.4 | 25.9 | 4 | 138.4 | 39.7 | 4 | 186.5 | 53.5 | 4 | 234.5 | 67.3 | 4 | 282.6 | 81.0 |
| 5 | 43.3 | 12.4 | 5 | 91.3 | 26.2 | 5 | 139.4 | 40.0 | 5 | 187.4 | 53.7 | 5 | 235.5 | 67.5 | 5 | 283.6 | 81.3 |
| 6 | 44.2 | 12.7 | 6 | 92.3 | 26.5 | 6 | 140.3 | 40.2 | 6 | 188.4 | 54.0 | 6 | 236.5 | 67.8 | 6 | 284.5 | 81.6 |
| 7 | 45.2 | 13.0 | 7 | 93.2 | 26.7 | 7 | 141.3 | 40.5 | 7 | 189.4 | 54.3 | 7 | 237.4 | 68.1 | 7 | 285.5 | 81.9 |
| 8 | 46.1 | 13.2 | 8 | 94.2 | 27.0 | 8 | 142.3 | 40.8 | 8 | 190.3 | 54.6 | 8 | 238.4 | 68.4 | 8 | 286.5 | 82.1 |
| 9 | 47.1 | 13.5 | 9 | 95.2 | 27.3 | 9 | 143.2 | 41.1 | 9 | 191.3 | 54.9 | 9 | 239.4 | 68.6 | 9 | 287.4 | 82.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 286 315
269 254 225

R

089 074° 045
091 106 135

R ou φm

R

TABELA 1

R ou φm

359 344° 315
181 196 225

TÁBUAS DE CARTEAÇÃO

001 016 045
179 164 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 288.4 | 82.7 | 350 | 336.4 | 96.5 | 400 | 384.5 | 110.3 | 450 | 432.6 | 124.0 | 500 | 480.6 | 137.8 | 550 | 528.7 | 151.6 |
| 1 | 289.3 | 83.0 | 1 | 337.4 | 96.7 | 1 | 385.5 | 110.5 | 1 | 433.5 | 124.3 | 1 | 481.6 | 138.1 | 1 | 529.7 | 151.9 |
| 2 | 290.3 | 83.2 | 2 | 338.4 | 97.0 | 2 | 386.4 | 110.8 | 2 | 434.5 | 124.6 | 2 | 482.6 | 138.4 | 2 | 530.6 | 152.2 |
| 3 | 291.3 | 83.5 | 3 | 339.3 | 97.3 | 3 | 387.4 | 111.1 | 3 | 435.5 | 124.9 | 3 | 483.5 | 138.6 | 3 | 531.6 | 152.4 |
| 4 | 292.2 | 83.8 | 4 | 340.3 | 97.6 | 4 | 388.3 | 111.4 | 4 | 436.4 | 125.1 | 4 | 484.5 | 138.9 | 4 | 532.5 | 152.7 |
| 5 | 293.2 | 84.1 | 5 | 341.2 | 97.9 | 5 | 389.3 | 111.6 | 5 | 437.4 | 125.4 | 5 | 485.4 | 139.2 | 5 | 533.5 | 153.0 |
| 6 | 294.1 | 84.3 | 6 | 342.2 | 98.1 | 6 | 390.3 | 111.9 | 6 | 438.3 | 125.7 | 6 | 486.4 | 139.5 | 6 | 534.5 | 153.3 |
| 7 | 295.1 | 84.6 | 7 | 343.2 | 98.4 | 7 | 391.2 | 112.2 | 7 | 439.3 | 126.0 | 7 | 487.4 | 139.7 | 7 | 535.4 | 153.5 |
| 8 | 296.1 | 84.9 | 8 | 344.1 | 98.7 | 8 | 392.2 | 112.5 | 8 | 440.3 | 126.2 | 8 | 488.3 | 140.0 | 8 | 536.4 | 153.8 |
| 9 | 297.0 | 85.2 | 9 | 345.1 | 99.0 | 9 | 393.2 | 112.7 | 9 | 441.2 | 126.5 | 9 | 489.3 | 140.3 | 9 | 537.3 | 154.1 |
| 310 | 298.0 | 85.4 | 360 | 346.1 | 99.2 | 410 | 394.1 | 113.0 | 460 | 442.2 | 126.8 | 510 | 490.2 | 140.6 | 560 | 538.3 | 154.4 |
| 1 | 299.0 | 85.7 | 1 | 347.0 | 99.5 | 1 | 395.1 | 113.3 | 1 | 443.1 | 127.1 | 1 | 491.2 | 140.9 | 1 | 539.3 | 154.6 |
| 2 | 299.9 | 86.0 | 2 | 348.0 | 99.8 | 2 | 396.0 | 113.6 | 2 | 444.1 | 127.3 | 2 | 492.2 | 141.1 | 2 | 540.2 | 154.9 |
| 3 | 300.9 | 86.3 | 3 | 348.9 | 100.1 | 3 | 397.0 | 113.8 | 3 | 445.1 | 127.6 | 3 | 493.1 | 141.4 | 3 | 541.2 | 155.2 |
| 4 | 301.8 | 86.6 | 4 | 349.9 | 100.3 | 4 | 398.0 | 114.1 | 4 | 446.0 | 127.9 | 4 | 494.1 | 141.7 | 4 | 542.2 | 155.5 |
| 5 | 302.8 | 86.8 | 5 | 350.9 | 100.6 | 5 | 398.9 | 114.4 | 5 | 447.0 | 128.2 | 5 | 495.0 | 142.0 | 5 | 543.1 | 155.7 |
| 6 | 303.8 | 87.1 | 6 | 351.8 | 100.9 | 6 | 399.9 | 114.7 | 6 | 447.9 | 128.4 | 6 | 496.0 | 142.2 | 6 | 544.1 | 156.0 |
| 7 | 304.7 | 87.4 | 7 | 352.8 | 101.2 | 7 | 400.8 | 114.9 | 7 | 448.9 | 128.7 | 7 | 497.0 | 142.5 | 7 | 545.0 | 156.3 |
| 8 | 305.7 | 87.7 | 8 | 353.7 | 101.4 | 8 | 401.8 | 115.2 | 8 | 449.9 | 129.0 | 8 | 497.9 | 142.8 | 8 | 546.0 | 156.6 |
| 9 | 306.6 | 87.9 | 9 | 354.7 | 101.7 | 9 | 402.8 | 115.5 | 9 | 450.8 | 129.3 | 9 | 498.9 | 143.1 | 9 | 547.0 | 156.8 |
| 320 | 307.6 | 88.2 | 370 | 355.7 | 102.0 | 420 | 403.7 | 115.8 | 470 | 451.8 | 129.5 | 520 | 499.9 | 143.3 | 570 | 547.9 | 157.1 |
| 1 | 308.6 | 88.5 | 1 | 356.6 | 102.3 | 1 | 404.7 | 116.0 | 1 | 452.8 | 129.8 | 1 | 500.8 | 143.6 | 1 | 548.9 | 157.4 |
| 2 | 309.5 | 88.8 | 2 | 357.6 | 102.5 | 2 | 405.7 | 116.3 | 2 | 453.7 | 130.1 | 2 | 501.8 | 143.9 | 2 | 549.8 | 157.7 |
| 3 | 310.5 | 89.0 | 3 | 358.6 | 102.8 | 3 | 406.6 | 116.6 | 3 | 454.7 | 130.4 | 3 | 502.7 | 144.2 | 3 | 550.8 | 157.9 |
| 4 | 311.4 | 89.3 | 4 | 359.5 | 103.1 | 4 | 407.6 | 116.9 | 4 | 455.6 | 130.7 | 4 | 503.7 | 144.4 | 4 | 551.8 | 158.2 |
| 5 | 312.4 | 89.6 | 5 | 360.5 | 103.4 | 5 | 408.5 | 117.1 | 5 | 456.6 | 130.9 | 5 | 504.7 | 144.7 | 5 | 552.7 | 158.5 |
| 6 | 313.4 | 89.9 | 6 | 361.4 | 103.6 | 6 | 409.5 | 117.4 | 6 | 457.6 | 131.2 | 6 | 505.6 | 145.0 | 6 | 553.7 | 158.8 |
| 7 | 314.3 | 90.1 | 7 | 362.4 | 103.9 | 7 | 410.5 | 117.7 | 7 | 458.5 | 131.5 | 7 | 506.6 | 145.3 | 7 | 554.6 | 159.0 |
| 8 | 315.3 | 90.4 | 8 | 363.4 | 104.2 | 8 | 411.4 | 118.0 | 8 | 459.5 | 131.8 | 8 | 507.5 | 145.5 | 8 | 555.6 | 159.3 |
| 9 | 316.3 | 90.7 | 9 | 364.3 | 104.5 | 9 | 412.4 | 118.2 | 9 | 460.4 | 132.0 | 9 | 508.5 | 145.8 | 9 | 556.6 | 159.6 |
| 330 | 317.2 | 91.0 | 380 | 365.3 | 104.7 | 430 | 413.3 | 118.5 | 480 | 461.4 | 132.3 | 530 | 509.5 | 146.1 | 580 | 557.5 | 159.9 |
| 1 | 318.2 | 91.2 | 1 | 366.2 | 105.0 | 1 | 414.3 | 118.8 | 1 | 462.4 | 132.6 | 1 | 510.4 | 146.4 | 1 | 558.5 | 160.1 |
| 2 | 319.1 | 91.5 | 2 | 367.2 | 105.3 | 2 | 415.3 | 119.1 | 2 | 463.3 | 132.9 | 2 | 511.4 | 146.6 | 2 | 559.5 | 160.4 |
| 3 | 320.1 | 91.8 | 3 | 368.2 | 105.6 | 3 | 416.2 | 119.4 | 3 | 464.3 | 133.1 | 3 | 512.4 | 146.9 | 3 | 560.4 | 160.7 |
| 4 | 321.1 | 92.1 | 4 | 369.1 | 105.8 | 4 | 417.2 | 119.6 | 4 | 465.3 | 133.4 | 4 | 513.3 | 147.2 | 4 | 561.4 | 161.0 |
| 5 | 322.0 | 92.3 | 5 | 370.1 | 106.1 | 5 | 418.1 | 119.9 | 5 | 466.2 | 133.7 | 5 | 514.3 | 147.5 | 5 | 562.3 | 161.2 |
| 6 | 323.0 | 92.6 | 6 | 371.0 | 106.4 | 6 | 419.1 | 120.2 | 6 | 467.2 | 134.0 | 6 | 515.2 | 147.7 | 6 | 563.3 | 161.5 |
| 7 | 323.9 | 92.9 | 7 | 372.0 | 106.7 | 7 | 420.1 | 120.5 | 7 | 468.1 | 134.2 | 7 | 516.2 | 148.0 | 7 | 564.3 | 161.8 |
| 8 | 324.9 | 93.2 | 8 | 373.0 | 106.9 | 8 | 421.0 | 120.7 | 8 | 469.1 | 134.5 | 8 | 517.2 | 148.3 | 8 | 565.2 | 162.1 |
| 9 | 325.9 | 93.4 | 9 | 373.9 | 107.2 | 9 | 422.0 | 121.0 | 9 | 470.1 | 134.8 | 9 | 518.1 | 148.6 | 9 | 566.2 | 162.4 |
| 340 | 326.8 | 93.7 | 390 | 374.9 | 107.5 | 440 | 423.0 | 121.3 | 490 | 471.0 | 135.1 | 540 | 519.1 | 148.8 | 590 | 567.1 | 162.6 |
| 1 | 327.8 | 94.0 | 1 | 375.9 | 107.8 | 1 | 423.9 | 121.6 | 1 | 472.0 | 135.3 | 1 | 520.0 | 149.1 | 1 | 568.1 | 162.9 |
| 2 | 328.8 | 94.3 | 2 | 376.8 | 108.0 | 2 | 424.9 | 121.8 | 2 | 472.9 | 135.6 | 2 | 521.0 | 149.4 | 2 | 569.1 | 163.2 |
| 3 | 329.7 | 94.5 | 3 | 377.8 | 108.3 | 3 | 425.8 | 122.1 | 3 | 473.9 | 135.9 | 3 | 522.0 | 149.7 | 3 | 570.0 | 163.5 |
| 4 | 330.7 | 94.8 | 4 | 378.7 | 108.6 | 4 | 426.8 | 122.4 | 4 | 474.9 | 136.2 | 4 | 522.9 | 149.9 | 4 | 571.0 | 163.7 |
| 5 | 331.6 | 95.1 | 5 | 379.7 | 108.9 | 5 | 427.8 | 122.7 | 5 | 475.8 | 136.4 | 5 | 523.9 | 150.2 | 5 | 572.0 | 164.0 |
| 6 | 332.6 | 95.4 | 6 | 380.7 | 109.2 | 6 | 428.7 | 122.9 | 6 | 476.8 | 136.7 | 6 | 524.8 | 150.5 | 6 | 572.9 | 164.3 |
| 7 | 333.6 | 95.6 | 7 | 381.6 | 109.4 | 7 | 429.7 | 123.2 | 7 | 477.7 | 137.0 | 7 | 525.8 | 150.8 | 7 | 573.9 | 164.6 |
| 8 | 334.5 | 95.9 | 8 | 382.6 | 109.7 | 8 | 430.6 | 123.5 | 8 | 478.7 | 137.3 | 8 | 526.8 | 151.0 | 8 | 574.8 | 164.8 |
| 9 | 335.5 | 96.2 | 9 | 383.5 | 110.0 | 9 | 431.6 | 123.8 | 9 | 479.7 | 137.5 | 9 | 527.7 | 151.3 | 9 | 575.8 | 165.1 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 286 315
269 254 225

R

089 074° 045
091 106 135

R ou φm

R

TABELA 1

R ou φm

359 343° 315
181 197 225

TÁBUAS DE CARTEAÇÃO

001 017 045
179 163 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 47.8 | 14.6 | 100 | 95.6 | 29.2 | 150 | 143.4 | 43.9 | 200 | 191.3 | 58.5 | 250 | 239.1 | 73.1 |
| 1 | 1.0 | 0.3 | 1 | 48.8 | 14.9 | 1 | 96.6 | 29.5 | 1 | 144.4 | 44.1 | 1 | 192.2 | 58.8 | 1 | 240.0 | 73.4 |
| 2 | 1.9 | 0.6 | 2 | 49.7 | 15.2 | 2 | 97.5 | 29.8 | 2 | 145.4 | 44.4 | 2 | 193.2 | 59.1 | 2 | 241.0 | 73.7 |
| 3 | 2.9 | 0.9 | 3 | 50.7 | 15.5 | 3 | 98.5 | 30.1 | 3 | 146.3 | 44.7 | 3 | 194.1 | 59.4 | 3 | 241.9 | 74.0 |
| 4 | 3.8 | 1.2 | 4 | 51.6 | 15.8 | 4 | 99.5 | 30.4 | 4 | 147.3 | 45.0 | 4 | 195.1 | 59.6 | 4 | 242.9 | 74.3 |
| 5 | 4.8 | 1.5 | 5 | 52.6 | 16.1 | 5 | 100.4 | 30.7 | 5 | 148.2 | 45.3 | 5 | 196.0 | 59.9 | 5 | 243.9 | 74.6 |
| 6 | 5.7 | 1.8 | 6 | 53.6 | 16.4 | 6 | 101.4 | 31.0 | 6 | 149.2 | 45.6 | 6 | 197.0 | 60.2 | 6 | 244.8 | 74.8 |
| 7 | 6.7 | 2.0 | 7 | 54.5 | 16.7 | 7 | 102.3 | 31.3 | 7 | 150.1 | 45.9 | 7 | 198.0 | 60.5 | 7 | 245.8 | 75.1 |
| 8 | 7.7 | 2.3 | 8 | 55.5 | 17.0 | 8 | 103.3 | 31.6 | 8 | 151.1 | 46.2 | 8 | 198.9 | 60.8 | 8 | 246.7 | 75.4 |
| 9 | 8.6 | 2.6 | 9 | 56.4 | 17.2 | 9 | 104.2 | 31.9 | 9 | 152.1 | 46.5 | 9 | 199.9 | 61.1 | 9 | 247.7 | 75.7 |
| 10 | 9.6 | 2.9 | 60 | 57.4 | 17.5 | 110 | 105.2 | 32.2 | 160 | 153.0 | 46.8 | 210 | 200.8 | 61.4 | 260 | 248.6 | 76.0 |
| 1 | 10.5 | 3.2 | 1 | 58.3 | 17.8 | 1 | 106.1 | 32.5 | 1 | 154.0 | 47.1 | 1 | 201.8 | 61.7 | 1 | 249.6 | 76.3 |
| 2 | 11.5 | 3.5 | 2 | 59.3 | 18.1 | 2 | 107.1 | 32.7 | 2 | 154.9 | 47.4 | 2 | 202.7 | 62.0 | 2 | 250.6 | 76.6 |
| 3 | 12.4 | 3.8 | 3 | 60.2 | 18.4 | 3 | 108.1 | 33.0 | 3 | 155.9 | 47.7 | 3 | 203.7 | 62.3 | 3 | 251.5 | 76.9 |
| 4 | 13.4 | 4.1 | 4 | 61.2 | 18.7 | 4 | 109.0 | 33.3 | 4 | 156.8 | 47.9 | 4 | 204.6 | 62.6 | 4 | 252.5 | 77.2 |
| 5 | 14.3 | 4.4 | 5 | 62.2 | 19.0 | 5 | 110.0 | 33.6 | 5 | 157.8 | 48.2 | 5 | 205.6 | 62.9 | 5 | 253.4 | 77.5 |
| 6 | 15.3 | 4.7 | 6 | 63.1 | 19.3 | 6 | 110.9 | 33.9 | 6 | 158.7 | 48.5 | 6 | 206.6 | 63.2 | 6 | 254.4 | 77.8 |
| 7 | 16.3 | 5.0 | 7 | 64.1 | 19.6 | 7 | 111.9 | 34.2 | 7 | 159.7 | 48.8 | 7 | 207.5 | 63.4 | 7 | 255.3 | 78.1 |
| 8 | 17.2 | 5.3 | 8 | 65.0 | 19.9 | 8 | 112.8 | 34.5 | 8 | 160.7 | 49.1 | 8 | 208.5 | 63.7 | 8 | 256.3 | 78.4 |
| 9 | 18.2 | 5.6 | 9 | 66.0 | 20.2 | 9 | 113.8 | 34.8 | 9 | 161.6 | 49.4 | 9 | 209.4 | 64.0 | 9 | 257.2 | 78.6 |
| 20 | 19.1 | 5.8 | 70 | 66.9 | 20.5 | 120 | 114.8 | 35.1 | 170 | 162.6 | 49.7 | 220 | 210.4 | 64.3 | 270 | 258.2 | 78.9 |
| 1 | 20.1 | 6.1 | 1 | 67.9 | 20.8 | 1 | 115.7 | 35.4 | 1 | 163.5 | 50.0 | 1 | 211.3 | 64.6 | 1 | 259.2 | 79.2 |
| 2 | 21.0 | 6.4 | 2 | 68.9 | 21.1 | 2 | 116.7 | 35.7 | 2 | 164.5 | 50.3 | 2 | 212.3 | 64.9 | 2 | 260.1 | 79.5 |
| 3 | 22.0 | 6.7 | 3 | 69.8 | 21.3 | 3 | 117.6 | 36.0 | 3 | 165.4 | 50.6 | 3 | 213.3 | 65.2 | 3 | 261.1 | 79.8 |
| 4 | 23.0 | 7.0 | 4 | 70.8 | 21.6 | 4 | 118.6 | 36.3 | 4 | 166.4 | 50.9 | 4 | 214.2 | 65.5 | 4 | 262.0 | 80.1 |
| 5 | 23.9 | 7.3 | 5 | 71.7 | 21.9 | 5 | 119.5 | 36.5 | 5 | 167.4 | 51.2 | 5 | 215.2 | 65.8 | 5 | 263.0 | 80.4 |
| 6 | 24.9 | 7.6 | 6 | 72.7 | 22.2 | 6 | 120.5 | 36.8 | 6 | 168.3 | 51.5 | 6 | 216.1 | 66.1 | 6 | 263.9 | 80.7 |
| 7 | 25.8 | 7.9 | 7 | 73.6 | 22.5 | 7 | 121.5 | 37.1 | 7 | 169.3 | 51.7 | 7 | 217.1 | 66.4 | 7 | 264.9 | 81.0 |
| 8 | 26.8 | 8.2 | 8 | 74.6 | 22.8 | 8 | 122.4 | 37.4 | 8 | 170.2 | 52.0 | 8 | 218.0 | 66.7 | 8 | 265.9 | 81.3 |
| 9 | 27.7 | 8.5 | 9 | 75.5 | 23.1 | 9 | 123.4 | 37.7 | 9 | 171.2 | 52.3 | 9 | 219.0 | 67.0 | 9 | 266.8 | 81.6 |
| 30 | 28.7 | 8.8 | 80 | 76.5 | 23.4 | 130 | 124.3 | 38.0 | 180 | 172.1 | 52.6 | 230 | 220.0 | 67.2 | 280 | 267.8 | 81.9 |
| 1 | 29.6 | 9.1 | 1 | 77.5 | 23.7 | 1 | 125.3 | 38.3 | 1 | 173.1 | 52.9 | 1 | 220.9 | 67.5 | 1 | 268.7 | 82.2 |
| 2 | 30.6 | 9.4 | 2 | 78.4 | 24.0 | 2 | 126.2 | 38.6 | 2 | 174.0 | 53.2 | 2 | 221.9 | 67.8 | 2 | 269.7 | 82.4 |
| 3 | 31.6 | 9.6 | 3 | 79.4 | 24.3 | 3 | 127.2 | 38.9 | 3 | 175.0 | 53.5 | 3 | 222.8 | 68.1 | 3 | 270.6 | 82.7 |
| 4 | 32.5 | 9.9 | 4 | 80.3 | 24.6 | 4 | 128.1 | 39.2 | 4 | 176.0 | 53.8 | 4 | 223.8 | 68.4 | 4 | 271.6 | 83.0 |
| 5 | 33.5 | 10.2 | 5 | 81.3 | 24.9 | 5 | 129.1 | 39.5 | 5 | 176.9 | 54.1 | 5 | 224.7 | 68.7 | 5 | 272.5 | 83.3 |
| 6 | 34.4 | 10.5 | 6 | 82.2 | 25.1 | 6 | 130.1 | 39.8 | 6 | 177.9 | 54.4 | 6 | 225.7 | 69.0 | 6 | 273.5 | 83.6 |
| 7 | 35.4 | 10.8 | 7 | 83.2 | 25.4 | 7 | 131.0 | 40.1 | 7 | 178.8 | 54.7 | 7 | 226.6 | 69.3 | 7 | 274.5 | 83.9 |
| 8 | 36.3 | 11.1 | 8 | 84.2 | 25.7 | 8 | 132.0 | 40.3 | 8 | 179.8 | 55.0 | 8 | 227.6 | 69.6 | 8 | 275.4 | 84.2 |
| 9 | 37.3 | 11.4 | 9 | 85.1 | 26.0 | 9 | 132.9 | 40.6 | 9 | 180.7 | 55.3 | 9 | 228.6 | 69.9 | 9 | 276.4 | 84.5 |
| 40 | 38.3 | 11.7 | 90 | 86.1 | 26.3 | 140 | 133.9 | 40.9 | 190 | 181.7 | 55.6 | 240 | 229.5 | 70.2 | 290 | 277.3 | 84.8 |
| 1 | 39.2 | 12.0 | 1 | 87.0 | 26.6 | 1 | 134.8 | 41.2 | 1 | 182.7 | 55.8 | 1 | 230.5 | 70.5 | 1 | 278.3 | 85.1 |
| 2 | 40.2 | 12.3 | 2 | 88.0 | 26.9 | 2 | 135.8 | 41.5 | 2 | 183.6 | 56.1 | 2 | 231.4 | 70.8 | 2 | 279.2 | 85.4 |
| 3 | 41.1 | 12.6 | 3 | 88.9 | 27.2 | 3 | 136.8 | 41.8 | 3 | 184.6 | 56.4 | 3 | 232.4 | 71.0 | 3 | 280.2 | 85.7 |
| 4 | 42.1 | 12.9 | 4 | 89.9 | 27.5 | 4 | 137.7 | 42.1 | 4 | 185.5 | 56.7 | 4 | 233.3 | 71.3 | 4 | 281.2 | 86.0 |
| 5 | 43.0 | 13.2 | 5 | 90.8 | 27.8 | 5 | 138.7 | 42.4 | 5 | 186.5 | 57.0 | 5 | 234.3 | 71.6 | 5 | 282.1 | 86.2 |
| 6 | 44.0 | 13.4 | 6 | 91.8 | 28.1 | 6 | 139.6 | 42.7 | 6 | 187.4 | 57.3 | 6 | 235.3 | 71.9 | 6 | 283.1 | 86.5 |
| 7 | 44.9 | 13.7 | 7 | 92.8 | 28.4 | 7 | 140.6 | 43.0 | 7 | 188.4 | 57.6 | 7 | 236.2 | 72.2 | 7 | 284.0 | 86.8 |
| 8 | 45.9 | 14.0 | 8 | 93.7 | 28.7 | 8 | 141.5 | 43.3 | 8 | 189.3 | 57.9 | 8 | 237.2 | 72.5 | 8 | 285.0 | 87.1 |
| 9 | 46.9 | 14.3 | 9 | 94.7 | 28.9 | 9 | 142.5 | 43.6 | 9 | 190.3 | 58.2 | 9 | 238.1 | 72.8 | 9 | 285.9 | 87.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 287 315
269 253 225

R

089 073° 045
091 107 135

R ou φm

R

TABELA 1

R ou φm

359 343° 315
181 197 225

TÁBUAS DE CARTEAÇÃO

001 017 045
179 163 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 286.9 | 87.7 | 350 | 334.7 | 102.3 | 400 | 382.5 | 116.9 | 450 | 430.3 | 131.6 | 500 | 478.2 | 146.2 | 550 | 526.0 | 160.8 |
| 1 | 287.8 | 88.0 | 1 | 335.7 | 102.6 | 1 | 383.5 | 117.2 | 1 | 431.3 | 131.9 | 1 | 479.1 | 146.5 | 1 | 526.9 | 161.1 |
| 2 | 288.8 | 88.3 | 2 | 336.6 | 102.9 | 2 | 384.4 | 117.5 | 2 | 432.2 | 132.2 | 2 | 480.1 | 146.8 | 2 | 527.9 | 161.4 |
| 3 | 289.8 | 88.6 | 3 | 337.6 | 103.2 | 3 | 385.4 | 117.8 | 3 | 433.2 | 132.4 | 3 | 481.0 | 147.1 | 3 | 528.8 | 161.7 |
| 4 | 290.7 | 88.9 | 4 | 338.5 | 103.5 | 4 | 386.3 | 118.1 | 4 | 434.2 | 132.7 | 4 | 482.0 | 147.4 | 4 | 529.8 | 162.0 |
| 5 | 291.7 | 89.2 | 5 | 339.5 | 103.8 | 5 | 387.3 | 118.4 | 5 | 435.1 | 133.0 | 5 | 482.9 | 147.6 | 5 | 530.7 | 162.3 |
| 6 | 292.6 | 89.5 | 6 | 340.4 | 104.1 | 6 | 388.3 | 118.7 | 6 | 436.1 | 133.3 | 6 | 483.9 | 147.9 | 6 | 531.7 | 162.6 |
| 7 | 293.6 | 89.8 | 7 | 341.4 | 104.4 | 7 | 389.2 | 119.0 | 7 | 437.0 | 133.6 | 7 | 484.8 | 148.2 | 7 | 532.7 | 162.9 |
| 8 | 294.5 | 90.1 | 8 | 342.4 | 104.7 | 8 | 390.2 | 119.3 | 8 | 438.0 | 133.9 | 8 | 485.8 | 148.5 | 8 | 533.6 | 163.1 |
| 9 | 295.5 | 90.3 | 9 | 343.3 | 105.0 | 9 | 391.1 | 119.6 | 9 | 438.9 | 134.2 | 9 | 486.8 | 148.8 | 9 | 534.6 | 163.4 |
| 310 | 296.5 | 90.6 | 360 | 344.3 | 105.3 | 410 | 392.1 | 119.9 | 460 | 439.9 | 134.5 | 510 | 487.7 | 149.1 | 560 | 535.5 | 163.7 |
| 1 | 297.4 | 90.9 | 1 | 345.2 | 105.5 | 1 | 393.0 | 120.2 | 1 | 440.9 | 134.8 | 1 | 488.7 | 149.4 | 1 | 536.5 | 164.0 |
| 2 | 298.4 | 91.2 | 2 | 346.2 | 105.8 | 2 | 394.0 | 120.5 | 2 | 441.8 | 135.1 | 2 | 489.6 | 149.7 | 2 | 537.4 | 164.3 |
| 3 | 299.3 | 91.5 | 3 | 347.1 | 106.1 | 3 | 395.0 | 120.7 | 3 | 442.8 | 135.4 | 3 | 490.6 | 150.0 | 3 | 538.4 | 164.6 |
| 4 | 300.3 | 91.8 | 4 | 348.1 | 106.4 | 4 | 395.9 | 121.0 | 4 | 443.7 | 135.7 | 4 | 491.5 | 150.3 | 4 | 539.4 | 164.9 |
| 5 | 301.2 | 92.1 | 5 | 349.1 | 106.7 | 5 | 396.9 | 121.3 | 5 | 444.7 | 136.0 | 5 | 492.5 | 150.6 | 5 | 540.3 | 165.2 |
| 6 | 302.2 | 92.4 | 6 | 350.0 | 107.0 | 6 | 397.8 | 121.6 | 6 | 445.6 | 136.2 | 6 | 493.5 | 150.9 | 6 | 541.3 | 165.5 |
| 7 | 303.1 | 92.7 | 7 | 351.0 | 107.3 | 7 | 398.8 | 121.9 | 7 | 446.6 | 136.5 | 7 | 494.4 | 151.2 | 7 | 542.2 | 165.8 |
| 8 | 304.1 | 93.0 | 8 | 351.9 | 107.6 | 8 | 399.7 | 122.2 | 8 | 447.6 | 136.8 | 8 | 495.4 | 151.4 | 8 | 543.2 | 166.1 |
| 9 | 305.1 | 93.3 | 9 | 352.9 | 107.9 | 9 | 400.7 | 122.5 | 9 | 448.5 | 137.1 | 9 | 496.3 | 151.7 | 9 | 544.1 | 166.4 |
| 320 | 306.0 | 93.6 | 370 | 353.8 | 108.2 | 420 | 401.6 | 122.8 | 470 | 449.5 | 137.4 | 520 | 497.3 | 152.0 | 570 | 545.1 | 166.7 |
| 1 | 307.0 | 93.9 | 1 | 354.8 | 108.5 | 1 | 402.6 | 123.1 | 1 | 450.4 | 137.7 | 1 | 498.2 | 152.3 | 1 | 546.0 | 166.9 |
| 2 | 307.9 | 94.1 | 2 | 355.7 | 108.8 | 2 | 403.6 | 123.4 | 2 | 451.4 | 138.0 | 2 | 499.2 | 152.6 | 2 | 547.0 | 167.2 |
| 3 | 308.9 | 94.4 | 3 | 356.7 | 109.1 | 3 | 404.5 | 123.7 | 3 | 452.3 | 138.3 | 3 | 500.1 | 152.9 | 3 | 548.0 | 167.5 |
| 4 | 309.8 | 94.7 | 4 | 357.7 | 109.3 | 4 | 405.5 | 124.0 | 4 | 453.3 | 138.6 | 4 | 501.1 | 153.2 | 4 | 548.9 | 167.8 |
| 5 | 310.8 | 95.0 | 5 | 358.6 | 109.6 | 5 | 406.4 | 124.3 | 5 | 454.2 | 138.9 | 5 | 502.1 | 153.5 | 5 | 549.9 | 168.1 |
| 6 | 311.8 | 95.3 | 6 | 359.6 | 109.9 | 6 | 407.4 | 124.6 | 6 | 455.2 | 139.2 | 6 | 503.0 | 153.8 | 6 | 550.8 | 168.4 |
| 7 | 312.7 | 95.6 | 7 | 360.5 | 110.2 | 7 | 408.3 | 124.8 | 7 | 456.2 | 139.5 | 7 | 504.0 | 154.1 | 7 | 551.8 | 168.7 |
| 8 | 313.7 | 95.9 | 8 | 361.5 | 110.5 | 8 | 409.3 | 125.1 | 8 | 457.1 | 139.8 | 8 | 504.9 | 154.4 | 8 | 552.7 | 169.0 |
| 9 | 314.6 | 96.2 | 9 | 362.4 | 110.8 | 9 | 410.3 | 125.4 | 9 | 458.1 | 140.0 | 9 | 505.9 | 154.7 | 9 | 553.7 | 169.3 |
| 330 | 315.6 | 96.5 | 380 | 363.4 | 111.1 | 430 | 411.2 | 125.7 | 480 | 459.0 | 140.3 | 530 | 506.8 | 155.0 | 580 | 554.7 | 169.6 |
| 1 | 316.5 | 96.8 | 1 | 364.4 | 111.4 | 1 | 412.2 | 126.0 | 1 | 460.0 | 140.6 | 1 | 507.8 | 155.2 | 1 | 555.6 | 169.9 |
| 2 | 317.5 | 97.1 | 2 | 365.3 | 111.7 | 2 | 413.1 | 126.3 | 2 | 460.9 | 140.9 | 2 | 508.8 | 155.5 | 2 | 556.6 | 170.2 |
| 3 | 318.4 | 97.4 | 3 | 366.3 | 112.0 | 3 | 414.1 | 126.6 | 3 | 461.9 | 141.2 | 3 | 509.7 | 155.8 | 3 | 557.5 | 170.5 |
| 4 | 319.4 | 97.7 | 4 | 367.2 | 112.3 | 4 | 415.0 | 126.9 | 4 | 462.9 | 141.5 | 4 | 510.7 | 156.1 | 4 | 558.5 | 170.7 |
| 5 | 320.4 | 97.9 | 5 | 368.2 | 112.6 | 5 | 416.0 | 127.2 | 5 | 463.8 | 141.8 | 5 | 511.6 | 156.4 | 5 | 559.4 | 171.0 |
| 6 | 321.3 | 98.2 | 6 | 369.1 | 112.9 | 6 | 416.9 | 127.5 | 6 | 464.8 | 142.1 | 6 | 512.6 | 156.7 | 6 | 560.4 | 171.3 |
| 7 | 322.3 | 98.5 | 7 | 370.1 | 113.1 | 7 | 417.9 | 127.8 | 7 | 465.7 | 142.4 | 7 | 513.5 | 157.0 | 7 | 561.4 | 171.6 |
| 8 | 323.2 | 98.8 | 8 | 371.0 | 113.4 | 8 | 418.9 | 128.1 | 8 | 466.7 | 142.7 | 8 | 514.5 | 157.3 | 8 | 562.3 | 171.9 |
| 9 | 324.2 | 99.1 | 9 | 372.0 | 113.7 | 9 | 419.8 | 128.4 | 9 | 467.6 | 143.0 | 9 | 515.4 | 157.6 | 9 | 563.3 | 172.2 |
| 340 | 325.1 | 99.4 | 390 | 373.0 | 114.0 | 440 | 420.8 | 128.6 | 490 | 468.6 | 143.3 | 540 | 516.4 | 157.9 | 590 | 564.2 | 172.5 |
| 1 | 326.1 | 99.7 | 1 | 373.9 | 114.3 | 1 | 421.7 | 128.9 | 1 | 469.5 | 143.6 | 1 | 517.4 | 158.2 | 1 | 565.2 | 172.8 |
| 2 | 327.1 | 100.0 | 2 | 374.9 | 114.6 | 2 | 422.7 | 129.2 | 2 | 470.5 | 143.8 | 2 | 518.3 | 158.5 | 2 | 566.1 | 173.1 |
| 3 | 328.0 | 100.3 | 3 | 375.8 | 114.9 | 3 | 423.6 | 129.5 | 3 | 471.5 | 144.1 | 3 | 519.3 | 158.8 | 3 | 567.1 | 173.4 |
| 4 | 329.0 | 100.6 | 4 | 376.8 | 115.2 | 4 | 424.6 | 129.8 | 4 | 472.4 | 144.4 | 4 | 520.2 | 159.1 | 4 | 568.0 | 173.7 |
| 5 | 329.9 | 100.9 | 5 | 377.7 | 115.5 | 5 | 425.6 | 130.1 | 5 | 473.4 | 144.7 | 5 | 521.2 | 159.3 | 5 | 569.0 | 174.0 |
| 6 | 330.9 | 101.2 | 6 | 378.7 | 115.8 | 6 | 426.5 | 130.4 | 6 | 474.3 | 145.0 | 6 | 522.1 | 159.6 | 6 | 570.0 | 174.3 |
| 7 | 331.8 | 101.5 | 7 | 379.7 | 116.1 | 7 | 427.5 | 130.7 | 7 | 475.3 | 145.3 | 7 | 523.1 | 159.9 | 7 | 570.9 | 174.5 |
| 8 | 332.8 | 101.7 | 8 | 380.6 | 116.4 | 8 | 428.4 | 131.0 | 8 | 476.2 | 145.6 | 8 | 524.1 | 160.2 | 8 | 571.9 | 174.8 |
| 9 | 333.8 | 102.0 | 9 | 381.6 | 116.7 | 9 | 429.4 | 131.3 | 9 | 477.2 | 145.9 | 9 | 525.0 | 160.5 | 9 | 572.8 | 175.1 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 287 315
269 253 225

R

089 073° 045
091 107 135

R ou φm

R

TABELA 1

R ou φm

359 342° 315
181 198 225

TÁBUAS DE CARTEAÇÃO

001 018 045
179 162 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 47.6 | 15.5 | 100 | 95.1 | 30.9 | 150 | 142.7 | 46.4 | 200 | 190.2 | 61.8 | 250 | 237.8 | 77.3 |
| 1 | 1.0 | 0.3 | 1 | 48.5 | 15.8 | 1 | 96.1 | 31.2 | 1 | 143.6 | 46.7 | 1 | 191.2 | 62.1 | 1 | 238.7 | 77.6 |
| 2 | 1.9 | 0.6 | 2 | 49.5 | 16.1 | 2 | 97.0 | 31.5 | 2 | 144.6 | 47.0 | 2 | 192.1 | 62.4 | 2 | 239.7 | 77.9 |
| 3 | 2.9 | 0.9 | 3 | 50.4 | 16.4 | 3 | 98.0 | 31.8 | 3 | 145.5 | 47.3 | 3 | 193.1 | 62.7 | 3 | 240.6 | 78.2 |
| 4 | 3.8 | 1.2 | 4 | 51.4 | 16.7 | 4 | 98.9 | 32.1 | 4 | 146.5 | 47.6 | 4 | 194.0 | 63.0 | 4 | 241.6 | 78.5 |
| 5 | 4.8 | 1.5 | 5 | 52.3 | 17.0 | 5 | 99.9 | 32.4 | 5 | 147.4 | 47.9 | 5 | 195.0 | 63.3 | 5 | 242.5 | 78.8 |
| 6 | 5.7 | 1.9 | 6 | 53.3 | 17.3 | 6 | 100.8 | 32.8 | 6 | 148.4 | 48.2 | 6 | 195.9 | 63.7 | 6 | 243.5 | 79.1 |
| 7 | 6.7 | 2.2 | 7 | 54.2 | 17.6 | 7 | 101.8 | 33.1 | 7 | 149.3 | 48.5 | 7 | 196.9 | 64.0 | 7 | 244.4 | 79.4 |
| 8 | 7.6 | 2.5 | 8 | 55.2 | 17.9 | 8 | 102.7 | 33.4 | 8 | 150.3 | 48.8 | 8 | 197.8 | 64.3 | 8 | 245.4 | 79.7 |
| 9 | 8.6 | 2.8 | 9 | 56.1 | 18.2 | 9 | 103.7 | 33.7 | 9 | 151.2 | 49.1 | 9 | 198.8 | 64.6 | 9 | 246.3 | 80.0 |
| 10 | 9.5 | 3.1 | 60 | 57.1 | 18.5 | 110 | 104.6 | 34.0 | 160 | 152.2 | 49.4 | 210 | 199.7 | 64.9 | 260 | 247.3 | 80.3 |
| 1 | 10.5 | 3.4 | 1 | 58.0 | 18.9 | 1 | 105.6 | 34.3 | 1 | 153.1 | 49.8 | 1 | 200.7 | 65.2 | 1 | 248.2 | 80.7 |
| 2 | 11.4 | 3.7 | 2 | 59.0 | 19.2 | 2 | 106.5 | 34.6 | 2 | 154.1 | 50.1 | 2 | 201.6 | 65.5 | 2 | 249.2 | 81.0 |
| 3 | 12.4 | 4.0 | 3 | 59.9 | 19.5 | 3 | 107.5 | 34.9 | 3 | 155.0 | 50.4 | 3 | 202.6 | 65.8 | 3 | 250.1 | 81.3 |
| 4 | 13.3 | 4.3 | 4 | 60.9 | 19.8 | 4 | 108.4 | 35.2 | 4 | 156.0 | 50.7 | 4 | 203.5 | 66.1 | 4 | 251.1 | 81.6 |
| 5 | 14.3 | 4.6 | 5 | 61.8 | 20.1 | 5 | 109.4 | 35.5 | 5 | 156.9 | 51.0 | 5 | 204.5 | 66.4 | 5 | 252.0 | 81.9 |
| 6 | 15.2 | 4.9 | 6 | 62.8 | 20.4 | 6 | 110.3 | 35.8 | 6 | 157.9 | 51.3 | 6 | 205.4 | 66.7 | 6 | 253.0 | 82.2 |
| 7 | 16.2 | 5.3 | 7 | 63.7 | 20.7 | 7 | 111.3 | 36.2 | 7 | 158.8 | 51.6 | 7 | 206.4 | 67.1 | 7 | 253.9 | 82.5 |
| 8 | 17.1 | 5.6 | 8 | 64.7 | 21.0 | 8 | 112.2 | 36.5 | 8 | 159.8 | 51.9 | 8 | 207.3 | 67.4 | 8 | 254.9 | 82.8 |
| 9 | 18.1 | 5.9 | 9 | 65.6 | 21.3 | 9 | 113.2 | 36.8 | 9 | 160.7 | 52.2 | 9 | 208.3 | 67.7 | 9 | 255.8 | 83.1 |
| 20 | 19.0 | 6.2 | 70 | 66.6 | 21.6 | 120 | 114.1 | 37.1 | 170 | 161.7 | 52.5 | 220 | 209.2 | 68.0 | 270 | 256.8 | 83.4 |
| 1 | 20.0 | 6.5 | 1 | 67.5 | 21.9 | 1 | 115.1 | 37.4 | 1 | 162.6 | 52.8 | 1 | 210.2 | 68.3 | 1 | 257.7 | 83.7 |
| 2 | 20.9 | 6.8 | 2 | 68.5 | 22.2 | 2 | 116.0 | 37.7 | 2 | 163.6 | 53.2 | 2 | 211.1 | 68.6 | 2 | 258.7 | 84.1 |
| 3 | 21.9 | 7.1 | 3 | 69.4 | 22.6 | 3 | 117.0 | 38.0 | 3 | 164.5 | 53.5 | 3 | 212.1 | 68.9 | 3 | 259.6 | 84.4 |
| 4 | 22.8 | 7.4 | 4 | 70.4 | 22.9 | 4 | 117.9 | 38.3 | 4 | 165.5 | 53.8 | 4 | 213.0 | 69.2 | 4 | 260.6 | 84.7 |
| 5 | 23.8 | 7.7 | 5 | 71.3 | 23.2 | 5 | 118.9 | 38.6 | 5 | 166.4 | 54.1 | 5 | 214.0 | 69.5 | 5 | 261.5 | 85.0 |
| 6 | 24.7 | 8.0 | 6 | 72.3 | 23.5 | 6 | 119.8 | 38.9 | 6 | 167.4 | 54.4 | 6 | 214.9 | 69.8 | 6 | 262.5 | 85.3 |
| 7 | 25.7 | 8.3 | 7 | 73.2 | 23.8 | 7 | 120.8 | 39.2 | 7 | 168.3 | 54.7 | 7 | 215.9 | 70.1 | 7 | 263.4 | 85.6 |
| 8 | 26.6 | 8.7 | 8 | 74.2 | 24.1 | 8 | 121.7 | 39.6 | 8 | 169.3 | 55.0 | 8 | 216.8 | 70.5 | 8 | 264.4 | 85.9 |
| 9 | 27.6 | 9.0 | 9 | 75.1 | 24.4 | 9 | 122.7 | 39.9 | 9 | 170.2 | 55.3 | 9 | 217.8 | 70.8 | 9 | 265.3 | 86.2 |
| 30 | 28.5 | 9.3 | 80 | 76.1 | 24.7 | 130 | 123.6 | 40.2 | 180 | 171.2 | 55.6 | 230 | 218.7 | 71.1 | 280 | 266.3 | 86.5 |
| 1 | 29.5 | 9.6 | 1 | 77.0 | 25.0 | 1 | 124.6 | 40.5 | 1 | 172.1 | 55.9 | 1 | 219.7 | 71.4 | 1 | 267.2 | 86.8 |
| 2 | 30.4 | 9.9 | 2 | 78.0 | 25.3 | 2 | 125.5 | 40.8 | 2 | 173.1 | 56.2 | 2 | 220.6 | 71.7 | 2 | 268.2 | 87.1 |
| 3 | 31.4 | 10.2 | 3 | 78.9 | 25.6 | 3 | 126.5 | 41.1 | 3 | 174.0 | 56.6 | 3 | 221.6 | 72.0 | 3 | 269.1 | 87.5 |
| 4 | 32.3 | 10.5 | 4 | 79.9 | 26.0 | 4 | 127.4 | 41.4 | 4 | 175.0 | 56.9 | 4 | 222.5 | 72.3 | 4 | 270.1 | 87.8 |
| 5 | 33.3 | 10.8 | 5 | 80.8 | 26.3 | 5 | 128.4 | 41.7 | 5 | 175.9 | 57.2 | 5 | 223.5 | 72.6 | 5 | 271.1 | 88.1 |
| 6 | 34.2 | 11.1 | 6 | 81.8 | 26.6 | 6 | 129.3 | 42.0 | 6 | 176.9 | 57.5 | 6 | 224.4 | 72.9 | 6 | 272.0 | 88.4 |
| 7 | 35.2 | 11.4 | 7 | 82.7 | 26.9 | 7 | 130.3 | 42.3 | 7 | 177.8 | 57.8 | 7 | 225.4 | 73.2 | 7 | 273.0 | 88.7 |
| 8 | 36.1 | 11.7 | 8 | 83.7 | 27.2 | 8 | 131.2 | 42.6 | 8 | 178.8 | 58.1 | 8 | 226.4 | 73.5 | 8 | 273.9 | 89.0 |
| 9 | 37.1 | 12.1 | 9 | 84.6 | 27.5 | 9 | 132.2 | 43.0 | 9 | 179.7 | 58.4 | 9 | 227.3 | 73.9 | 9 | 274.9 | 89.3 |
| 40 | 38.0 | 12.4 | 90 | 85.6 | 27.8 | 140 | 133.1 | 43.3 | 190 | 180.7 | 58.7 | 240 | 228.3 | 74.2 | 290 | 275.8 | 89.6 |
| 1 | 39.0 | 12.7 | 1 | 86.5 | 28.1 | 1 | 134.1 | 43.6 | 1 | 181.7 | 59.0 | 1 | 229.2 | 74.5 | 1 | 276.8 | 89.9 |
| 2 | 39.9 | 13.0 | 2 | 87.5 | 28.4 | 2 | 135.1 | 43.9 | 2 | 182.6 | 59.3 | 2 | 230.2 | 74.8 | 2 | 277.7 | 90.2 |
| 3 | 40.9 | 13.3 | 3 | 88.4 | 28.7 | 3 | 136.0 | 44.2 | 3 | 183.6 | 59.6 | 3 | 231.1 | 75.1 | 3 | 278.7 | 90.5 |
| 4 | 41.8 | 13.6 | 4 | 89.4 | 29.0 | 4 | 137.0 | 44.5 | 4 | 184.5 | 59.9 | 4 | 232.1 | 75.4 | 4 | 279.6 | 90.9 |
| 5 | 42.8 | 13.9 | 5 | 90.4 | 29.4 | 5 | 137.9 | 44.8 | 5 | 185.5 | 60.3 | 5 | 233.0 | 75.7 | 5 | 280.6 | 91.2 |
| 6 | 43.7 | 14.2 | 6 | 91.3 | 29.7 | 6 | 138.9 | 45.1 | 6 | 186.4 | 60.6 | 6 | 234.0 | 76.0 | 6 | 281.5 | 91.5 |
| 7 | 44.7 | 14.5 | 7 | 92.3 | 30.0 | 7 | 139.8 | 45.4 | 7 | 187.4 | 60.9 | 7 | 234.9 | 76.3 | 7 | 282.5 | 91.8 |
| 8 | 45.7 | 14.8 | 8 | 93.2 | 30.3 | 8 | 140.8 | 45.7 | 8 | 188.3 | 61.2 | 8 | 235.9 | 76.6 | 8 | 283.4 | 92.1 |
| 9 | 46.6 | 15.1 | 9 | 94.2 | 30.6 | 9 | 141.7 | 46.0 | 9 | 189.3 | 61.5 | 9 | 236.8 | 76.9 | 9 | 284.4 | 92.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 288 315
269 252 225

R

089 072° 045
091 108 135

R ou φm

R**TABELA 1****R** ou ϕ m

359 **342°** 315
181 **198** 225

TÁBUAS DE CARTEAÇÃO

001 **018** 045
179 **162** 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|
| D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap |
| 300 | 285.3 | 92.7 | 350 | 332.9 | 108.2 | 400 | 380.4 | 123.6 | 450 | 428.0 | 139.1 | 500 | 475.5 | 154.5 | 550 | 523.1 | 170.0 |
| 1 | 286.3 | 93.0 | 1 | 333.8 | 108.5 | 1 | 381.4 | 123.9 | 1 | 428.9 | 139.4 | 1 | 476.5 | 154.8 | 1 | 524.0 | 170.3 |
| 2 | 287.2 | 93.3 | 2 | 334.8 | 108.8 | 2 | 382.3 | 124.2 | 2 | 429.9 | 139.7 | 2 | 477.4 | 155.1 | 2 | 525.0 | 170.6 |
| 3 | 288.2 | 93.6 | 3 | 335.7 | 109.1 | 3 | 383.3 | 124.5 | 3 | 430.8 | 140.0 | 3 | 478.4 | 155.4 | 3 | 525.9 | 170.9 |
| 4 | 289.1 | 93.9 | 4 | 336.7 | 109.4 | 4 | 384.2 | 124.8 | 4 | 431.8 | 140.3 | 4 | 479.3 | 155.7 | 4 | 526.9 | 171.2 |
| 5 | 290.1 | 94.3 | 5 | 337.6 | 109.7 | 5 | 385.2 | 125.2 | 5 | 432.7 | 140.6 | 5 | 480.3 | 156.1 | 5 | 527.8 | 171.5 |
| 6 | 291.0 | 94.6 | 6 | 338.6 | 110.0 | 6 | 386.1 | 125.5 | 6 | 433.7 | 140.9 | 6 | 481.2 | 156.4 | 6 | 528.8 | 171.8 |
| 7 | 292.0 | 94.9 | 7 | 339.5 | 110.3 | 7 | 387.1 | 125.8 | 7 | 434.6 | 141.2 | 7 | 482.2 | 156.7 | 7 | 529.7 | 172.1 |
| 8 | 292.9 | 95.2 | 8 | 340.5 | 110.6 | 8 | 388.0 | 126.1 | 8 | 435.6 | 141.5 | 8 | 483.1 | 157.0 | 8 | 530.7 | 172.4 |
| 9 | 293.9 | 95.5 | 9 | 341.4 | 110.9 | 9 | 389.0 | 126.4 | 9 | 436.5 | 141.8 | 9 | 484.1 | 157.3 | 9 | 531.6 | 172.7 |
| 310 | 294.8 | 95.8 | 360 | 342.4 | 111.2 | 410 | 389.9 | 126.7 | 460 | 437.5 | 142.1 | 510 | 485.0 | 157.6 | 560 | 532.6 | 173.0 |
| 1 | 295.8 | 96.1 | 1 | 343.3 | 111.6 | 1 | 390.9 | 127.0 | 1 | 438.4 | 142.5 | 1 | 486.0 | 157.9 | 1 | 533.5 | 173.4 |
| 2 | 296.7 | 96.4 | 2 | 344.3 | 111.9 | 2 | 391.8 | 127.3 | 2 | 439.4 | 142.8 | 2 | 486.9 | 158.2 | 2 | 534.5 | 173.7 |
| 3 | 297.7 | 96.7 | 3 | 345.2 | 112.2 | 3 | 392.8 | 127.6 | 3 | 440.3 | 143.1 | 3 | 487.9 | 158.5 | 3 | 535.4 | 174.0 |
| 4 | 298.6 | 97.0 | 4 | 346.2 | 112.5 | 4 | 393.7 | 127.9 | 4 | 441.3 | 143.4 | 4 | 488.8 | 158.8 | 4 | 536.4 | 174.3 |
| 5 | 299.6 | 97.3 | 5 | 347.1 | 112.8 | 5 | 394.7 | 128.2 | 5 | 442.2 | 143.7 | 5 | 489.8 | 159.1 | 5 | 537.3 | 174.6 |
| 6 | 300.5 | 97.6 | 6 | 348.1 | 113.1 | 6 | 395.6 | 128.6 | 6 | 443.2 | 144.0 | 6 | 490.7 | 159.5 | 6 | 538.3 | 174.9 |
| 7 | 301.5 | 98.0 | 7 | 349.0 | 113.4 | 7 | 396.6 | 128.9 | 7 | 444.1 | 144.3 | 7 | 491.7 | 159.8 | 7 | 539.2 | 175.2 |
| 8 | 302.4 | 98.3 | 8 | 350.0 | 113.7 | 8 | 397.5 | 129.2 | 8 | 445.1 | 144.6 | 8 | 492.6 | 160.1 | 8 | 540.2 | 175.5 |
| 9 | 303.4 | 98.6 | 9 | 350.9 | 114.0 | 9 | 398.5 | 129.5 | 9 | 446.0 | 144.9 | 9 | 493.6 | 160.4 | 9 | 541.2 | 175.8 |
| 320 | 304.3 | 98.9 | 370 | 351.9 | 114.3 | 420 | 399.4 | 129.8 | 470 | 447.0 | 145.2 | 520 | 494.5 | 160.7 | 570 | 542.1 | 176.1 |
| 1 | 305.3 | 99.2 | 1 | 352.8 | 114.6 | 1 | 400.4 | 130.1 | 1 | 447.9 | 145.5 | 1 | 495.5 | 161.0 | 1 | 543.1 | 176.4 |
| 2 | 306.2 | 99.5 | 2 | 353.8 | 115.0 | 2 | 401.3 | 130.4 | 2 | 448.9 | 145.9 | 2 | 496.5 | 161.3 | 2 | 544.0 | 176.8 |
| 3 | 307.2 | 99.8 | 3 | 354.7 | 115.3 | 3 | 402.3 | 130.7 | 3 | 449.8 | 146.2 | 3 | 497.4 | 161.6 | 3 | 545.0 | 177.1 |
| 4 | 308.1 | 100.1 | 4 | 355.7 | 115.6 | 4 | 403.2 | 131.0 | 4 | 450.8 | 146.5 | 4 | 498.4 | 161.9 | 4 | 545.9 | 177.4 |
| 5 | 309.1 | 100.4 | 5 | 356.6 | 115.9 | 5 | 404.2 | 131.3 | 5 | 451.8 | 146.8 | 5 | 499.3 | 162.2 | 5 | 546.9 | 177.7 |
| 6 | 310.0 | 100.7 | 6 | 357.6 | 116.2 | 6 | 405.1 | 131.6 | 6 | 452.7 | 147.1 | 6 | 500.3 | 162.5 | 6 | 547.8 | 178.0 |
| 7 | 311.0 | 101.0 | 7 | 358.5 | 116.5 | 7 | 406.1 | 132.0 | 7 | 453.7 | 147.4 | 7 | 501.2 | 162.9 | 7 | 548.8 | 178.3 |
| 8 | 311.9 | 101.4 | 8 | 359.5 | 116.8 | 8 | 407.1 | 132.3 | 8 | 454.6 | 147.7 | 8 | 502.2 | 163.2 | 8 | 549.7 | 178.6 |
| 9 | 312.9 | 101.7 | 9 | 360.5 | 117.1 | 9 | 408.0 | 132.6 | 9 | 455.6 | 148.0 | 9 | 503.1 | 163.5 | 9 | 550.7 | 178.9 |
| 330 | 313.8 | 102.0 | 380 | 361.4 | 117.4 | 430 | 409.0 | 132.9 | 480 | 456.5 | 148.3 | 530 | 504.1 | 163.8 | 580 | 551.6 | 179.2 |
| 1 | 314.8 | 102.3 | 1 | 362.4 | 117.7 | 1 | 409.9 | 133.2 | 1 | 457.5 | 148.6 | 1 | 505.0 | 164.1 | 1 | 552.6 | 179.5 |
| 2 | 315.8 | 102.6 | 2 | 363.3 | 118.0 | 2 | 410.9 | 133.5 | 2 | 458.4 | 148.9 | 2 | 506.0 | 164.4 | 2 | 553.5 | 179.8 |
| 3 | 316.7 | 102.9 | 3 | 364.3 | 118.4 | 3 | 411.8 | 133.8 | 3 | 459.4 | 149.3 | 3 | 506.9 | 164.7 | 3 | 554.5 | 180.2 |
| 4 | 317.7 | 103.2 | 4 | 365.2 | 118.7 | 4 | 412.8 | 134.1 | 4 | 460.3 | 149.6 | 4 | 507.9 | 165.0 | 4 | 555.4 | 180.5 |
| 5 | 318.6 | 103.5 | 5 | 366.2 | 119.0 | 5 | 413.7 | 134.4 | 5 | 461.3 | 149.9 | 5 | 508.8 | 165.3 | 5 | 556.4 | 180.8 |
| 6 | 319.6 | 103.8 | 6 | 367.1 | 119.3 | 6 | 414.7 | 134.7 | 6 | 462.2 | 150.2 | 6 | 509.8 | 165.6 | 6 | 557.3 | 181.1 |
| 7 | 320.5 | 104.1 | 7 | 368.1 | 119.6 | 7 | 415.6 | 135.0 | 7 | 463.2 | 150.5 | 7 | 510.7 | 165.9 | 7 | 558.3 | 181.4 |
| 8 | 321.5 | 104.4 | 8 | 369.0 | 119.9 | 8 | 416.6 | 135.3 | 8 | 464.1 | 150.8 | 8 | 511.7 | 166.3 | 8 | 559.2 | 181.7 |
| 9 | 322.4 | 104.8 | 9 | 370.0 | 120.2 | 9 | 417.5 | 135.7 | 9 | 465.1 | 151.1 | 9 | 512.6 | 166.6 | 9 | 560.2 | 182.0 |
| 340 | 323.4 | 105.1 | 390 | 370.9 | 120.5 | 440 | 418.5 | 136.0 | 490 | 466.0 | 151.4 | 540 | 513.6 | 166.9 | 590 | 561.1 | 182.3 |
| 1 | 324.3 | 105.4 | 1 | 371.9 | 120.8 | 1 | 419.4 | 136.3 | 1 | 467.0 | 151.7 | 1 | 514.5 | 167.2 | 1 | 562.1 | 182.6 |
| 2 | 325.3 | 105.7 | 2 | 372.8 | 121.1 | 2 | 420.4 | 136.6 | 2 | 467.9 | 152.0 | 2 | 515.5 | 167.5 | 2 | 563.0 | 182.9 |
| 3 | 326.2 | 106.0 | 3 | 373.8 | 121.4 | 3 | 421.3 | 136.9 | 3 | 468.9 | 152.3 | 3 | 516.4 | 167.8 | 3 | 564.0 | 183.2 |
| 4 | 327.2 | 106.3 | 4 | 374.7 | 121.8 | 4 | 422.3 | 137.2 | 4 | 469.8 | 152.7 | 4 | 517.4 | 168.1 | 4 | 564.9 | 183.6 |
| 5 | 328.1 | 106.6 | 5 | 375.7 | 122.1 | 5 | 423.2 | 137.5 | 5 | 470.8 | 153.0 | 5 | 518.3 | 168.4 | 5 | 565.9 | 183.9 |
| 6 | 329.1 | 106.9 | 6 | 376.6 | 122.4 | 6 | 424.2 | 137.8 | 6 | 471.7 | 153.3 | 6 | 519.3 | 168.7 | 6 | 566.8 | 184.2 |
| 7 | 330.0 | 107.2 | 7 | 377.6 | 122.7 | 7 | 425.1 | 138.1 | 7 | 472.7 | 153.6 | 7 | 520.2 | 169.0 | 7 | 567.8 | 184.5 |
| 8 | 331.0 | 107.5 | 8 | 378.5 | 123.0 | 8 | 426.1 | 138.4 | 8 | 473.6 | 153.9 | 8 | 521.2 | 169.3 | 8 | 568.7 | 184.8 |
| 9 | 331.9 | 107.8 | 9 | 379.5 | 123.3 | 9 | 427.0 | 138.7 | 9 | 474.6 | 154.2 | 9 | 522.1 | 169.7 | 9 | 569.7 | 185.1 |
| D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 **288** 315
269 **252** 225

R

089 **072°** 045
091 **108** 135

R ou ϕ m

R

TABELA 1

R ou φm

359 341° 315
181 199 225

TÁBUAS DE CARTEAÇÃO

091 019 045
179 161 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 47.3 | 16.3 | 100 | 94.6 | 32.6 | 150 | 141.8 | 48.8 | 200 | 189.1 | 65.1 | 250 | 236.4 | 81.4 |
| 1 | 0.9 | 0.3 | 1 | 48.2 | 16.6 | 1 | 95.5 | 32.9 | 1 | 142.8 | 49.2 | 1 | 190.0 | 65.4 | 1 | 237.3 | 81.7 |
| 2 | 1.9 | 0.7 | 2 | 49.2 | 16.9 | 2 | 96.4 | 33.2 | 2 | 143.7 | 49.5 | 2 | 191.0 | 65.8 | 2 | 238.3 | 82.0 |
| 3 | 2.8 | 1.0 | 3 | 50.1 | 17.3 | 3 | 97.4 | 33.5 | 3 | 144.7 | 49.8 | 3 | 191.9 | 66.1 | 3 | 239.2 | 82.4 |
| 4 | 3.8 | 1.3 | 4 | 51.1 | 17.6 | 4 | 98.3 | 33.9 | 4 | 145.6 | 50.1 | 4 | 192.9 | 66.4 | 4 | 240.2 | 82.7 |
| 5 | 4.7 | 1.6 | 5 | 52.0 | 17.9 | 5 | 99.3 | 34.2 | 5 | 146.6 | 50.5 | 5 | 193.8 | 66.7 | 5 | 241.1 | 83.0 |
| 6 | 5.7 | 2.0 | 6 | 52.9 | 18.2 | 6 | 100.2 | 34.5 | 6 | 147.5 | 50.8 | 6 | 194.8 | 67.1 | 6 | 242.1 | 83.3 |
| 7 | 6.6 | 2.3 | 7 | 53.9 | 18.6 | 7 | 101.2 | 34.8 | 7 | 148.4 | 51.1 | 7 | 195.7 | 67.4 | 7 | 243.0 | 83.7 |
| 8 | 7.6 | 2.6 | 8 | 54.8 | 18.9 | 8 | 102.1 | 35.2 | 8 | 149.4 | 51.4 | 8 | 196.7 | 67.7 | 8 | 243.9 | 84.0 |
| 9 | 8.5 | 2.9 | 9 | 55.8 | 19.2 | 9 | 103.1 | 35.5 | 9 | 150.3 | 51.8 | 9 | 197.6 | 68.0 | 9 | 244.9 | 84.3 |
| 10 | 9.5 | 3.3 | 60 | 56.7 | 19.5 | 110 | 104.0 | 35.8 | 160 | 151.3 | 52.1 | 210 | 198.6 | 68.4 | 260 | 245.8 | 84.6 |
| 1 | 10.4 | 3.6 | 1 | 57.7 | 19.9 | 1 | 105.0 | 36.1 | 1 | 152.2 | 52.4 | 1 | 199.5 | 68.7 | 1 | 246.8 | 85.0 |
| 2 | 11.3 | 3.9 | 2 | 58.6 | 20.2 | 2 | 105.9 | 36.5 | 2 | 153.2 | 52.7 | 2 | 200.4 | 69.0 | 2 | 247.7 | 85.3 |
| 3 | 12.3 | 4.2 | 3 | 59.6 | 20.5 | 3 | 106.8 | 36.8 | 3 | 154.1 | 53.1 | 3 | 201.4 | 69.3 | 3 | 248.7 | 85.6 |
| 4 | 13.2 | 4.6 | 4 | 60.5 | 20.8 | 4 | 107.8 | 37.1 | 4 | 155.1 | 53.4 | 4 | 202.3 | 69.7 | 4 | 249.6 | 85.9 |
| 5 | 14.2 | 4.9 | 5 | 61.5 | 21.2 | 5 | 108.7 | 37.4 | 5 | 156.0 | 53.7 | 5 | 203.3 | 70.0 | 5 | 250.6 | 86.3 |
| 6 | 15.1 | 5.2 | 6 | 62.4 | 21.5 | 6 | 109.7 | 37.8 | 6 | 157.0 | 54.0 | 6 | 204.2 | 70.3 | 6 | 251.5 | 86.6 |
| 7 | 16.1 | 5.5 | 7 | 63.3 | 21.8 | 7 | 110.6 | 38.1 | 7 | 157.9 | 54.4 | 7 | 205.2 | 70.6 | 7 | 252.5 | 86.9 |
| 8 | 17.0 | 5.9 | 8 | 64.3 | 22.1 | 8 | 111.6 | 38.4 | 8 | 158.8 | 54.7 | 8 | 206.1 | 71.0 | 8 | 253.4 | 87.3 |
| 9 | 18.0 | 6.2 | 9 | 65.2 | 22.5 | 9 | 112.5 | 38.7 | 9 | 159.8 | 55.0 | 9 | 207.1 | 71.3 | 9 | 254.3 | 87.6 |
| 20 | 18.9 | 6.5 | 70 | 66.2 | 22.8 | 120 | 113.5 | 39.1 | 170 | 160.7 | 55.3 | 220 | 208.0 | 71.6 | 270 | 255.3 | 87.9 |
| 1 | 19.9 | 6.8 | 1 | 67.1 | 23.1 | 1 | 114.4 | 39.4 | 1 | 161.7 | 55.7 | 1 | 209.0 | 72.0 | 1 | 256.2 | 88.2 |
| 2 | 20.8 | 7.2 | 2 | 68.1 | 23.4 | 2 | 115.4 | 39.7 | 2 | 162.6 | 56.0 | 2 | 209.9 | 72.3 | 2 | 257.2 | 88.6 |
| 3 | 21.7 | 7.5 | 3 | 69.0 | 23.8 | 3 | 116.3 | 40.0 | 3 | 163.6 | 56.3 | 3 | 210.9 | 72.6 | 3 | 258.1 | 88.9 |
| 4 | 22.7 | 7.8 | 4 | 70.0 | 24.1 | 4 | 117.2 | 40.4 | 4 | 164.5 | 56.6 | 4 | 211.8 | 72.9 | 4 | 259.1 | 89.2 |
| 5 | 23.6 | 8.1 | 5 | 70.9 | 24.4 | 5 | 118.2 | 40.7 | 5 | 165.5 | 57.0 | 5 | 212.7 | 73.3 | 5 | 260.0 | 89.5 |
| 6 | 24.6 | 8.5 | 6 | 71.9 | 24.7 | 6 | 119.1 | 41.0 | 6 | 166.4 | 57.3 | 6 | 213.7 | 73.6 | 6 | 261.0 | 89.9 |
| 7 | 25.5 | 8.8 | 7 | 72.8 | 25.1 | 7 | 120.1 | 41.3 | 7 | 167.4 | 57.6 | 7 | 214.6 | 73.9 | 7 | 261.9 | 90.2 |
| 8 | 26.5 | 9.1 | 8 | 73.8 | 25.4 | 8 | 121.0 | 41.7 | 8 | 168.3 | 58.0 | 8 | 215.6 | 74.2 | 8 | 262.9 | 90.5 |
| 9 | 27.4 | 9.4 | 9 | 74.7 | 25.7 | 9 | 122.0 | 42.0 | 9 | 169.2 | 58.3 | 9 | 216.5 | 74.6 | 9 | 263.8 | 90.8 |
| 30 | 28.4 | 9.8 | 80 | 75.6 | 26.0 | 130 | 122.9 | 42.3 | 180 | 170.2 | 58.6 | 230 | 217.5 | 74.9 | 280 | 264.7 | 91.2 |
| 1 | 29.3 | 10.1 | 1 | 76.6 | 26.4 | 1 | 123.9 | 42.6 | 1 | 171.1 | 58.9 | 1 | 218.4 | 75.2 | 1 | 265.7 | 91.5 |
| 2 | 30.3 | 10.4 | 2 | 77.5 | 26.7 | 2 | 124.8 | 43.0 | 2 | 172.1 | 59.3 | 2 | 219.4 | 75.5 | 2 | 266.6 | 91.8 |
| 3 | 31.2 | 10.7 | 3 | 78.5 | 27.0 | 3 | 125.8 | 43.3 | 3 | 173.0 | 59.6 | 3 | 220.3 | 75.9 | 3 | 267.6 | 92.1 |
| 4 | 32.1 | 11.1 | 4 | 79.4 | 27.3 | 4 | 126.7 | 43.6 | 4 | 174.0 | 59.9 | 4 | 221.3 | 76.2 | 4 | 268.5 | 92.5 |
| 5 | 33.1 | 11.4 | 5 | 80.4 | 27.7 | 5 | 127.6 | 44.0 | 5 | 174.9 | 60.2 | 5 | 222.2 | 76.5 | 5 | 269.5 | 92.8 |
| 6 | 34.0 | 11.7 | 6 | 81.3 | 28.0 | 6 | 128.6 | 44.3 | 6 | 175.9 | 60.6 | 6 | 223.1 | 76.8 | 6 | 270.4 | 93.1 |
| 7 | 35.0 | 12.0 | 7 | 82.3 | 28.3 | 7 | 129.5 | 44.6 | 7 | 176.8 | 60.9 | 7 | 224.1 | 77.2 | 7 | 271.4 | 93.4 |
| 8 | 35.9 | 12.4 | 8 | 83.2 | 28.6 | 8 | 130.5 | 44.9 | 8 | 177.8 | 61.2 | 8 | 225.0 | 77.5 | 8 | 272.3 | 93.8 |
| 9 | 36.9 | 12.7 | 9 | 84.2 | 29.0 | 9 | 131.4 | 45.3 | 9 | 178.7 | 61.5 | 9 | 226.0 | 77.8 | 9 | 273.3 | 94.1 |
| 40 | 37.8 | 13.0 | 90 | 85.1 | 29.3 | 140 | 132.4 | 45.6 | 190 | 179.6 | 61.9 | 240 | 226.9 | 78.1 | 290 | 274.2 | 94.4 |
| 1 | 38.8 | 13.3 | 1 | 86.0 | 29.6 | 1 | 133.3 | 45.9 | 1 | 180.6 | 62.2 | 1 | 227.9 | 78.5 | 1 | 275.1 | 94.7 |
| 2 | 39.7 | 13.7 | 2 | 87.0 | 30.0 | 2 | 134.3 | 46.2 | 2 | 181.5 | 62.5 | 2 | 228.8 | 78.8 | 2 | 276.1 | 95.1 |
| 3 | 40.7 | 14.0 | 3 | 87.9 | 30.3 | 3 | 135.2 | 46.6 | 3 | 182.5 | 62.8 | 3 | 229.8 | 79.1 | 3 | 277.0 | 95.4 |
| 4 | 41.6 | 14.3 | 4 | 88.9 | 30.6 | 4 | 136.2 | 46.9 | 4 | 183.4 | 63.2 | 4 | 230.7 | 79.4 | 4 | 278.0 | 95.7 |
| 5 | 42.5 | 14.7 | 5 | 89.8 | 30.9 | 5 | 137.1 | 47.2 | 5 | 184.4 | 63.5 | 5 | 231.7 | 79.8 | 5 | 278.9 | 96.0 |
| 6 | 43.5 | 15.0 | 6 | 90.8 | 31.3 | 6 | 138.0 | 47.5 | 6 | 185.3 | 63.8 | 6 | 232.6 | 80.1 | 6 | 279.9 | 96.4 |
| 7 | 44.4 | 15.3 | 7 | 91.7 | 31.6 | 7 | 139.0 | 47.9 | 7 | 186.3 | 64.1 | 7 | 233.5 | 80.4 | 7 | 280.8 | 96.7 |
| 8 | 45.4 | 15.6 | 8 | 92.7 | 31.9 | 8 | 139.9 | 48.2 | 8 | 187.2 | 64.5 | 8 | 234.5 | 80.7 | 8 | 281.8 | 97.0 |
| 9 | 46.3 | 16.0 | 9 | 93.6 | 32.2 | 9 | 140.9 | 48.5 | 9 | 188.2 | 64.8 | 9 | 235.4 | 81.1 | 9 | 282.7 | 97.3 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 289 315
269 251 225

R

089 071° 045
091 109 135

R ou φm

R**TABELA 1****R** ou φ m

359 **341°** 315
181 **199** 225

TÁBUAS DE CARTEAÇÃO

001 **019** 045
179 **161** 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|
| D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap |
| 300 | 283.7 | 97.7 | 350 | 330.9 | 113.9 | 400 | 378.2 | 130.2 | 450 | 425.5 | 146.5 | 500 | 472.8 | 162.8 | 550 | 520.0 | 179.1 |
| 1 | 284.6 | 98.0 | 1 | 331.9 | 114.3 | 1 | 379.2 | 130.6 | 1 | 426.4 | 146.8 | 1 | 473.7 | 163.1 | 1 | 521.0 | 179.4 |
| 2 | 285.5 | 98.3 | 2 | 332.8 | 114.6 | 2 | 380.1 | 130.9 | 2 | 427.4 | 147.2 | 2 | 474.7 | 163.4 | 2 | 521.9 | 179.7 |
| 3 | 286.5 | 98.6 | 3 | 333.8 | 114.9 | 3 | 381.0 | 131.2 | 3 | 428.3 | 147.5 | 3 | 475.6 | 163.8 | 3 | 522.9 | 180.0 |
| 4 | 287.4 | 99.0 | 4 | 334.7 | 115.3 | 4 | 382.0 | 131.5 | 4 | 429.3 | 147.8 | 4 | 476.5 | 164.1 | 4 | 523.8 | 180.4 |
| 5 | 288.4 | 99.3 | 5 | 335.7 | 115.6 | 5 | 382.9 | 131.9 | 5 | 430.2 | 148.1 | 5 | 477.5 | 164.4 | 5 | 524.8 | 180.7 |
| 6 | 289.3 | 99.6 | 6 | 336.6 | 115.9 | 6 | 383.9 | 132.2 | 6 | 431.2 | 148.5 | 6 | 478.4 | 164.7 | 6 | 525.7 | 181.0 |
| 7 | 290.3 | 99.9 | 7 | 337.6 | 116.2 | 7 | 384.8 | 132.5 | 7 | 432.1 | 148.8 | 7 | 479.4 | 165.1 | 7 | 526.7 | 181.3 |
| 8 | 291.2 | 100.3 | 8 | 338.5 | 116.6 | 8 | 385.8 | 132.8 | 8 | 433.0 | 149.1 | 8 | 480.3 | 165.4 | 8 | 527.6 | 181.7 |
| 9 | 292.2 | 100.6 | 9 | 339.4 | 116.9 | 9 | 386.7 | 133.2 | 9 | 434.0 | 149.4 | 9 | 481.3 | 165.7 | 9 | 528.5 | 182.0 |
| 310 | 293.1 | 100.9 | 360 | 340.4 | 117.2 | 410 | 387.7 | 133.5 | 460 | 434.9 | 149.8 | 510 | 482.2 | 166.0 | 560 | 529.5 | 182.3 |
| 1 | 294.1 | 101.3 | 1 | 341.3 | 117.5 | 1 | 388.6 | 133.8 | 1 | 435.9 | 150.1 | 1 | 483.2 | 166.4 | 1 | 530.4 | 182.6 |
| 2 | 295.0 | 101.6 | 2 | 342.3 | 117.9 | 2 | 389.6 | 134.1 | 2 | 436.8 | 150.4 | 2 | 484.1 | 166.7 | 2 | 531.4 | 183.0 |
| 3 | 295.9 | 101.9 | 3 | 343.2 | 118.2 | 3 | 390.5 | 134.5 | 3 | 437.8 | 150.7 | 3 | 485.1 | 167.0 | 3 | 532.3 | 183.3 |
| 4 | 296.9 | 102.2 | 4 | 344.2 | 118.5 | 4 | 391.4 | 134.8 | 4 | 438.7 | 151.1 | 4 | 486.0 | 167.3 | 4 | 533.3 | 183.6 |
| 5 | 297.8 | 102.6 | 5 | 345.1 | 118.8 | 5 | 392.4 | 135.1 | 5 | 439.7 | 151.4 | 5 | 486.9 | 167.7 | 5 | 534.2 | 183.9 |
| 6 | 298.8 | 102.9 | 6 | 346.1 | 119.2 | 6 | 393.3 | 135.4 | 6 | 440.6 | 151.7 | 6 | 487.9 | 168.0 | 6 | 535.2 | 184.3 |
| 7 | 299.7 | 103.2 | 7 | 347.0 | 119.5 | 7 | 394.3 | 135.8 | 7 | 441.6 | 152.0 | 7 | 488.8 | 168.3 | 7 | 536.1 | 184.6 |
| 8 | 300.7 | 103.5 | 8 | 348.0 | 119.8 | 8 | 395.2 | 136.1 | 8 | 442.5 | 152.4 | 8 | 489.8 | 168.6 | 8 | 537.1 | 184.9 |
| 9 | 301.6 | 103.9 | 9 | 348.9 | 120.1 | 9 | 396.2 | 136.4 | 9 | 443.4 | 152.7 | 9 | 490.7 | 169.0 | 9 | 538.0 | 185.2 |
| 320 | 302.6 | 104.2 | 370 | 349.8 | 120.5 | 420 | 397.1 | 136.7 | 470 | 444.4 | 153.0 | 520 | 491.7 | 169.3 | 570 | 538.9 | 185.6 |
| 1 | 303.5 | 104.5 | 1 | 350.8 | 120.8 | 1 | 398.1 | 137.1 | 1 | 445.3 | 153.3 | 1 | 492.6 | 169.6 | 1 | 539.9 | 185.9 |
| 2 | 304.5 | 104.8 | 2 | 351.7 | 121.1 | 2 | 399.0 | 137.4 | 2 | 446.3 | 153.7 | 2 | 493.6 | 169.9 | 2 | 540.8 | 186.2 |
| 3 | 305.4 | 105.2 | 3 | 352.7 | 121.4 | 3 | 400.0 | 137.7 | 3 | 447.2 | 154.0 | 3 | 494.5 | 170.3 | 3 | 541.8 | 186.6 |
| 4 | 306.3 | 105.5 | 4 | 353.6 | 121.8 | 4 | 400.9 | 138.0 | 4 | 448.2 | 154.3 | 4 | 495.5 | 170.6 | 4 | 542.7 | 186.9 |
| 5 | 307.3 | 105.8 | 5 | 354.6 | 122.1 | 5 | 401.8 | 138.4 | 5 | 449.1 | 154.6 | 5 | 496.4 | 170.9 | 5 | 543.7 | 187.2 |
| 6 | 308.2 | 106.1 | 6 | 355.5 | 122.4 | 6 | 402.8 | 138.7 | 6 | 450.1 | 155.0 | 6 | 497.3 | 171.2 | 6 | 544.6 | 187.5 |
| 7 | 309.2 | 106.5 | 7 | 356.5 | 122.7 | 7 | 403.7 | 139.0 | 7 | 451.0 | 155.3 | 7 | 498.3 | 171.6 | 7 | 545.6 | 187.9 |
| 8 | 310.1 | 106.8 | 8 | 357.4 | 123.1 | 8 | 404.7 | 139.3 | 8 | 452.0 | 155.6 | 8 | 499.2 | 171.9 | 8 | 546.5 | 188.2 |
| 9 | 311.1 | 107.1 | 9 | 358.4 | 123.4 | 9 | 405.6 | 139.7 | 9 | 452.9 | 155.9 | 9 | 500.2 | 172.2 | 9 | 547.5 | 188.5 |
| 330 | 312.0 | 107.4 | 380 | 359.3 | 123.7 | 430 | 406.6 | 140.0 | 480 | 453.8 | 156.3 | 530 | 501.1 | 172.6 | 580 | 548.4 | 188.8 |
| 1 | 313.0 | 107.8 | 1 | 360.2 | 124.0 | 1 | 407.5 | 140.3 | 1 | 454.8 | 156.6 | 1 | 502.1 | 172.9 | 1 | 549.3 | 189.2 |
| 2 | 313.9 | 108.1 | 2 | 361.2 | 124.4 | 2 | 408.5 | 140.6 | 2 | 455.7 | 156.9 | 2 | 503.0 | 173.2 | 2 | 550.3 | 189.5 |
| 3 | 314.9 | 108.4 | 3 | 362.1 | 124.7 | 3 | 409.4 | 141.0 | 3 | 456.7 | 157.2 | 3 | 504.0 | 173.5 | 3 | 551.2 | 189.8 |
| 4 | 315.8 | 108.7 | 4 | 363.1 | 125.0 | 4 | 410.4 | 141.3 | 4 | 457.6 | 157.6 | 4 | 504.9 | 173.9 | 4 | 552.2 | 190.1 |
| 5 | 316.7 | 109.1 | 5 | 364.0 | 125.3 | 5 | 411.3 | 141.6 | 5 | 458.6 | 157.9 | 5 | 505.9 | 174.2 | 5 | 553.1 | 190.5 |
| 6 | 317.7 | 109.4 | 6 | 365.0 | 125.7 | 6 | 412.2 | 141.9 | 6 | 459.5 | 158.2 | 6 | 506.8 | 174.5 | 6 | 554.1 | 190.8 |
| 7 | 318.6 | 109.7 | 7 | 365.9 | 126.0 | 7 | 413.2 | 142.3 | 7 | 460.5 | 158.6 | 7 | 507.7 | 174.8 | 7 | 555.0 | 191.1 |
| 8 | 319.6 | 110.0 | 8 | 366.9 | 126.3 | 8 | 414.1 | 142.6 | 8 | 461.4 | 158.9 | 8 | 508.7 | 175.2 | 8 | 556.0 | 191.4 |
| 9 | 320.5 | 110.4 | 9 | 367.8 | 126.6 | 9 | 415.1 | 142.9 | 9 | 462.4 | 159.2 | 9 | 509.6 | 175.5 | 9 | 556.9 | 191.8 |
| 340 | 321.5 | 110.7 | 390 | 368.8 | 127.0 | 440 | 416.0 | 143.2 | 490 | 463.3 | 159.5 | 540 | 510.6 | 175.8 | 590 | 557.9 | 192.1 |
| 1 | 322.4 | 111.0 | 1 | 369.7 | 127.3 | 1 | 417.0 | 143.6 | 1 | 464.2 | 159.9 | 1 | 511.5 | 176.1 | 1 | 558.8 | 192.4 |
| 2 | 323.4 | 111.3 | 2 | 370.6 | 127.6 | 2 | 417.9 | 143.9 | 2 | 465.2 | 160.2 | 2 | 512.5 | 176.5 | 2 | 559.7 | 192.7 |
| 3 | 324.3 | 111.7 | 3 | 371.6 | 127.9 | 3 | 418.9 | 144.2 | 3 | 466.1 | 160.5 | 3 | 513.4 | 176.8 | 3 | 560.7 | 193.1 |
| 4 | 325.3 | 112.0 | 4 | 372.5 | 128.3 | 4 | 419.8 | 144.6 | 4 | 467.1 | 160.8 | 4 | 514.4 | 177.1 | 4 | 561.6 | 193.4 |
| 5 | 326.2 | 112.3 | 5 | 373.5 | 128.6 | 5 | 420.8 | 144.9 | 5 | 468.0 | 161.2 | 5 | 515.3 | 177.4 | 5 | 562.6 | 193.7 |
| 6 | 327.1 | 112.6 | 6 | 374.4 | 128.9 | 6 | 421.7 | 145.2 | 6 | 469.0 | 161.5 | 6 | 516.3 | 177.8 | 6 | 563.5 | 194.0 |
| 7 | 328.1 | 113.0 | 7 | 375.4 | 129.3 | 7 | 422.6 | 145.5 | 7 | 469.9 | 161.8 | 7 | 517.2 | 178.1 | 7 | 564.5 | 194.4 |
| 8 | 329.0 | 113.3 | 8 | 376.3 | 129.6 | 8 | 423.6 | 145.9 | 8 | 470.9 | 162.1 | 8 | 518.1 | 178.4 | 8 | 565.4 | 194.7 |
| 9 | 330.0 | 113.6 | 9 | 377.3 | 129.9 | 9 | 424.5 | 146.2 | 9 | 471.8 | 162.5 | 9 | 519.1 | 178.7 | 9 | 566.4 | 195.0 |
| D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 **289** 315
269 **251** 225

R

089 **071°** 045
091 **109** 135

R ou φ m

R

TABELA 1

R ou φm

359 340° 315
181 200 225

TÁBUAS DE CARTEAÇÃO

001 020 045
179 160 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 47.0 | 17.1 | 100 | 94.0 | 34.2 | 150 | 141.0 | 51.3 | 200 | 187.9 | 68.4 | 250 | 234.9 | 85.5 |
| 1 | 0.9 | 0.3 | 1 | 47.9 | 17.4 | 1 | 94.9 | 34.5 | 1 | 141.9 | 51.6 | 1 | 188.9 | 68.7 | 1 | 235.9 | 85.8 |
| 2 | 1.9 | 0.7 | 2 | 48.9 | 17.8 | 2 | 95.8 | 34.9 | 2 | 142.8 | 52.0 | 2 | 189.8 | 69.1 | 2 | 236.8 | 86.2 |
| 3 | 2.8 | 1.0 | 3 | 49.8 | 18.1 | 3 | 96.8 | 35.2 | 3 | 143.8 | 52.3 | 3 | 190.8 | 69.4 | 3 | 237.7 | 86.5 |
| 4 | 3.8 | 1.4 | 4 | 50.7 | 18.5 | 4 | 97.7 | 35.6 | 4 | 144.7 | 52.7 | 4 | 191.7 | 69.8 | 4 | 238.7 | 86.9 |
| 5 | 4.7 | 1.7 | 5 | 51.7 | 18.8 | 5 | 98.7 | 35.9 | 5 | 145.7 | 53.0 | 5 | 192.6 | 70.1 | 5 | 239.6 | 87.2 |
| 6 | 5.6 | 2.1 | 6 | 52.6 | 19.2 | 6 | 99.6 | 36.3 | 6 | 146.6 | 53.4 | 6 | 193.6 | 70.5 | 6 | 240.6 | 87.6 |
| 7 | 6.6 | 2.4 | 7 | 53.6 | 19.5 | 7 | 100.5 | 36.6 | 7 | 147.5 | 53.7 | 7 | 194.5 | 70.8 | 7 | 241.5 | 87.9 |
| 8 | 7.5 | 2.7 | 8 | 54.5 | 19.8 | 8 | 101.5 | 36.9 | 8 | 148.5 | 54.0 | 8 | 195.5 | 71.1 | 8 | 242.4 | 88.2 |
| 9 | 8.5 | 3.1 | 9 | 55.4 | 20.2 | 9 | 102.4 | 37.3 | 9 | 149.4 | 54.4 | 9 | 196.4 | 71.5 | 9 | 243.4 | 88.6 |
| 10 | 9.4 | 3.4 | 60 | 56.4 | 20.5 | 110 | 103.4 | 37.6 | 160 | 150.4 | 54.7 | 210 | 197.3 | 71.8 | 260 | 244.3 | 88.9 |
| 1 | 10.3 | 3.8 | 1 | 57.3 | 20.9 | 1 | 104.3 | 38.0 | 1 | 151.3 | 55.1 | 1 | 198.3 | 72.2 | 1 | 245.3 | 89.3 |
| 2 | 11.3 | 4.1 | 2 | 58.3 | 21.2 | 2 | 105.2 | 38.3 | 2 | 152.2 | 55.4 | 2 | 199.2 | 72.5 | 2 | 246.2 | 89.6 |
| 3 | 12.2 | 4.4 | 3 | 59.2 | 21.5 | 3 | 106.2 | 38.6 | 3 | 153.2 | 55.7 | 3 | 200.2 | 72.9 | 3 | 247.1 | 90.0 |
| 4 | 13.2 | 4.8 | 4 | 60.1 | 21.9 | 4 | 107.1 | 39.0 | 4 | 154.1 | 56.1 | 4 | 201.1 | 73.2 | 4 | 248.1 | 90.3 |
| 5 | 14.1 | 5.1 | 5 | 61.1 | 22.2 | 5 | 108.1 | 39.3 | 5 | 155.0 | 56.4 | 5 | 202.0 | 73.5 | 5 | 249.0 | 90.6 |
| 6 | 15.0 | 5.5 | 6 | 62.0 | 22.6 | 6 | 109.0 | 39.7 | 6 | 156.0 | 56.8 | 6 | 203.0 | 73.9 | 6 | 250.0 | 91.0 |
| 7 | 16.0 | 5.8 | 7 | 63.0 | 22.9 | 7 | 109.9 | 40.0 | 7 | 156.9 | 57.1 | 7 | 203.9 | 74.2 | 7 | 250.9 | 91.3 |
| 8 | 16.9 | 6.2 | 8 | 63.9 | 23.3 | 8 | 110.9 | 40.4 | 8 | 157.9 | 57.5 | 8 | 204.9 | 74.6 | 8 | 251.8 | 91.7 |
| 9 | 17.9 | 6.5 | 9 | 64.8 | 23.6 | 9 | 111.8 | 40.7 | 9 | 158.8 | 57.8 | 9 | 205.8 | 74.9 | 9 | 252.8 | 92.0 |
| 20 | 18.8 | 6.8 | 70 | 65.8 | 23.9 | 120 | 112.8 | 41.0 | 170 | 159.7 | 58.1 | 220 | 206.7 | 75.2 | 270 | 253.7 | 92.3 |
| 1 | 19.7 | 7.2 | 1 | 66.7 | 24.3 | 1 | 113.7 | 41.4 | 1 | 160.7 | 58.5 | 1 | 207.7 | 75.6 | 1 | 254.7 | 92.7 |
| 2 | 20.7 | 7.5 | 2 | 67.7 | 24.6 | 2 | 114.6 | 41.7 | 2 | 161.6 | 58.8 | 2 | 208.6 | 75.9 | 2 | 255.6 | 93.0 |
| 3 | 21.6 | 7.9 | 3 | 68.6 | 25.0 | 3 | 115.6 | 42.1 | 3 | 162.6 | 59.2 | 3 | 209.6 | 76.3 | 3 | 256.5 | 93.4 |
| 4 | 22.6 | 8.2 | 4 | 69.5 | 25.3 | 4 | 116.5 | 42.4 | 4 | 163.5 | 59.5 | 4 | 210.5 | 76.6 | 4 | 257.5 | 93.7 |
| 5 | 23.5 | 8.6 | 5 | 70.5 | 25.7 | 5 | 117.5 | 42.8 | 5 | 164.4 | 59.9 | 5 | 211.4 | 77.0 | 5 | 258.4 | 94.1 |
| 6 | 24.4 | 8.9 | 6 | 71.4 | 26.0 | 6 | 118.4 | 43.1 | 6 | 165.4 | 60.2 | 6 | 212.4 | 77.3 | 6 | 259.4 | 94.4 |
| 7 | 25.4 | 9.2 | 7 | 72.4 | 26.3 | 7 | 119.3 | 43.4 | 7 | 166.3 | 60.5 | 7 | 213.3 | 77.6 | 7 | 260.3 | 94.7 |
| 8 | 26.3 | 9.6 | 8 | 73.3 | 26.7 | 8 | 120.3 | 43.8 | 8 | 167.3 | 60.9 | 8 | 214.2 | 78.0 | 8 | 261.2 | 95.1 |
| 9 | 27.3 | 9.9 | 9 | 74.2 | 27.0 | 9 | 121.2 | 44.1 | 9 | 168.2 | 61.2 | 9 | 215.2 | 78.3 | 9 | 262.2 | 95.4 |
| 30 | 28.2 | 10.3 | 80 | 75.2 | 27.4 | 130 | 122.2 | 44.5 | 180 | 169.1 | 61.6 | 230 | 216.1 | 78.7 | 280 | 263.1 | 95.8 |
| 1 | 29.1 | 10.6 | 1 | 76.1 | 27.7 | 1 | 123.1 | 44.8 | 1 | 170.1 | 61.9 | 1 | 217.1 | 79.0 | 1 | 264.1 | 96.1 |
| 2 | 30.1 | 10.9 | 2 | 77.1 | 28.0 | 2 | 124.0 | 45.1 | 2 | 171.0 | 62.2 | 2 | 218.0 | 79.3 | 2 | 265.0 | 96.4 |
| 3 | 31.0 | 11.3 | 3 | 78.0 | 28.4 | 3 | 125.0 | 45.5 | 3 | 172.0 | 62.6 | 3 | 218.9 | 79.7 | 3 | 265.9 | 96.8 |
| 4 | 31.9 | 11.6 | 4 | 78.9 | 28.7 | 4 | 125.9 | 45.8 | 4 | 172.9 | 62.9 | 4 | 219.9 | 80.0 | 4 | 266.9 | 97.1 |
| 5 | 32.9 | 12.0 | 5 | 79.9 | 29.1 | 5 | 126.9 | 46.2 | 5 | 173.8 | 63.3 | 5 | 220.8 | 80.4 | 5 | 267.8 | 97.5 |
| 6 | 33.8 | 12.3 | 6 | 80.8 | 29.4 | 6 | 127.8 | 46.5 | 6 | 174.8 | 63.6 | 6 | 221.8 | 80.7 | 6 | 268.8 | 97.8 |
| 7 | 34.8 | 12.7 | 7 | 81.8 | 29.8 | 7 | 128.7 | 46.9 | 7 | 175.7 | 64.0 | 7 | 222.7 | 81.1 | 7 | 269.7 | 98.2 |
| 8 | 35.7 | 13.0 | 8 | 82.7 | 30.1 | 8 | 129.7 | 47.2 | 8 | 176.7 | 64.3 | 8 | 223.6 | 81.4 | 8 | 270.6 | 98.5 |
| 9 | 36.6 | 13.3 | 9 | 83.6 | 30.4 | 9 | 130.6 | 47.5 | 9 | 177.6 | 64.6 | 9 | 224.6 | 81.7 | 9 | 271.6 | 98.8 |
| 40 | 37.6 | 13.7 | 90 | 84.6 | 30.8 | 140 | 131.6 | 47.9 | 190 | 178.5 | 65.0 | 240 | 225.5 | 82.1 | 290 | 272.5 | 99.2 |
| 1 | 38.5 | 14.0 | 1 | 85.5 | 31.1 | 1 | 132.5 | 48.2 | 1 | 179.5 | 65.3 | 1 | 226.5 | 82.4 | 1 | 273.5 | 99.5 |
| 2 | 39.5 | 14.4 | 2 | 86.5 | 31.5 | 2 | 133.4 | 48.6 | 2 | 180.4 | 65.7 | 2 | 227.4 | 82.8 | 2 | 274.4 | 99.9 |
| 3 | 40.4 | 14.7 | 3 | 87.4 | 31.8 | 3 | 134.4 | 48.9 | 3 | 181.4 | 66.0 | 3 | 228.3 | 83.1 | 3 | 275.3 | 100.2 |
| 4 | 41.3 | 15.0 | 4 | 88.3 | 32.1 | 4 | 135.3 | 49.3 | 4 | 182.3 | 66.4 | 4 | 229.3 | 83.5 | 4 | 276.3 | 100.6 |
| 5 | 42.3 | 15.4 | 5 | 89.3 | 32.5 | 5 | 136.3 | 49.6 | 5 | 183.2 | 66.7 | 5 | 230.2 | 83.8 | 5 | 277.2 | 100.9 |
| 6 | 43.2 | 15.7 | 6 | 90.2 | 32.8 | 6 | 137.2 | 49.9 | 6 | 184.2 | 67.0 | 6 | 231.2 | 84.1 | 6 | 278.1 | 101.2 |
| 7 | 44.2 | 16.1 | 7 | 91.2 | 33.2 | 7 | 138.1 | 50.3 | 7 | 185.1 | 67.4 | 7 | 232.1 | 84.5 | 7 | 279.1 | 101.6 |
| 8 | 45.1 | 16.4 | 8 | 92.1 | 33.5 | 8 | 139.1 | 50.6 | 8 | 186.1 | 67.7 | 8 | 233.0 | 84.8 | 8 | 280.0 | 101.9 |
| 9 | 46.0 | 16.8 | 9 | 93.0 | 33.9 | 9 | 140.0 | 51.0 | 9 | 187.0 | 68.1 | 9 | 234.0 | 85.2 | 9 | 281.0 | 102.3 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 290 315
269 250 225

R

089 070° 045
091 110 135

R ou φm

R

TABELA 1

R ou φm

359 340° 315
181 200 225

TÁBUAS DE CARTEAÇÃO

001 020 045
179 160 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 281.9 | 102.6 | 350 | 328.9 | 119.7 | 400 | 375.9 | 136.8 | 450 | 422.9 | 153.9 | 500 | 469.8 | 171.0 | 550 | 516.8 | 188.1 |
| 1 | 282.8 | 102.9 | 1 | 329.8 | 120.0 | 1 | 376.8 | 137.2 | 1 | 423.8 | 154.3 | 1 | 470.8 | 171.4 | 1 | 517.8 | 188.5 |
| 2 | 283.8 | 103.3 | 2 | 330.8 | 120.4 | 2 | 377.8 | 137.5 | 2 | 424.7 | 154.6 | 2 | 471.7 | 171.7 | 2 | 518.7 | 188.8 |
| 3 | 284.7 | 103.6 | 3 | 331.7 | 120.7 | 3 | 378.7 | 137.8 | 3 | 425.7 | 154.9 | 3 | 472.7 | 172.0 | 3 | 519.6 | 189.1 |
| 4 | 285.7 | 104.0 | 4 | 332.7 | 121.1 | 4 | 379.6 | 138.2 | 4 | 426.6 | 155.3 | 4 | 473.6 | 172.4 | 4 | 520.6 | 189.5 |
| 5 | 286.6 | 104.3 | 5 | 333.6 | 121.4 | 5 | 380.6 | 138.5 | 5 | 427.6 | 155.6 | 5 | 474.5 | 172.7 | 5 | 521.5 | 189.8 |
| 6 | 287.5 | 104.7 | 6 | 334.5 | 121.8 | 6 | 381.5 | 138.9 | 6 | 428.5 | 156.0 | 6 | 475.5 | 173.1 | 6 | 522.5 | 190.2 |
| 7 | 288.5 | 105.0 | 7 | 335.5 | 122.1 | 7 | 382.5 | 139.2 | 7 | 429.4 | 156.3 | 7 | 476.4 | 173.4 | 7 | 523.4 | 190.5 |
| 8 | 289.4 | 105.3 | 8 | 336.4 | 122.4 | 8 | 383.4 | 139.5 | 8 | 430.4 | 156.6 | 8 | 477.4 | 173.7 | 8 | 524.3 | 190.8 |
| 9 | 290.4 | 105.7 | 9 | 337.3 | 122.8 | 9 | 384.3 | 139.9 | 9 | 431.3 | 157.0 | 9 | 478.3 | 174.1 | 9 | 525.3 | 191.2 |
| 310 | 291.3 | 106.0 | 360 | 338.3 | 123.1 | 410 | 385.3 | 140.2 | 460 | 432.3 | 157.3 | 510 | 479.2 | 174.4 | 560 | 526.2 | 191.5 |
| 1 | 292.2 | 106.4 | 1 | 339.2 | 123.5 | 1 | 386.2 | 140.6 | 1 | 433.2 | 157.7 | 1 | 480.2 | 174.8 | 1 | 527.2 | 191.9 |
| 2 | 293.2 | 106.7 | 2 | 340.2 | 123.8 | 2 | 387.2 | 140.9 | 2 | 434.1 | 158.0 | 2 | 481.1 | 175.1 | 2 | 528.1 | 192.2 |
| 3 | 294.1 | 107.1 | 3 | 341.1 | 124.2 | 3 | 388.1 | 141.3 | 3 | 435.1 | 158.4 | 3 | 482.1 | 175.5 | 3 | 529.0 | 192.6 |
| 4 | 295.1 | 107.4 | 4 | 342.0 | 124.5 | 4 | 389.0 | 141.6 | 4 | 436.0 | 158.7 | 4 | 483.0 | 175.8 | 4 | 530.0 | 192.9 |
| 5 | 296.0 | 107.7 | 5 | 343.0 | 124.8 | 5 | 390.0 | 141.9 | 5 | 437.0 | 159.0 | 5 | 483.9 | 176.1 | 5 | 530.9 | 193.2 |
| 6 | 296.9 | 108.1 | 6 | 343.9 | 125.2 | 6 | 390.9 | 142.3 | 6 | 437.9 | 159.4 | 6 | 484.9 | 176.5 | 6 | 531.9 | 193.6 |
| 7 | 297.9 | 108.4 | 7 | 344.9 | 125.5 | 7 | 391.9 | 142.6 | 7 | 438.8 | 159.7 | 7 | 485.8 | 176.8 | 7 | 532.8 | 193.9 |
| 8 | 298.8 | 108.8 | 8 | 345.8 | 125.9 | 8 | 392.8 | 143.0 | 8 | 439.8 | 160.1 | 8 | 486.8 | 177.2 | 8 | 533.7 | 194.3 |
| 9 | 299.8 | 109.1 | 9 | 346.7 | 126.2 | 9 | 393.7 | 143.3 | 9 | 440.7 | 160.4 | 9 | 487.7 | 177.5 | 9 | 534.7 | 194.6 |
| 320 | 300.7 | 109.4 | 370 | 347.7 | 126.5 | 420 | 394.7 | 143.6 | 470 | 441.7 | 160.7 | 520 | 488.6 | 177.9 | 570 | 535.6 | 195.0 |
| 1 | 301.6 | 109.8 | 1 | 348.6 | 126.9 | 1 | 395.6 | 144.0 | 1 | 442.6 | 161.1 | 1 | 489.6 | 178.2 | 1 | 536.6 | 195.3 |
| 2 | 302.6 | 110.1 | 2 | 349.6 | 127.2 | 2 | 396.6 | 144.3 | 2 | 443.5 | 161.4 | 2 | 490.5 | 178.5 | 2 | 537.5 | 195.6 |
| 3 | 303.5 | 110.5 | 3 | 350.5 | 127.6 | 3 | 397.5 | 144.7 | 3 | 444.5 | 161.8 | 3 | 491.5 | 178.9 | 3 | 538.4 | 196.0 |
| 4 | 304.5 | 110.8 | 4 | 351.4 | 127.9 | 4 | 398.4 | 145.0 | 4 | 445.4 | 162.1 | 4 | 492.4 | 179.2 | 4 | 539.4 | 196.3 |
| 5 | 305.4 | 111.2 | 5 | 352.4 | 128.3 | 5 | 399.4 | 145.4 | 5 | 446.4 | 162.5 | 5 | 493.3 | 179.6 | 5 | 540.3 | 196.7 |
| 6 | 306.3 | 111.5 | 6 | 353.3 | 128.6 | 6 | 400.3 | 145.7 | 6 | 447.3 | 162.8 | 6 | 494.3 | 179.9 | 6 | 541.3 | 197.0 |
| 7 | 307.3 | 111.8 | 7 | 354.3 | 128.9 | 7 | 401.2 | 146.0 | 7 | 448.2 | 163.1 | 7 | 495.2 | 180.2 | 7 | 542.2 | 197.3 |
| 8 | 308.2 | 112.2 | 8 | 355.2 | 129.3 | 8 | 402.2 | 146.4 | 8 | 449.2 | 163.5 | 8 | 496.2 | 180.6 | 8 | 543.1 | 197.7 |
| 9 | 309.2 | 112.5 | 9 | 356.1 | 129.6 | 9 | 403.1 | 146.7 | 9 | 450.1 | 163.8 | 9 | 497.1 | 180.9 | 9 | 544.1 | 198.0 |
| 330 | 310.1 | 112.9 | 380 | 357.1 | 130.0 | 430 | 404.1 | 147.1 | 480 | 451.1 | 164.2 | 530 | 498.0 | 181.3 | 580 | 545.0 | 198.4 |
| 1 | 311.0 | 113.2 | 1 | 358.0 | 130.3 | 1 | 405.0 | 147.4 | 1 | 452.0 | 164.5 | 1 | 499.0 | 181.6 | 1 | 546.0 | 198.7 |
| 2 | 312.0 | 113.6 | 2 | 359.0 | 130.7 | 2 | 405.9 | 147.8 | 2 | 452.9 | 164.9 | 2 | 499.9 | 182.0 | 2 | 546.9 | 199.1 |
| 3 | 312.9 | 113.9 | 3 | 359.9 | 131.0 | 3 | 406.9 | 148.1 | 3 | 453.9 | 165.2 | 3 | 500.9 | 182.3 | 3 | 547.8 | 199.4 |
| 4 | 313.9 | 114.2 | 4 | 360.8 | 131.3 | 4 | 407.8 | 148.4 | 4 | 454.8 | 165.5 | 4 | 501.8 | 182.6 | 4 | 548.8 | 199.7 |
| 5 | 314.8 | 114.6 | 5 | 361.8 | 131.7 | 5 | 408.8 | 148.8 | 5 | 455.8 | 165.9 | 5 | 502.7 | 183.0 | 5 | 549.7 | 200.1 |
| 6 | 315.7 | 114.9 | 6 | 362.7 | 132.0 | 6 | 409.7 | 149.1 | 6 | 456.7 | 166.2 | 6 | 503.7 | 183.3 | 6 | 550.7 | 200.4 |
| 7 | 316.7 | 115.3 | 7 | 363.7 | 132.4 | 7 | 410.6 | 149.5 | 7 | 457.6 | 166.6 | 7 | 504.6 | 183.7 | 7 | 551.6 | 200.8 |
| 8 | 317.6 | 115.6 | 8 | 364.6 | 132.7 | 8 | 411.6 | 149.8 | 8 | 458.6 | 166.9 | 8 | 505.6 | 184.0 | 8 | 552.5 | 201.1 |
| 9 | 318.6 | 115.9 | 9 | 365.5 | 133.0 | 9 | 412.5 | 150.1 | 9 | 459.5 | 167.2 | 9 | 506.5 | 184.3 | 9 | 553.5 | 201.4 |
| 340 | 319.5 | 116.3 | 390 | 366.5 | 133.4 | 440 | 413.5 | 150.5 | 490 | 460.4 | 167.6 | 540 | 507.4 | 184.7 | 590 | 554.4 | 201.8 |
| 1 | 320.4 | 116.6 | 1 | 367.4 | 133.7 | 1 | 414.4 | 150.8 | 1 | 461.4 | 167.9 | 1 | 508.4 | 185.0 | 1 | 555.4 | 202.1 |
| 2 | 321.4 | 117.0 | 2 | 368.4 | 134.1 | 2 | 415.3 | 151.2 | 2 | 462.3 | 168.3 | 2 | 509.3 | 185.4 | 2 | 556.3 | 202.5 |
| 3 | 322.3 | 117.3 | 3 | 369.3 | 134.4 | 3 | 416.3 | 151.5 | 3 | 463.3 | 168.6 | 3 | 510.3 | 185.7 | 3 | 557.2 | 202.8 |
| 4 | 323.3 | 117.7 | 4 | 370.2 | 134.8 | 4 | 417.2 | 151.9 | 4 | 464.2 | 169.0 | 4 | 511.2 | 186.1 | 4 | 558.2 | 203.2 |
| 5 | 324.2 | 118.0 | 5 | 371.2 | 135.1 | 5 | 418.2 | 152.2 | 5 | 465.1 | 169.3 | 5 | 512.1 | 186.4 | 5 | 559.1 | 203.5 |
| 6 | 325.1 | 118.3 | 6 | 372.1 | 135.4 | 6 | 419.1 | 152.5 | 6 | 466.1 | 169.6 | 6 | 513.1 | 186.7 | 6 | 560.1 | 203.8 |
| 7 | 326.1 | 118.7 | 7 | 373.1 | 135.8 | 7 | 420.0 | 152.9 | 7 | 467.0 | 170.0 | 7 | 514.0 | 187.1 | 7 | 561.0 | 204.2 |
| 8 | 327.0 | 119.0 | 8 | 374.0 | 136.1 | 8 | 421.0 | 153.2 | 8 | 468.0 | 170.3 | 8 | 515.0 | 187.4 | 8 | 561.9 | 204.5 |
| 9 | 328.0 | 119.4 | 9 | 374.9 | 136.5 | 9 | 421.9 | 153.6 | 9 | 468.9 | 170.7 | 9 | 515.9 | 187.8 | 9 | 562.9 | 204.9 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 290 315
269 250 225

R

089 070° 045
091 110 135

R ou φm

R

TABELA 1

R ou φm

359 339° 315
181 201 225

TÁBUAS DE CARTEAÇÃO

001 021 045
179 159 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 46.7 | 17.9 | 100 | 93.4 | 35.8 | 150 | 140.0 | 53.8 | 200 | 186.7 | 71.7 | 250 | 233.4 | 89.6 |
| 1 | 0.9 | 0.4 | 1 | 47.6 | 18.3 | 1 | 94.3 | 36.2 | 1 | 141.0 | 54.1 | 1 | 187.6 | 72.0 | 1 | 234.3 | 90.0 |
| 2 | 1.9 | 0.7 | 2 | 48.5 | 18.6 | 2 | 95.2 | 36.6 | 2 | 141.9 | 54.5 | 2 | 188.6 | 72.4 | 2 | 235.3 | 90.3 |
| 3 | 2.8 | 1.1 | 3 | 49.5 | 19.0 | 3 | 96.2 | 36.9 | 3 | 142.8 | 54.8 | 3 | 189.5 | 72.7 | 3 | 236.2 | 90.7 |
| 4 | 3.7 | 1.4 | 4 | 50.4 | 19.4 | 4 | 97.1 | 37.3 | 4 | 143.8 | 55.2 | 4 | 190.5 | 73.1 | 4 | 237.1 | 91.0 |
| 5 | 4.7 | 1.8 | 5 | 51.3 | 19.7 | 5 | 98.0 | 37.6 | 5 | 144.7 | 55.5 | 5 | 191.4 | 73.5 | 5 | 238.1 | 91.4 |
| 6 | 5.6 | 2.2 | 6 | 52.3 | 20.1 | 6 | 99.0 | 38.0 | 6 | 145.6 | 55.9 | 6 | 192.3 | 73.8 | 6 | 239.0 | 91.7 |
| 7 | 6.5 | 2.5 | 7 | 53.2 | 20.4 | 7 | 99.9 | 38.3 | 7 | 146.6 | 56.3 | 7 | 193.3 | 74.2 | 7 | 239.9 | 92.1 |
| 8 | 7.5 | 2.9 | 8 | 54.1 | 20.8 | 8 | 100.8 | 38.7 | 8 | 147.5 | 56.6 | 8 | 194.2 | 74.5 | 8 | 240.9 | 92.5 |
| 9 | 8.4 | 3.2 | 9 | 55.1 | 21.1 | 9 | 101.8 | 39.1 | 9 | 148.4 | 57.0 | 9 | 195.1 | 74.9 | 9 | 241.8 | 92.8 |
| 10 | 9.3 | 3.6 | 60 | 56.0 | 21.5 | 110 | 102.7 | 39.4 | 160 | 149.4 | 57.3 | 210 | 196.1 | 75.3 | 260 | 242.7 | 93.2 |
| 1 | 10.3 | 3.9 | 1 | 56.9 | 21.9 | 1 | 103.6 | 39.8 | 1 | 150.3 | 57.7 | 1 | 197.0 | 75.6 | 1 | 243.7 | 93.5 |
| 2 | 11.2 | 4.3 | 2 | 57.9 | 22.2 | 2 | 104.6 | 40.1 | 2 | 151.2 | 58.1 | 2 | 197.9 | 76.0 | 2 | 244.6 | 93.9 |
| 3 | 12.1 | 4.7 | 3 | 58.8 | 22.6 | 3 | 105.5 | 40.5 | 3 | 152.2 | 58.4 | 3 | 198.9 | 76.3 | 3 | 245.5 | 94.3 |
| 4 | 13.1 | 5.0 | 4 | 59.7 | 22.9 | 4 | 106.4 | 40.9 | 4 | 153.1 | 58.8 | 4 | 199.8 | 76.7 | 4 | 246.5 | 94.6 |
| 5 | 14.0 | 5.4 | 5 | 60.7 | 23.3 | 5 | 107.4 | 41.2 | 5 | 154.0 | 59.1 | 5 | 200.7 | 77.0 | 5 | 247.4 | 95.0 |
| 6 | 14.9 | 5.7 | 6 | 61.6 | 23.7 | 6 | 108.3 | 41.6 | 6 | 155.0 | 59.5 | 6 | 201.7 | 77.4 | 6 | 248.3 | 95.3 |
| 7 | 15.9 | 6.1 | 7 | 62.5 | 24.0 | 7 | 109.2 | 41.9 | 7 | 155.9 | 59.8 | 7 | 202.6 | 77.8 | 7 | 249.3 | 95.7 |
| 8 | 16.8 | 6.5 | 8 | 63.5 | 24.4 | 8 | 110.2 | 42.3 | 8 | 156.8 | 60.2 | 8 | 203.5 | 78.1 | 8 | 250.2 | 96.0 |
| 9 | 17.7 | 6.8 | 9 | 64.4 | 24.7 | 9 | 111.1 | 42.6 | 9 | 157.8 | 60.6 | 9 | 204.5 | 78.5 | 9 | 251.1 | 96.4 |
| 20 | 18.7 | 7.2 | 70 | 65.4 | 25.1 | 120 | 112.0 | 43.0 | 170 | 158.7 | 60.9 | 220 | 205.4 | 78.8 | 270 | 252.1 | 96.8 |
| 1 | 19.6 | 7.5 | 1 | 66.3 | 25.4 | 1 | 113.0 | 43.4 | 1 | 159.6 | 61.3 | 1 | 206.3 | 79.2 | 1 | 253.0 | 97.1 |
| 2 | 20.5 | 7.9 | 2 | 67.2 | 25.8 | 2 | 113.9 | 43.7 | 2 | 160.6 | 61.6 | 2 | 207.3 | 79.6 | 2 | 253.9 | 97.5 |
| 3 | 21.5 | 8.2 | 3 | 68.2 | 26.2 | 3 | 114.8 | 44.1 | 3 | 161.5 | 62.0 | 3 | 208.2 | 79.9 | 3 | 254.9 | 97.8 |
| 4 | 22.4 | 8.6 | 4 | 69.1 | 26.5 | 4 | 115.8 | 44.4 | 4 | 162.4 | 62.4 | 4 | 209.1 | 80.3 | 4 | 255.8 | 98.2 |
| 5 | 23.3 | 9.0 | 5 | 70.0 | 26.9 | 5 | 116.7 | 44.8 | 5 | 163.4 | 62.7 | 5 | 210.1 | 80.6 | 5 | 256.7 | 98.6 |
| 6 | 24.3 | 9.3 | 6 | 71.0 | 27.2 | 6 | 117.6 | 45.2 | 6 | 164.3 | 63.1 | 6 | 211.0 | 81.0 | 6 | 257.7 | 98.9 |
| 7 | 25.2 | 9.7 | 7 | 71.9 | 27.6 | 7 | 118.6 | 45.5 | 7 | 165.2 | 63.4 | 7 | 211.9 | 81.3 | 7 | 258.6 | 99.3 |
| 8 | 26.1 | 10.0 | 8 | 72.8 | 28.0 | 8 | 119.5 | 45.9 | 8 | 166.2 | 63.8 | 8 | 212.9 | 81.7 | 8 | 259.5 | 99.6 |
| 9 | 27.1 | 10.4 | 9 | 73.8 | 28.3 | 9 | 120.4 | 46.2 | 9 | 167.1 | 64.1 | 9 | 213.8 | 82.1 | 9 | 260.5 | 100.0 |
| 30 | 28.0 | 10.8 | 80 | 74.7 | 28.7 | 130 | 121.4 | 46.6 | 180 | 168.0 | 64.5 | 230 | 214.7 | 82.4 | 280 | 261.4 | 100.3 |
| 1 | 28.9 | 11.1 | 1 | 75.6 | 29.0 | 1 | 122.3 | 46.9 | 1 | 169.0 | 64.9 | 1 | 215.7 | 82.8 | 1 | 262.3 | 100.7 |
| 2 | 29.9 | 11.5 | 2 | 76.6 | 29.4 | 2 | 123.2 | 47.3 | 2 | 169.9 | 65.2 | 2 | 216.6 | 83.1 | 2 | 263.3 | 101.1 |
| 3 | 30.8 | 11.8 | 3 | 77.5 | 29.7 | 3 | 124.2 | 47.7 | 3 | 170.8 | 65.6 | 3 | 217.5 | 83.5 | 3 | 264.2 | 101.4 |
| 4 | 31.7 | 12.2 | 4 | 78.4 | 30.1 | 4 | 125.1 | 48.0 | 4 | 171.8 | 65.9 | 4 | 218.5 | 83.9 | 4 | 265.1 | 101.8 |
| 5 | 32.7 | 12.5 | 5 | 79.4 | 30.5 | 5 | 126.0 | 48.4 | 5 | 172.7 | 66.3 | 5 | 219.4 | 84.2 | 5 | 266.1 | 102.1 |
| 6 | 33.6 | 12.9 | 6 | 80.3 | 30.8 | 6 | 127.0 | 48.7 | 6 | 173.6 | 66.7 | 6 | 220.3 | 84.6 | 6 | 267.0 | 102.5 |
| 7 | 34.5 | 13.3 | 7 | 81.2 | 31.2 | 7 | 127.9 | 49.1 | 7 | 174.6 | 67.0 | 7 | 221.3 | 84.9 | 7 | 267.9 | 102.9 |
| 8 | 35.5 | 13.6 | 8 | 82.2 | 31.5 | 8 | 128.8 | 49.5 | 8 | 175.5 | 67.4 | 8 | 222.2 | 85.3 | 8 | 268.9 | 103.2 |
| 9 | 36.4 | 14.0 | 9 | 83.1 | 31.9 | 9 | 129.8 | 49.8 | 9 | 176.4 | 67.7 | 9 | 223.1 | 85.6 | 9 | 269.8 | 103.6 |
| 40 | 37.3 | 14.3 | 90 | 84.0 | 32.3 | 140 | 130.7 | 50.2 | 190 | 177.4 | 68.1 | 240 | 224.1 | 86.0 | 290 | 270.7 | 103.9 |
| 1 | 38.3 | 14.7 | 1 | 85.0 | 32.6 | 1 | 131.6 | 50.5 | 1 | 178.3 | 68.4 | 1 | 225.0 | 86.4 | 1 | 271.7 | 104.3 |
| 2 | 39.2 | 15.1 | 2 | 85.9 | 33.0 | 2 | 132.6 | 50.9 | 2 | 179.2 | 68.8 | 2 | 225.9 | 86.7 | 2 | 272.6 | 104.6 |
| 3 | 40.1 | 15.4 | 3 | 86.8 | 33.3 | 3 | 133.5 | 51.2 | 3 | 180.2 | 69.2 | 3 | 226.9 | 87.1 | 3 | 273.5 | 105.0 |
| 4 | 41.1 | 15.8 | 4 | 87.8 | 33.7 | 4 | 134.4 | 51.6 | 4 | 181.1 | 69.5 | 4 | 227.8 | 87.4 | 4 | 274.5 | 105.4 |
| 5 | 42.0 | 16.1 | 5 | 88.7 | 34.0 | 5 | 135.4 | 52.0 | 5 | 182.0 | 69.9 | 5 | 228.7 | 87.8 | 5 | 275.4 | 105.7 |
| 6 | 42.9 | 16.5 | 6 | 89.6 | 34.4 | 6 | 136.3 | 52.3 | 6 | 183.0 | 70.2 | 6 | 229.7 | 88.2 | 6 | 276.3 | 106.1 |
| 7 | 43.9 | 16.8 | 7 | 90.6 | 34.8 | 7 | 137.2 | 52.7 | 7 | 183.9 | 70.6 | 7 | 230.6 | 88.5 | 7 | 277.3 | 106.4 |
| 8 | 44.8 | 17.2 | 8 | 91.5 | 35.1 | 8 | 138.2 | 53.0 | 8 | 184.8 | 71.0 | 8 | 231.5 | 88.9 | 8 | 278.2 | 106.8 |
| 9 | 45.7 | 17.6 | 9 | 92.4 | 35.5 | 9 | 139.1 | 53.4 | 9 | 185.8 | 71.3 | 9 | 232.5 | 89.2 | 9 | 279.1 | 107.2 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 291 315
269 249 225

R

089 069° 045
091 111 135

R ou φm

R

TABELA 1

R ou φm

359 339° 315
181 201 225

TÁBUAS DE CARTEAÇÃO

001 021 045
179 159 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 280.1 | 107.5 | 350 | 326.8 | 125.4 | 400 | 373.4 | 143.3 | 450 | 420.1 | 161.3 | 500 | 466.8 | 179.2 | 550 | 513.5 | 197.1 |
| 1 | 281.0 | 107.9 | 1 | 327.7 | 125.8 | 1 | 374.4 | 143.7 | 1 | 421.0 | 161.6 | 1 | 467.7 | 179.5 | 1 | 514.4 | 197.5 |
| 2 | 281.9 | 108.2 | 2 | 328.6 | 126.1 | 2 | 375.3 | 144.1 | 2 | 422.0 | 162.0 | 2 | 468.7 | 179.9 | 2 | 515.3 | 197.8 |
| 3 | 282.9 | 108.6 | 3 | 329.6 | 126.5 | 3 | 376.2 | 144.4 | 3 | 422.9 | 162.3 | 3 | 469.6 | 180.3 | 3 | 516.3 | 198.2 |
| 4 | 283.8 | 108.9 | 4 | 330.5 | 126.9 | 4 | 377.2 | 144.8 | 4 | 423.8 | 162.7 | 4 | 470.5 | 180.6 | 4 | 517.2 | 198.5 |
| 5 | 284.7 | 109.3 | 5 | 331.4 | 127.2 | 5 | 378.1 | 145.1 | 5 | 424.8 | 163.1 | 5 | 471.5 | 181.0 | 5 | 518.1 | 198.9 |
| 6 | 285.7 | 109.7 | 6 | 332.4 | 127.6 | 6 | 379.0 | 145.5 | 6 | 425.7 | 163.4 | 6 | 472.4 | 181.3 | 6 | 519.1 | 199.3 |
| 7 | 286.6 | 110.0 | 7 | 333.3 | 127.9 | 7 | 380.0 | 145.9 | 7 | 426.6 | 163.8 | 7 | 473.3 | 181.7 | 7 | 520.0 | 199.6 |
| 8 | 287.5 | 110.4 | 8 | 334.2 | 128.3 | 8 | 380.9 | 146.2 | 8 | 427.6 | 164.1 | 8 | 474.3 | 182.1 | 8 | 520.9 | 200.0 |
| 9 | 288.5 | 110.7 | 9 | 335.2 | 128.7 | 9 | 381.8 | 146.6 | 9 | 428.5 | 164.5 | 9 | 475.2 | 182.4 | 9 | 521.9 | 200.3 |
| 310 | 289.4 | 111.1 | 360 | 336.1 | 129.0 | 410 | 382.8 | 146.9 | 460 | 429.4 | 164.8 | 510 | 476.1 | 182.8 | 560 | 522.8 | 200.7 |
| 1 | 290.3 | 111.5 | 1 | 337.0 | 129.4 | 1 | 383.7 | 147.3 | 1 | 430.4 | 165.2 | 1 | 477.1 | 183.1 | 1 | 523.7 | 201.0 |
| 2 | 291.3 | 111.8 | 2 | 338.0 | 129.7 | 2 | 384.6 | 147.6 | 2 | 431.3 | 165.6 | 2 | 478.0 | 183.5 | 2 | 524.7 | 201.4 |
| 3 | 292.2 | 112.2 | 3 | 338.9 | 130.1 | 3 | 385.6 | 148.0 | 3 | 432.2 | 165.9 | 3 | 478.9 | 183.8 | 3 | 525.6 | 201.8 |
| 4 | 293.1 | 112.5 | 4 | 339.8 | 130.4 | 4 | 386.5 | 148.4 | 4 | 433.2 | 166.3 | 4 | 479.9 | 184.2 | 4 | 526.5 | 202.1 |
| 5 | 294.1 | 112.9 | 5 | 340.8 | 130.8 | 5 | 387.4 | 148.7 | 5 | 434.1 | 166.6 | 5 | 480.8 | 184.6 | 5 | 527.5 | 202.5 |
| 6 | 295.0 | 113.2 | 6 | 341.7 | 131.2 | 6 | 388.4 | 149.1 | 6 | 435.0 | 167.0 | 6 | 481.7 | 184.9 | 6 | 528.4 | 202.8 |
| 7 | 295.9 | 113.6 | 7 | 342.6 | 131.5 | 7 | 389.3 | 149.4 | 7 | 436.0 | 167.4 | 7 | 482.7 | 185.3 | 7 | 529.3 | 203.2 |
| 8 | 296.9 | 114.0 | 8 | 343.6 | 131.9 | 8 | 390.2 | 149.8 | 8 | 436.9 | 167.7 | 8 | 483.6 | 185.6 | 8 | 530.3 | 203.6 |
| 9 | 297.8 | 114.3 | 9 | 344.5 | 132.2 | 9 | 391.2 | 150.2 | 9 | 437.8 | 168.1 | 9 | 484.5 | 186.0 | 9 | 531.2 | 203.9 |
| 320 | 298.7 | 114.7 | 370 | 345.4 | 132.6 | 420 | 392.1 | 150.5 | 470 | 438.8 | 168.4 | 520 | 485.5 | 186.4 | 570 | 532.1 | 204.3 |
| 1 | 299.7 | 115.0 | 1 | 346.4 | 133.0 | 1 | 393.0 | 150.9 | 1 | 439.7 | 168.8 | 1 | 486.4 | 186.7 | 1 | 533.1 | 204.6 |
| 2 | 300.6 | 115.4 | 2 | 347.3 | 133.3 | 2 | 394.0 | 151.2 | 2 | 440.6 | 169.1 | 2 | 487.3 | 187.1 | 2 | 534.0 | 205.0 |
| 3 | 301.5 | 115.8 | 3 | 348.2 | 133.7 | 3 | 394.9 | 151.6 | 3 | 441.6 | 169.5 | 3 | 488.3 | 187.4 | 3 | 534.9 | 205.3 |
| 4 | 302.5 | 116.1 | 4 | 349.2 | 134.0 | 4 | 395.8 | 151.9 | 4 | 442.5 | 169.9 | 4 | 489.2 | 187.8 | 4 | 535.9 | 205.7 |
| 5 | 303.4 | 116.5 | 5 | 350.1 | 134.4 | 5 | 396.8 | 152.3 | 5 | 443.5 | 170.2 | 5 | 490.1 | 188.1 | 5 | 536.8 | 206.1 |
| 6 | 304.3 | 116.8 | 6 | 351.0 | 134.7 | 6 | 397.7 | 152.7 | 6 | 444.4 | 170.6 | 6 | 491.1 | 188.5 | 6 | 537.7 | 206.4 |
| 7 | 305.3 | 117.2 | 7 | 352.0 | 135.1 | 7 | 398.6 | 153.0 | 7 | 445.3 | 170.9 | 7 | 492.0 | 188.9 | 7 | 538.7 | 206.8 |
| 8 | 306.2 | 117.5 | 8 | 352.9 | 135.5 | 8 | 399.6 | 153.4 | 8 | 446.3 | 171.3 | 8 | 492.9 | 189.2 | 8 | 539.6 | 207.1 |
| 9 | 307.1 | 117.9 | 9 | 353.8 | 135.8 | 9 | 400.5 | 153.7 | 9 | 447.2 | 171.7 | 9 | 493.9 | 189.6 | 9 | 540.5 | 207.5 |
| 330 | 308.1 | 118.3 | 380 | 354.8 | 136.2 | 430 | 401.4 | 154.1 | 480 | 448.1 | 172.0 | 530 | 494.8 | 189.9 | 580 | 541.5 | 207.9 |
| 1 | 309.0 | 118.6 | 1 | 355.7 | 136.5 | 1 | 402.4 | 154.5 | 1 | 449.1 | 172.4 | 1 | 495.7 | 190.3 | 1 | 542.4 | 208.2 |
| 2 | 309.9 | 119.0 | 2 | 356.6 | 136.9 | 2 | 403.3 | 154.8 | 2 | 450.0 | 172.7 | 2 | 496.7 | 190.7 | 2 | 543.3 | 208.6 |
| 3 | 310.9 | 119.3 | 3 | 357.6 | 137.3 | 3 | 404.2 | 155.2 | 3 | 450.9 | 173.1 | 3 | 497.6 | 191.0 | 3 | 544.3 | 208.9 |
| 4 | 311.8 | 119.7 | 4 | 358.5 | 137.6 | 4 | 405.2 | 155.5 | 4 | 451.9 | 173.5 | 4 | 498.5 | 191.4 | 4 | 545.2 | 209.3 |
| 5 | 312.7 | 120.1 | 5 | 359.4 | 138.0 | 5 | 406.1 | 155.9 | 5 | 452.8 | 173.8 | 5 | 499.5 | 191.7 | 5 | 546.1 | 209.6 |
| 6 | 313.7 | 120.4 | 6 | 360.4 | 138.3 | 6 | 407.0 | 156.2 | 6 | 453.7 | 174.2 | 6 | 500.4 | 192.1 | 6 | 547.1 | 210.0 |
| 7 | 314.6 | 120.8 | 7 | 361.3 | 138.7 | 7 | 408.0 | 156.6 | 7 | 454.7 | 174.5 | 7 | 501.3 | 192.4 | 7 | 548.0 | 210.4 |
| 8 | 315.6 | 121.1 | 8 | 362.2 | 139.0 | 8 | 408.9 | 157.0 | 8 | 455.6 | 174.9 | 8 | 502.3 | 192.8 | 8 | 548.9 | 210.7 |
| 9 | 316.5 | 121.5 | 9 | 363.2 | 139.4 | 9 | 409.8 | 157.3 | 9 | 456.5 | 175.2 | 9 | 503.2 | 193.2 | 9 | 549.9 | 211.1 |
| 340 | 317.4 | 121.8 | 390 | 364.1 | 139.8 | 440 | 410.8 | 157.7 | 490 | 457.5 | 175.6 | 540 | 504.1 | 193.5 | 590 | 550.8 | 211.4 |
| 1 | 318.4 | 122.2 | 1 | 365.0 | 140.1 | 1 | 411.7 | 158.0 | 1 | 458.4 | 176.0 | 1 | 505.1 | 193.9 | 1 | 551.7 | 211.8 |
| 2 | 319.3 | 122.6 | 2 | 366.0 | 140.5 | 2 | 412.6 | 158.4 | 2 | 459.3 | 176.3 | 2 | 506.0 | 194.2 | 2 | 552.7 | 212.2 |
| 3 | 320.2 | 122.9 | 3 | 366.9 | 140.8 | 3 | 413.6 | 158.8 | 3 | 460.3 | 176.7 | 3 | 506.9 | 194.6 | 3 | 553.6 | 212.5 |
| 4 | 321.2 | 123.3 | 4 | 367.8 | 141.2 | 4 | 414.5 | 159.1 | 4 | 461.2 | 177.0 | 4 | 507.9 | 195.0 | 4 | 554.5 | 212.9 |
| 5 | 322.1 | 123.6 | 5 | 368.8 | 141.6 | 5 | 415.4 | 159.5 | 5 | 462.1 | 177.4 | 5 | 508.8 | 195.3 | 5 | 555.5 | 213.2 |
| 6 | 323.0 | 124.0 | 6 | 369.7 | 141.9 | 6 | 416.4 | 159.8 | 6 | 463.1 | 177.8 | 6 | 509.7 | 195.7 | 6 | 556.4 | 213.6 |
| 7 | 324.0 | 124.4 | 7 | 370.6 | 142.3 | 7 | 417.3 | 160.2 | 7 | 464.0 | 178.1 | 7 | 510.7 | 196.0 | 7 | 557.3 | 213.9 |
| 8 | 324.9 | 124.7 | 8 | 371.6 | 142.6 | 8 | 418.2 | 160.5 | 8 | 464.9 | 178.5 | 8 | 511.6 | 196.4 | 8 | 558.3 | 214.3 |
| 9 | 325.8 | 125.1 | 9 | 372.5 | 143.0 | 9 | 419.2 | 160.9 | 9 | 465.9 | 178.8 | 9 | 512.5 | 196.7 | 9 | 559.2 | 214.7 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 291 315
269 249 225

089 069° 045
091 111 135

R

R ou φm

R

TABELA 1

R ou φm

359 338° 315
181 202 225

TÁBUAS DE CARTEAÇÃO

001 022 045
179 158 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 46.4 | 18.7 | 100 | 92.7 | 37.5 | 150 | 139.1 | 56.2 | 200 | 185.4 | 74.9 | 250 | 231.8 | 93.7 |
| 1 | 0.9 | 0.4 | 1 | 47.3 | 19.1 | 1 | 93.6 | 37.8 | 1 | 140.0 | 56.6 | 1 | 186.4 | 75.3 | 1 | 232.7 | 94.0 |
| 2 | 1.9 | 0.7 | 2 | 48.2 | 19.5 | 2 | 94.6 | 38.2 | 2 | 140.9 | 56.9 | 2 | 187.3 | 75.7 | 2 | 233.7 | 94.4 |
| 3 | 2.8 | 1.1 | 3 | 49.1 | 19.9 | 3 | 95.5 | 38.6 | 3 | 141.9 | 57.3 | 3 | 188.2 | 76.0 | 3 | 234.6 | 94.8 |
| 4 | 3.7 | 1.5 | 4 | 50.1 | 20.2 | 4 | 96.4 | 39.0 | 4 | 142.8 | 57.7 | 4 | 189.1 | 76.4 | 4 | 235.5 | 95.2 |
| 5 | 4.6 | 1.9 | 5 | 51.0 | 20.6 | 5 | 97.4 | 39.3 | 5 | 143.7 | 58.1 | 5 | 190.1 | 76.8 | 5 | 236.4 | 95.5 |
| 6 | 5.6 | 2.2 | 6 | 51.9 | 21.0 | 6 | 98.3 | 39.7 | 6 | 144.6 | 58.4 | 6 | 191.0 | 77.2 | 6 | 237.4 | 95.9 |
| 7 | 6.5 | 2.6 | 7 | 52.8 | 21.4 | 7 | 99.2 | 40.1 | 7 | 145.6 | 58.8 | 7 | 191.9 | 77.5 | 7 | 238.3 | 96.3 |
| 8 | 7.4 | 3.0 | 8 | 53.8 | 21.7 | 8 | 100.1 | 40.5 | 8 | 146.5 | 59.2 | 8 | 192.9 | 77.9 | 8 | 239.2 | 96.6 |
| 9 | 8.3 | 3.4 | 9 | 54.7 | 22.1 | 9 | 101.1 | 40.8 | 9 | 147.4 | 59.6 | 9 | 193.8 | 78.3 | 9 | 240.1 | 97.0 |
| 10 | 9.3 | 3.7 | 60 | 55.6 | 22.5 | 110 | 102.0 | 41.2 | 160 | 148.3 | 59.9 | 210 | 194.7 | 78.7 | 260 | 241.1 | 97.4 |
| 1 | 10.2 | 4.1 | 1 | 56.6 | 22.9 | 1 | 102.9 | 41.6 | 1 | 149.3 | 60.3 | 1 | 195.6 | 79.0 | 1 | 242.0 | 97.8 |
| 2 | 11.1 | 4.5 | 2 | 57.5 | 23.2 | 2 | 103.8 | 42.0 | 2 | 150.2 | 60.7 | 2 | 196.6 | 79.4 | 2 | 242.9 | 98.1 |
| 3 | 12.1 | 4.9 | 3 | 58.4 | 23.6 | 3 | 104.8 | 42.3 | 3 | 151.1 | 61.1 | 3 | 197.5 | 79.8 | 3 | 243.8 | 98.5 |
| 4 | 13.0 | 5.2 | 4 | 59.3 | 24.0 | 4 | 105.7 | 42.7 | 4 | 152.1 | 61.4 | 4 | 198.4 | 80.2 | 4 | 244.8 | 98.9 |
| 5 | 13.9 | 5.6 | 5 | 60.3 | 24.3 | 5 | 106.6 | 43.1 | 5 | 153.0 | 61.8 | 5 | 199.3 | 80.5 | 5 | 245.7 | 99.3 |
| 6 | 14.8 | 6.0 | 6 | 61.2 | 24.7 | 6 | 107.6 | 43.5 | 6 | 153.9 | 62.2 | 6 | 200.3 | 80.9 | 6 | 246.6 | 99.6 |
| 7 | 15.8 | 6.4 | 7 | 62.1 | 25.1 | 7 | 108.5 | 43.8 | 7 | 154.8 | 62.6 | 7 | 201.2 | 81.3 | 7 | 247.6 | 100.0 |
| 8 | 16.7 | 6.7 | 8 | 63.0 | 25.5 | 8 | 109.4 | 44.2 | 8 | 155.8 | 62.9 | 8 | 202.1 | 81.7 | 8 | 248.5 | 100.4 |
| 9 | 17.6 | 7.1 | 9 | 64.0 | 25.8 | 9 | 110.3 | 44.6 | 9 | 156.7 | 63.3 | 9 | 203.1 | 82.0 | 9 | 249.4 | 100.8 |
| 20 | 18.5 | 7.5 | 70 | 64.9 | 26.2 | 120 | 111.3 | 45.0 | 170 | 157.6 | 63.7 | 220 | 204.0 | 82.4 | 270 | 250.3 | 101.1 |
| 1 | 19.5 | 7.9 | 1 | 65.8 | 26.6 | 1 | 112.2 | 45.3 | 1 | 158.5 | 64.1 | 1 | 204.9 | 82.8 | 1 | 251.3 | 101.5 |
| 2 | 20.4 | 8.2 | 2 | 66.8 | 27.0 | 2 | 113.1 | 45.7 | 2 | 159.5 | 64.4 | 2 | 205.8 | 83.2 | 2 | 252.2 | 101.9 |
| 3 | 21.3 | 8.6 | 3 | 67.7 | 27.3 | 3 | 114.0 | 46.1 | 3 | 160.4 | 64.8 | 3 | 206.8 | 83.5 | 3 | 253.1 | 102.3 |
| 4 | 22.3 | 9.0 | 4 | 68.6 | 27.7 | 4 | 115.0 | 46.5 | 4 | 161.3 | 65.2 | 4 | 207.7 | 83.9 | 4 | 254.0 | 102.6 |
| 5 | 23.2 | 9.4 | 5 | 69.5 | 28.1 | 5 | 115.9 | 46.8 | 5 | 162.3 | 65.6 | 5 | 208.6 | 84.3 | 5 | 255.0 | 103.0 |
| 6 | 24.1 | 9.7 | 6 | 70.5 | 28.5 | 6 | 116.8 | 47.2 | 6 | 163.2 | 65.9 | 6 | 209.5 | 84.7 | 6 | 255.9 | 103.4 |
| 7 | 25.0 | 10.1 | 7 | 71.4 | 28.8 | 7 | 117.8 | 47.6 | 7 | 164.1 | 66.3 | 7 | 210.5 | 85.0 | 7 | 256.8 | 103.8 |
| 8 | 26.0 | 10.5 | 8 | 72.3 | 29.2 | 8 | 118.7 | 47.9 | 8 | 165.0 | 66.7 | 8 | 211.4 | 85.4 | 8 | 257.8 | 104.1 |
| 9 | 26.9 | 10.9 | 9 | 73.2 | 29.6 | 9 | 119.6 | 48.3 | 9 | 166.0 | 67.1 | 9 | 212.3 | 85.8 | 9 | 258.7 | 104.5 |
| 30 | 27.8 | 11.2 | 80 | 74.2 | 30.0 | 130 | 120.5 | 48.7 | 180 | 166.9 | 67.4 | 230 | 213.3 | 86.2 | 280 | 259.6 | 104.9 |
| 1 | 28.7 | 11.6 | 1 | 75.1 | 30.3 | 1 | 121.5 | 49.1 | 1 | 167.8 | 67.8 | 1 | 214.2 | 86.5 | 1 | 260.5 | 105.3 |
| 2 | 29.7 | 12.0 | 2 | 76.0 | 30.7 | 2 | 122.4 | 49.4 | 2 | 168.7 | 68.2 | 2 | 215.1 | 86.9 | 2 | 261.5 | 105.6 |
| 3 | 30.6 | 12.4 | 3 | 77.0 | 31.1 | 3 | 123.3 | 49.8 | 3 | 169.7 | 68.6 | 3 | 216.0 | 87.3 | 3 | 262.4 | 106.0 |
| 4 | 31.5 | 12.7 | 4 | 77.9 | 31.5 | 4 | 124.2 | 50.2 | 4 | 170.6 | 68.9 | 4 | 217.0 | 87.7 | 4 | 263.3 | 106.4 |
| 5 | 32.5 | 13.1 | 5 | 78.8 | 31.8 | 5 | 125.2 | 50.6 | 5 | 171.5 | 69.3 | 5 | 217.9 | 88.0 | 5 | 264.2 | 106.8 |
| 6 | 33.4 | 13.5 | 6 | 79.7 | 32.2 | 6 | 126.1 | 50.9 | 6 | 172.5 | 69.7 | 6 | 218.8 | 88.4 | 6 | 265.2 | 107.1 |
| 7 | 34.3 | 13.9 | 7 | 80.7 | 32.6 | 7 | 127.0 | 51.3 | 7 | 173.4 | 70.1 | 7 | 219.7 | 88.8 | 7 | 266.1 | 107.5 |
| 8 | 35.2 | 14.2 | 8 | 81.6 | 33.0 | 8 | 128.0 | 51.7 | 8 | 174.3 | 70.4 | 8 | 220.7 | 89.2 | 8 | 267.0 | 107.9 |
| 9 | 36.2 | 14.6 | 9 | 82.5 | 33.3 | 9 | 128.9 | 52.1 | 9 | 175.2 | 70.8 | 9 | 221.6 | 89.5 | 9 | 268.0 | 108.3 |
| 40 | 37.1 | 15.0 | 90 | 83.4 | 33.7 | 140 | 129.8 | 52.4 | 190 | 176.2 | 71.2 | 240 | 222.5 | 89.9 | 290 | 268.9 | 108.6 |
| 1 | 38.0 | 15.4 | 1 | 84.4 | 34.1 | 1 | 130.7 | 52.8 | 1 | 177.1 | 71.5 | 1 | 223.5 | 90.3 | 1 | 269.8 | 109.0 |
| 2 | 38.9 | 15.7 | 2 | 85.3 | 34.5 | 2 | 131.7 | 53.2 | 2 | 178.0 | 71.9 | 2 | 224.4 | 90.7 | 2 | 270.7 | 109.4 |
| 3 | 39.9 | 16.1 | 3 | 86.2 | 34.8 | 3 | 132.6 | 53.6 | 3 | 178.9 | 72.3 | 3 | 225.3 | 91.0 | 3 | 271.7 | 109.8 |
| 4 | 40.8 | 16.5 | 4 | 87.2 | 35.2 | 4 | 133.5 | 53.9 | 4 | 179.9 | 72.7 | 4 | 226.2 | 91.4 | 4 | 272.6 | 110.1 |
| 5 | 41.7 | 16.9 | 5 | 88.1 | 35.6 | 5 | 134.4 | 54.3 | 5 | 180.8 | 73.0 | 5 | 227.2 | 91.8 | 5 | 273.5 | 110.5 |
| 6 | 42.7 | 17.2 | 6 | 89.0 | 36.0 | 6 | 135.4 | 54.7 | 6 | 181.7 | 73.4 | 6 | 228.1 | 92.2 | 6 | 274.4 | 110.9 |
| 7 | 43.6 | 17.6 | 7 | 89.9 | 36.3 | 7 | 136.3 | 55.1 | 7 | 182.7 | 73.8 | 7 | 229.0 | 92.5 | 7 | 275.4 | 111.3 |
| 8 | 44.5 | 18.0 | 8 | 90.9 | 36.7 | 8 | 137.2 | 55.4 | 8 | 183.6 | 74.2 | 8 | 229.9 | 92.9 | 8 | 276.3 | 111.6 |
| 9 | 45.4 | 18.4 | 9 | 91.8 | 37.1 | 9 | 138.2 | 55.8 | 9 | 184.5 | 74.5 | 9 | 230.9 | 93.3 | 9 | 277.2 | 112.0 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 292 315
269 248 225

R

089 068° 045
091 112 135

R ou φm

R

TABELA 1

R ou φm

359 338° 315
181 202 225

TÁBUAS DE CARTEAÇÃO

001 022 045
175 158 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 278.2 | 112.4 | 350 | 324.5 | 131.1 | 400 | 370.9 | 149.8 | 450 | 417.2 | 168.6 | 500 | 463.6 | 187.3 | 550 | 510.0 | 206.0 |
| 1 | 279.1 | 112.8 | 1 | 325.4 | 131.5 | 1 | 371.8 | 150.2 | 1 | 418.2 | 168.9 | 1 | 464.5 | 187.7 | 1 | 510.9 | 206.4 |
| 2 | 280.0 | 113.1 | 2 | 326.4 | 131.9 | 2 | 372.7 | 150.6 | 2 | 419.1 | 169.3 | 2 | 465.4 | 188.1 | 2 | 511.8 | 206.8 |
| 3 | 280.9 | 113.5 | 3 | 327.3 | 132.2 | 3 | 373.7 | 151.0 | 3 | 420.0 | 169.7 | 3 | 466.4 | 188.4 | 3 | 512.7 | 207.2 |
| 4 | 281.9 | 113.9 | 4 | 328.2 | 132.6 | 4 | 374.6 | 151.3 | 4 | 420.9 | 170.1 | 4 | 467.3 | 188.8 | 4 | 513.7 | 207.5 |
| 5 | 282.8 | 114.3 | 5 | 329.2 | 133.0 | 5 | 375.5 | 151.7 | 5 | 421.9 | 170.4 | 5 | 468.2 | 189.2 | 5 | 514.6 | 207.9 |
| 6 | 283.7 | 114.6 | 6 | 330.1 | 133.4 | 6 | 376.4 | 152.1 | 6 | 422.8 | 170.8 | 6 | 469.2 | 189.6 | 6 | 515.5 | 208.3 |
| 7 | 284.6 | 115.0 | 7 | 331.0 | 133.7 | 7 | 377.4 | 152.5 | 7 | 423.7 | 171.2 | 7 | 470.1 | 189.9 | 7 | 516.4 | 208.7 |
| 8 | 285.6 | 115.4 | 8 | 331.9 | 134.1 | 8 | 378.3 | 152.8 | 8 | 424.7 | 171.6 | 8 | 471.0 | 190.3 | 8 | 517.4 | 209.0 |
| 9 | 286.5 | 115.8 | 9 | 332.9 | 134.5 | 9 | 379.2 | 153.2 | 9 | 425.6 | 171.9 | 9 | 471.9 | 190.7 | 9 | 518.3 | 209.4 |
| 310 | 287.4 | 116.1 | 360 | 333.8 | 134.9 | 410 | 380.1 | 153.6 | 460 | 426.5 | 172.3 | 510 | 472.9 | 191.0 | 560 | 519.2 | 209.8 |
| 1 | 288.4 | 116.5 | 1 | 334.7 | 135.2 | 1 | 381.1 | 154.0 | 1 | 427.4 | 172.7 | 1 | 473.8 | 191.4 | 1 | 520.2 | 210.2 |
| 2 | 289.3 | 116.9 | 2 | 335.6 | 135.6 | 2 | 382.0 | 154.3 | 2 | 428.4 | 173.1 | 2 | 474.7 | 191.8 | 2 | 521.1 | 210.5 |
| 3 | 290.2 | 117.3 | 3 | 336.6 | 136.0 | 3 | 382.9 | 154.7 | 3 | 429.3 | 173.4 | 3 | 475.6 | 192.2 | 3 | 522.0 | 210.9 |
| 4 | 291.1 | 117.6 | 4 | 337.5 | 136.4 | 4 | 383.9 | 155.1 | 4 | 430.2 | 173.8 | 4 | 476.6 | 192.5 | 4 | 522.9 | 211.3 |
| 5 | 292.1 | 118.0 | 5 | 338.4 | 136.7 | 5 | 384.8 | 155.5 | 5 | 431.1 | 174.2 | 5 | 477.5 | 192.9 | 5 | 523.9 | 211.7 |
| 6 | 293.0 | 118.4 | 6 | 339.3 | 137.1 | 6 | 385.7 | 155.8 | 6 | 432.1 | 174.6 | 6 | 478.4 | 193.3 | 6 | 524.8 | 212.0 |
| 7 | 293.9 | 118.8 | 7 | 340.3 | 137.5 | 7 | 386.6 | 156.2 | 7 | 433.0 | 174.9 | 7 | 479.4 | 193.7 | 7 | 525.7 | 212.4 |
| 8 | 294.8 | 119.1 | 8 | 341.2 | 137.9 | 8 | 387.6 | 156.6 | 8 | 433.9 | 175.3 | 8 | 480.3 | 194.0 | 8 | 526.6 | 212.8 |
| 9 | 295.8 | 119.5 | 9 | 342.1 | 138.2 | 9 | 388.5 | 157.0 | 9 | 434.8 | 175.7 | 9 | 481.2 | 194.4 | 9 | 527.6 | 213.2 |
| 320 | 296.7 | 119.9 | 370 | 343.1 | 138.6 | 420 | 389.4 | 157.3 | 470 | 435.8 | 176.1 | 520 | 482.1 | 194.8 | 570 | 528.5 | 213.5 |
| 1 | 297.6 | 120.2 | 1 | 344.0 | 139.0 | 1 | 390.3 | 157.7 | 1 | 436.7 | 176.4 | 1 | 483.1 | 195.2 | 1 | 529.4 | 213.9 |
| 2 | 298.6 | 120.6 | 2 | 344.9 | 139.4 | 2 | 391.3 | 158.1 | 2 | 437.6 | 176.8 | 2 | 484.0 | 195.5 | 2 | 530.3 | 214.3 |
| 3 | 299.5 | 121.0 | 3 | 345.8 | 139.7 | 3 | 392.2 | 158.5 | 3 | 438.6 | 177.2 | 3 | 484.9 | 195.9 | 3 | 531.3 | 214.6 |
| 4 | 300.4 | 121.4 | 4 | 346.8 | 140.1 | 4 | 393.1 | 158.8 | 4 | 439.5 | 177.6 | 4 | 485.8 | 196.3 | 4 | 532.2 | 215.0 |
| 5 | 301.3 | 121.7 | 5 | 347.7 | 140.5 | 5 | 394.1 | 159.2 | 5 | 440.4 | 177.9 | 5 | 486.8 | 196.7 | 5 | 533.1 | 215.4 |
| 6 | 302.3 | 122.1 | 6 | 348.6 | 140.9 | 6 | 395.0 | 159.6 | 6 | 441.3 | 178.3 | 6 | 487.7 | 197.0 | 6 | 534.1 | 215.8 |
| 7 | 303.2 | 122.5 | 7 | 349.5 | 141.2 | 7 | 395.9 | 160.0 | 7 | 442.3 | 178.7 | 7 | 488.6 | 197.4 | 7 | 535.0 | 216.1 |
| 8 | 304.1 | 122.9 | 8 | 350.5 | 141.6 | 8 | 396.8 | 160.3 | 8 | 443.2 | 179.1 | 8 | 489.6 | 197.8 | 8 | 535.9 | 216.5 |
| 9 | 305.0 | 123.2 | 9 | 351.4 | 142.0 | 9 | 397.8 | 160.7 | 9 | 444.1 | 179.4 | 9 | 490.5 | 198.2 | 9 | 536.8 | 216.9 |
| 330 | 306.0 | 123.6 | 380 | 352.3 | 142.4 | 430 | 398.7 | 161.1 | 480 | 445.0 | 179.8 | 530 | 491.4 | 198.5 | 580 | 537.8 | 217.3 |
| 1 | 306.9 | 124.0 | 1 | 353.3 | 142.7 | 1 | 399.6 | 161.5 | 1 | 446.0 | 180.2 | 1 | 492.3 | 198.9 | 1 | 538.7 | 217.6 |
| 2 | 307.8 | 124.4 | 2 | 354.2 | 143.1 | 2 | 400.5 | 161.8 | 2 | 446.9 | 180.6 | 2 | 493.3 | 199.3 | 2 | 539.6 | 218.0 |
| 3 | 308.8 | 124.7 | 3 | 355.1 | 143.5 | 3 | 401.5 | 162.2 | 3 | 447.8 | 180.9 | 3 | 494.2 | 199.7 | 3 | 540.5 | 218.4 |
| 4 | 309.7 | 125.1 | 4 | 356.0 | 143.8 | 4 | 402.4 | 162.6 | 4 | 448.8 | 181.3 | 4 | 495.1 | 200.0 | 4 | 541.5 | 218.8 |
| 5 | 310.6 | 125.5 | 5 | 357.0 | 144.2 | 5 | 403.3 | 163.0 | 5 | 449.7 | 181.7 | 5 | 496.0 | 200.4 | 5 | 542.4 | 219.1 |
| 6 | 311.5 | 125.9 | 6 | 357.9 | 144.6 | 6 | 404.3 | 163.3 | 6 | 450.6 | 182.1 | 6 | 497.0 | 200.8 | 6 | 543.3 | 219.5 |
| 7 | 312.5 | 126.2 | 7 | 358.8 | 145.0 | 7 | 405.2 | 163.7 | 7 | 451.5 | 182.4 | 7 | 497.9 | 201.2 | 7 | 544.3 | 219.9 |
| 8 | 313.4 | 126.6 | 8 | 359.7 | 145.3 | 8 | 406.1 | 164.1 | 8 | 452.5 | 182.8 | 8 | 498.8 | 201.5 | 8 | 545.2 | 220.3 |
| 9 | 314.3 | 127.0 | 9 | 360.7 | 145.7 | 9 | 407.0 | 164.5 | 9 | 453.4 | 183.2 | 9 | 499.8 | 201.9 | 9 | 546.1 | 220.6 |
| 340 | 315.2 | 127.4 | 390 | 361.6 | 146.1 | 440 | 408.0 | 164.8 | 490 | 454.3 | 183.6 | 540 | 500.7 | 202.3 | 590 | 547.0 | 221.0 |
| 1 | 316.2 | 127.7 | 1 | 362.5 | 146.5 | 1 | 408.9 | 165.2 | 1 | 455.2 | 183.9 | 1 | 501.6 | 202.7 | 1 | 548.0 | 221.4 |
| 2 | 317.1 | 128.1 | 2 | 363.5 | 146.8 | 2 | 409.8 | 165.6 | 2 | 456.2 | 184.3 | 2 | 502.5 | 203.0 | 2 | 548.9 | 221.8 |
| 3 | 318.0 | 128.5 | 3 | 364.4 | 147.2 | 3 | 410.7 | 166.0 | 3 | 457.1 | 184.7 | 3 | 503.5 | 203.4 | 3 | 549.8 | 222.1 |
| 4 | 319.0 | 128.9 | 4 | 365.3 | 147.6 | 4 | 411.7 | 166.3 | 4 | 458.0 | 185.1 | 4 | 504.4 | 203.8 | 4 | 550.7 | 222.5 |
| 5 | 319.9 | 129.2 | 5 | 366.2 | 148.0 | 5 | 412.6 | 166.7 | 5 | 459.0 | 185.4 | 5 | 505.3 | 204.2 | 5 | 551.7 | 222.9 |
| 6 | 320.8 | 129.6 | 6 | 367.2 | 148.3 | 6 | 413.5 | 167.1 | 6 | 459.9 | 185.8 | 6 | 506.2 | 204.5 | 6 | 552.6 | 223.3 |
| 7 | 321.7 | 130.0 | 7 | 368.1 | 148.7 | 7 | 414.5 | 167.4 | 7 | 460.8 | 186.2 | 7 | 507.2 | 204.9 | 7 | 553.5 | 223.6 |
| 8 | 322.7 | 130.4 | 8 | 369.0 | 149.1 | 8 | 415.4 | 167.8 | 8 | 461.7 | 186.6 | 8 | 508.1 | 205.3 | 8 | 554.5 | 224.0 |
| 9 | 323.6 | 130.7 | 9 | 369.9 | 149.5 | 9 | 416.3 | 168.2 | 9 | 462.7 | 186.9 | 9 | 509.0 | 205.7 | 9 | 555.4 | 224.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 292 315
269 248 225

R

089 068° 045
091 112 135

R ou φm

R

TABELA 1

R ou φm

359 337° 315
181 203 225

TÁBUAS DE CARTEAÇÃO

001 023 045
179 157 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 46.0 | 19.5 | 100 | 92.1 | 39.1 | 150 | 138.1 | 58.6 | 200 | 184.1 | 78.1 | 250 | 230.1 | 97.7 |
| 1 | 0.9 | 0.4 | 1 | 46.9 | 19.9 | 1 | 93.0 | 39.5 | 1 | 139.0 | 59.0 | 1 | 185.0 | 78.5 | 1 | 231.0 | 98.1 |
| 2 | 1.8 | 0.8 | 2 | 47.9 | 20.3 | 2 | 93.9 | 39.9 | 2 | 139.9 | 59.4 | 2 | 185.9 | 78.9 | 2 | 232.0 | 98.5 |
| 3 | 2.8 | 1.2 | 3 | 48.8 | 20.7 | 3 | 94.8 | 40.2 | 3 | 140.8 | 59.8 | 3 | 186.9 | 79.3 | 3 | 232.9 | 98.9 |
| 4 | 3.7 | 1.6 | 4 | 49.7 | 21.1 | 4 | 95.7 | 40.6 | 4 | 141.8 | 60.2 | 4 | 187.8 | 79.7 | 4 | 233.8 | 99.2 |
| 5 | 4.6 | 2.0 | 5 | 50.6 | 21.5 | 5 | 96.7 | 41.0 | 5 | 142.7 | 60.6 | 5 | 188.7 | 80.1 | 5 | 234.7 | 99.6 |
| 6 | 5.5 | 2.3 | 6 | 51.5 | 21.9 | 6 | 97.6 | 41.4 | 6 | 143.6 | 61.0 | 6 | 189.6 | 80.5 | 6 | 235.6 | 100.0 |
| 7 | 6.4 | 2.7 | 7 | 52.5 | 22.3 | 7 | 98.5 | 41.8 | 7 | 144.5 | 61.3 | 7 | 190.5 | 80.9 | 7 | 236.6 | 100.4 |
| 8 | 7.4 | 3.1 | 8 | 53.4 | 22.7 | 8 | 99.4 | 42.2 | 8 | 145.4 | 61.7 | 8 | 191.5 | 81.3 | 8 | 237.5 | 100.8 |
| 9 | 8.3 | 3.5 | 9 | 54.3 | 23.1 | 9 | 100.3 | 42.6 | 9 | 146.4 | 62.1 | 9 | 192.4 | 81.7 | 9 | 238.4 | 101.2 |
| 10 | 9.2 | 3.9 | 60 | 55.2 | 23.4 | 110 | 101.3 | 43.0 | 160 | 147.3 | 62.5 | 210 | 193.3 | 82.1 | 260 | 239.3 | 101.6 |
| 1 | 10.1 | 4.3 | 1 | 56.2 | 23.8 | 1 | 102.2 | 43.4 | 1 | 148.2 | 62.9 | 1 | 194.2 | 82.4 | 1 | 240.3 | 102.0 |
| 2 | 11.0 | 4.7 | 2 | 57.1 | 24.2 | 2 | 103.1 | 43.8 | 2 | 149.1 | 63.3 | 2 | 195.1 | 82.8 | 2 | 241.2 | 102.4 |
| 3 | 12.0 | 5.1 | 3 | 58.0 | 24.6 | 3 | 104.0 | 44.2 | 3 | 150.0 | 63.7 | 3 | 196.1 | 83.2 | 3 | 242.1 | 102.8 |
| 4 | 12.9 | 5.5 | 4 | 58.9 | 25.0 | 4 | 104.9 | 44.5 | 4 | 151.0 | 64.1 | 4 | 197.0 | 83.6 | 4 | 243.0 | 103.2 |
| 5 | 13.8 | 5.9 | 5 | 59.8 | 25.4 | 5 | 105.9 | 44.9 | 5 | 151.9 | 64.5 | 5 | 197.9 | 84.0 | 5 | 243.9 | 103.5 |
| 6 | 14.7 | 6.3 | 6 | 60.8 | 25.8 | 6 | 106.8 | 45.3 | 6 | 152.8 | 64.9 | 6 | 198.8 | 84.4 | 6 | 244.9 | 103.9 |
| 7 | 15.6 | 6.6 | 7 | 61.7 | 26.2 | 7 | 107.7 | 45.7 | 7 | 153.7 | 65.3 | 7 | 199.7 | 84.8 | 7 | 245.8 | 104.3 |
| 8 | 16.6 | 7.0 | 8 | 62.6 | 26.6 | 8 | 108.6 | 46.1 | 8 | 154.6 | 65.6 | 8 | 200.7 | 85.2 | 8 | 246.7 | 104.7 |
| 9 | 17.5 | 7.4 | 9 | 63.5 | 27.0 | 9 | 109.5 | 46.5 | 9 | 155.6 | 66.0 | 9 | 201.6 | 85.6 | 9 | 247.6 | 105.1 |
| 20 | 18.4 | 7.8 | 70 | 64.4 | 27.4 | 120 | 110.5 | 46.9 | 170 | 156.5 | 66.4 | 220 | 202.5 | 86.0 | 270 | 248.5 | 105.5 |
| 1 | 19.3 | 8.2 | 1 | 65.4 | 27.7 | 1 | 111.4 | 47.3 | 1 | 157.4 | 66.8 | 1 | 203.4 | 86.4 | 1 | 249.5 | 105.9 |
| 2 | 20.3 | 8.6 | 2 | 66.3 | 28.1 | 2 | 112.3 | 47.7 | 2 | 158.3 | 67.2 | 2 | 204.4 | 86.7 | 2 | 250.4 | 106.3 |
| 3 | 21.2 | 9.0 | 3 | 67.2 | 28.5 | 3 | 113.2 | 48.1 | 3 | 159.2 | 67.6 | 3 | 205.3 | 87.1 | 3 | 251.3 | 106.7 |
| 4 | 22.1 | 9.4 | 4 | 68.1 | 28.9 | 4 | 114.1 | 48.5 | 4 | 160.2 | 68.0 | 4 | 206.2 | 87.5 | 4 | 252.2 | 107.1 |
| 5 | 23.0 | 9.8 | 5 | 69.0 | 29.3 | 5 | 115.1 | 48.8 | 5 | 161.1 | 68.4 | 5 | 207.1 | 87.9 | 5 | 253.1 | 107.5 |
| 6 | 23.9 | 10.2 | 6 | 70.0 | 29.7 | 6 | 116.0 | 49.2 | 6 | 162.0 | 68.8 | 6 | 208.0 | 88.3 | 6 | 254.1 | 107.8 |
| 7 | 24.9 | 10.5 | 7 | 70.9 | 30.1 | 7 | 116.9 | 49.6 | 7 | 162.9 | 69.2 | 7 | 209.0 | 88.7 | 7 | 255.0 | 108.2 |
| 8 | 25.8 | 10.9 | 8 | 71.8 | 30.5 | 8 | 117.8 | 50.0 | 8 | 163.8 | 69.6 | 8 | 209.9 | 89.1 | 8 | 255.9 | 108.6 |
| 9 | 26.7 | 11.3 | 9 | 72.7 | 30.9 | 9 | 118.7 | 50.4 | 9 | 164.8 | 69.9 | 9 | 210.8 | 89.5 | 9 | 256.8 | 109.0 |
| 30 | 27.6 | 11.7 | 80 | 73.6 | 31.3 | 130 | 119.7 | 50.8 | 180 | 165.7 | 70.3 | 230 | 211.7 | 89.9 | 280 | 257.7 | 109.4 |
| 1 | 28.5 | 12.1 | 1 | 74.6 | 31.6 | 1 | 120.6 | 51.2 | 1 | 166.6 | 70.7 | 1 | 212.6 | 90.3 | 1 | 258.7 | 109.8 |
| 2 | 29.5 | 12.5 | 2 | 75.5 | 32.0 | 2 | 121.5 | 51.6 | 2 | 167.5 | 71.1 | 2 | 213.6 | 90.6 | 2 | 259.6 | 110.2 |
| 3 | 30.4 | 12.9 | 3 | 76.4 | 32.4 | 3 | 122.4 | 52.0 | 3 | 168.5 | 71.5 | 3 | 214.5 | 91.0 | 3 | 260.5 | 110.6 |
| 4 | 31.3 | 13.3 | 4 | 77.3 | 32.8 | 4 | 123.3 | 52.4 | 4 | 169.4 | 71.9 | 4 | 215.4 | 91.4 | 4 | 261.4 | 111.0 |
| 5 | 32.2 | 13.7 | 5 | 78.2 | 33.2 | 5 | 124.3 | 52.7 | 5 | 170.3 | 72.3 | 5 | 216.3 | 91.8 | 5 | 262.3 | 111.4 |
| 6 | 33.1 | 14.1 | 6 | 79.2 | 33.6 | 6 | 125.2 | 53.1 | 6 | 171.2 | 72.7 | 6 | 217.2 | 92.2 | 6 | 263.3 | 111.7 |
| 7 | 34.1 | 14.5 | 7 | 80.1 | 34.0 | 7 | 126.1 | 53.5 | 7 | 172.1 | 73.1 | 7 | 218.2 | 92.6 | 7 | 264.2 | 112.1 |
| 8 | 35.0 | 14.8 | 8 | 81.0 | 34.4 | 8 | 127.0 | 53.9 | 8 | 173.1 | 73.5 | 8 | 219.1 | 93.0 | 8 | 265.1 | 112.5 |
| 9 | 35.9 | 15.2 | 9 | 81.9 | 34.8 | 9 | 128.0 | 54.3 | 9 | 174.0 | 73.8 | 9 | 220.0 | 93.4 | 9 | 266.0 | 112.9 |
| 40 | 36.8 | 15.6 | 90 | 82.8 | 35.2 | 140 | 128.9 | 54.7 | 190 | 174.9 | 74.2 | 240 | 220.9 | 93.8 | 290 | 266.9 | 113.3 |
| 1 | 37.7 | 16.0 | 1 | 83.8 | 35.6 | 1 | 129.8 | 55.1 | 1 | 175.8 | 74.6 | 1 | 221.8 | 94.2 | 1 | 267.9 | 113.7 |
| 2 | 38.7 | 16.4 | 2 | 84.7 | 35.9 | 2 | 130.7 | 55.5 | 2 | 176.7 | 75.0 | 2 | 222.8 | 94.6 | 2 | 268.8 | 114.1 |
| 3 | 39.6 | 16.8 | 3 | 85.6 | 36.3 | 3 | 131.6 | 55.9 | 3 | 177.7 | 75.4 | 3 | 223.7 | 94.9 | 3 | 269.7 | 114.5 |
| 4 | 40.5 | 17.2 | 4 | 86.5 | 36.7 | 4 | 132.6 | 56.3 | 4 | 178.6 | 75.8 | 4 | 224.6 | 95.3 | 4 | 270.6 | 114.9 |
| 5 | 41.4 | 17.6 | 5 | 87.4 | 37.1 | 5 | 133.5 | 56.7 | 5 | 179.5 | 76.2 | 5 | 225.5 | 95.7 | 5 | 271.5 | 115.3 |
| 6 | 42.3 | 18.0 | 6 | 88.4 | 37.5 | 6 | 134.4 | 57.0 | 6 | 180.4 | 76.6 | 6 | 226.4 | 96.1 | 6 | 272.5 | 115.7 |
| 7 | 43.3 | 18.4 | 7 | 89.3 | 37.9 | 7 | 135.3 | 57.4 | 7 | 181.3 | 77.0 | 7 | 227.4 | 96.5 | 7 | 273.4 | 116.0 |
| 8 | 44.2 | 18.8 | 8 | 90.2 | 38.3 | 8 | 136.2 | 57.8 | 8 | 182.3 | 77.4 | 8 | 228.3 | 96.9 | 8 | 274.3 | 116.4 |
| 9 | 45.1 | 19.1 | 9 | 91.1 | 38.7 | 9 | 137.2 | 58.2 | 9 | 183.2 | 77.8 | 9 | 229.2 | 97.3 | 9 | 275.2 | 116.8 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 293 315
269 247 225

R

089 067° 045
091 113 135

R ou φm

R

TABELA 1

R ou φm

359 337° 315
181 203 225

TÁBUAS DE CARTEAÇÃO

001 023 045
179 157 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 276.2 | 117.2 | 350 | 322.2 | 136.8 | 400 | 368.2 | 156.3 | 450 | 414.2 | 175.8 | 500 | 460.3 | 195.4 | 550 | 506.3 | 214.9 |
| 1 | 277.1 | 117.6 | 1 | 323.1 | 137.1 | 1 | 369.1 | 156.7 | 1 | 415.1 | 176.2 | 1 | 461.2 | 195.8 | 1 | 507.2 | 215.3 |
| 2 | 278.0 | 118.0 | 2 | 324.0 | 137.5 | 2 | 370.0 | 157.1 | 2 | 416.1 | 176.6 | 2 | 462.1 | 196.1 | 2 | 508.1 | 215.7 |
| 3 | 278.9 | 118.4 | 3 | 324.9 | 137.9 | 3 | 371.0 | 157.5 | 3 | 417.0 | 177.0 | 3 | 463.0 | 196.5 | 3 | 509.0 | 216.1 |
| 4 | 279.8 | 118.8 | 4 | 325.9 | 138.3 | 4 | 371.9 | 157.9 | 4 | 417.9 | 177.4 | 4 | 463.9 | 196.9 | 4 | 510.0 | 216.5 |
| 5 | 280.8 | 119.2 | 5 | 326.8 | 138.7 | 5 | 372.8 | 158.2 | 5 | 418.8 | 177.8 | 5 | 464.9 | 197.3 | 5 | 510.9 | 216.9 |
| 6 | 281.7 | 119.6 | 6 | 327.7 | 139.1 | 6 | 373.7 | 158.6 | 6 | 419.8 | 178.2 | 6 | 465.8 | 197.7 | 6 | 511.8 | 217.2 |
| 7 | 282.6 | 120.0 | 7 | 328.6 | 139.5 | 7 | 374.6 | 159.0 | 7 | 420.7 | 178.6 | 7 | 466.7 | 198.1 | 7 | 512.7 | 217.6 |
| 8 | 283.5 | 120.3 | 8 | 329.5 | 139.9 | 8 | 375.6 | 159.4 | 8 | 421.6 | 179.0 | 8 | 467.6 | 198.5 | 8 | 513.6 | 218.0 |
| 9 | 284.4 | 120.7 | 9 | 330.5 | 140.3 | 9 | 376.5 | 159.8 | 9 | 422.5 | 179.3 | 9 | 468.5 | 198.9 | 9 | 514.6 | 218.4 |
| 310 | 285.4 | 121.1 | 360 | 331.4 | 140.7 | 410 | 377.4 | 160.2 | 460 | 423.4 | 179.7 | 510 | 469.5 | 199.3 | 560 | 515.5 | 218.8 |
| 1 | 286.3 | 121.5 | 1 | 332.3 | 141.1 | 1 | 378.3 | 160.6 | 1 | 424.4 | 180.1 | 1 | 470.4 | 199.7 | 1 | 516.4 | 219.2 |
| 2 | 287.2 | 121.9 | 2 | 333.2 | 141.4 | 2 | 379.2 | 161.0 | 2 | 425.3 | 180.5 | 2 | 471.3 | 200.1 | 2 | 517.3 | 219.6 |
| 3 | 288.1 | 122.3 | 3 | 334.1 | 141.8 | 3 | 380.2 | 161.4 | 3 | 426.2 | 180.9 | 3 | 472.2 | 200.4 | 3 | 518.2 | 220.0 |
| 4 | 289.0 | 122.7 | 4 | 335.1 | 142.2 | 4 | 381.1 | 161.8 | 4 | 427.1 | 181.3 | 4 | 473.1 | 200.8 | 4 | 519.2 | 220.4 |
| 5 | 290.0 | 123.1 | 5 | 336.0 | 142.6 | 5 | 382.0 | 162.2 | 5 | 428.0 | 181.7 | 5 | 474.1 | 201.2 | 5 | 520.1 | 220.8 |
| 6 | 290.9 | 123.5 | 6 | 336.9 | 143.0 | 6 | 382.9 | 162.5 | 6 | 429.0 | 182.1 | 6 | 475.0 | 201.6 | 6 | 521.0 | 221.2 |
| 7 | 291.8 | 123.9 | 7 | 337.8 | 143.4 | 7 | 383.9 | 162.9 | 7 | 429.9 | 182.5 | 7 | 475.9 | 202.0 | 7 | 521.9 | 221.5 |
| 8 | 292.7 | 124.3 | 8 | 338.7 | 143.8 | 8 | 384.8 | 163.3 | 8 | 430.8 | 182.9 | 8 | 476.8 | 202.4 | 8 | 522.8 | 221.9 |
| 9 | 293.6 | 124.6 | 9 | 339.7 | 144.2 | 9 | 385.7 | 163.7 | 9 | 431.7 | 183.3 | 9 | 477.7 | 202.8 | 9 | 523.8 | 222.3 |
| 320 | 294.6 | 125.0 | 370 | 340.6 | 144.6 | 420 | 386.6 | 164.1 | 470 | 432.6 | 183.6 | 520 | 478.7 | 203.2 | 570 | 524.7 | 222.7 |
| 1 | 295.5 | 125.4 | 1 | 341.5 | 145.0 | 1 | 387.5 | 164.5 | 1 | 433.6 | 184.0 | 1 | 479.6 | 203.6 | 1 | 525.6 | 223.1 |
| 2 | 296.4 | 125.8 | 2 | 342.4 | 145.4 | 2 | 388.5 | 164.9 | 2 | 434.5 | 184.4 | 2 | 480.5 | 204.0 | 2 | 526.5 | 223.5 |
| 3 | 297.3 | 126.2 | 3 | 343.3 | 145.7 | 3 | 389.4 | 165.3 | 3 | 435.4 | 184.8 | 3 | 481.4 | 204.4 | 3 | 527.4 | 223.9 |
| 4 | 298.2 | 126.6 | 4 | 344.3 | 146.1 | 4 | 390.3 | 165.7 | 4 | 436.3 | 185.2 | 4 | 482.3 | 204.7 | 4 | 528.4 | 224.3 |
| 5 | 299.2 | 127.0 | 5 | 345.2 | 146.5 | 5 | 391.2 | 166.1 | 5 | 437.2 | 185.6 | 5 | 483.3 | 205.1 | 5 | 529.3 | 224.7 |
| 6 | 300.1 | 127.4 | 6 | 346.1 | 146.9 | 6 | 392.1 | 166.5 | 6 | 438.2 | 186.0 | 6 | 484.2 | 205.5 | 6 | 530.2 | 225.1 |
| 7 | 301.0 | 127.8 | 7 | 347.0 | 147.3 | 7 | 393.1 | 166.8 | 7 | 439.1 | 186.4 | 7 | 485.1 | 205.9 | 7 | 531.1 | 225.5 |
| 8 | 301.9 | 128.2 | 8 | 348.0 | 147.7 | 8 | 394.0 | 167.2 | 8 | 440.0 | 186.8 | 8 | 486.0 | 206.3 | 8 | 532.1 | 225.8 |
| 9 | 302.8 | 128.6 | 9 | 348.9 | 148.1 | 9 | 394.9 | 167.6 | 9 | 440.9 | 187.2 | 9 | 486.9 | 206.7 | 9 | 533.0 | 226.2 |
| 330 | 303.8 | 128.9 | 380 | 349.8 | 148.5 | 430 | 395.8 | 168.0 | 480 | 441.8 | 187.6 | 530 | 487.9 | 207.1 | 580 | 533.9 | 226.6 |
| 1 | 304.7 | 129.3 | 1 | 350.7 | 148.9 | 1 | 396.7 | 168.4 | 1 | 442.8 | 187.9 | 1 | 488.8 | 207.5 | 1 | 534.8 | 227.0 |
| 2 | 305.6 | 129.7 | 2 | 351.6 | 149.3 | 2 | 397.7 | 168.8 | 2 | 443.7 | 188.3 | 2 | 489.7 | 207.9 | 2 | 535.7 | 227.4 |
| 3 | 306.5 | 130.1 | 3 | 352.6 | 149.6 | 3 | 398.6 | 169.2 | 3 | 444.6 | 188.7 | 3 | 490.6 | 208.3 | 3 | 536.7 | 227.8 |
| 4 | 307.4 | 130.5 | 4 | 353.5 | 150.0 | 4 | 399.5 | 169.6 | 4 | 445.5 | 189.1 | 4 | 491.5 | 208.7 | 4 | 537.6 | 228.2 |
| 5 | 308.4 | 130.9 | 5 | 354.4 | 150.4 | 5 | 400.4 | 170.0 | 5 | 446.4 | 189.5 | 5 | 492.5 | 209.0 | 5 | 538.5 | 228.6 |
| 6 | 309.3 | 131.3 | 6 | 355.3 | 150.8 | 6 | 401.3 | 170.4 | 6 | 447.4 | 189.9 | 6 | 493.4 | 209.4 | 6 | 539.4 | 229.0 |
| 7 | 310.2 | 131.7 | 7 | 356.2 | 151.2 | 7 | 402.3 | 170.7 | 7 | 448.3 | 190.3 | 7 | 494.3 | 209.8 | 7 | 540.3 | 229.4 |
| 8 | 311.1 | 132.1 | 8 | 357.2 | 151.6 | 8 | 403.2 | 171.1 | 8 | 449.2 | 190.7 | 8 | 495.2 | 210.2 | 8 | 541.3 | 229.7 |
| 9 | 312.1 | 132.5 | 9 | 358.1 | 152.0 | 9 | 404.1 | 171.5 | 9 | 450.1 | 191.1 | 9 | 496.2 | 210.6 | 9 | 542.2 | 230.1 |
| 340 | 313.0 | 132.8 | 390 | 359.0 | 152.4 | 440 | 405.0 | 171.9 | 490 | 451.0 | 191.5 | 540 | 497.1 | 211.0 | 590 | 543.1 | 230.5 |
| 1 | 313.9 | 133.2 | 1 | 359.9 | 152.8 | 1 | 405.9 | 172.3 | 1 | 452.0 | 191.8 | 1 | 498.0 | 211.4 | 1 | 544.0 | 230.9 |
| 2 | 314.8 | 133.6 | 2 | 360.8 | 153.2 | 2 | 406.9 | 172.7 | 2 | 452.9 | 192.2 | 2 | 498.9 | 211.8 | 2 | 544.9 | 231.3 |
| 3 | 315.7 | 134.0 | 3 | 361.8 | 153.6 | 3 | 407.8 | 173.1 | 3 | 453.8 | 192.6 | 3 | 499.8 | 212.2 | 3 | 545.9 | 231.7 |
| 4 | 316.7 | 134.4 | 4 | 362.7 | 153.9 | 4 | 408.7 | 173.5 | 4 | 454.7 | 193.0 | 4 | 500.8 | 212.6 | 4 | 546.8 | 232.1 |
| 5 | 317.6 | 134.8 | 5 | 363.6 | 154.3 | 5 | 409.6 | 173.9 | 5 | 455.6 | 193.4 | 5 | 501.7 | 212.9 | 5 | 547.7 | 232.5 |
| 6 | 318.5 | 135.2 | 6 | 364.5 | 154.7 | 6 | 410.5 | 174.3 | 6 | 456.6 | 193.8 | 6 | 502.6 | 213.3 | 6 | 548.6 | 232.9 |
| 7 | 319.4 | 135.6 | 7 | 365.4 | 155.1 | 7 | 411.5 | 174.7 | 7 | 457.5 | 194.2 | 7 | 503.5 | 213.7 | 7 | 549.5 | 233.3 |
| 8 | 320.3 | 136.0 | 8 | 366.4 | 155.5 | 8 | 412.4 | 175.0 | 8 | 458.4 | 194.6 | 8 | 504.4 | 214.1 | 8 | 550.5 | 233.7 |
| 9 | 321.3 | 136.4 | 9 | 367.3 | 155.9 | 9 | 413.3 | 175.4 | 9 | 459.3 | 195.0 | 9 | 505.4 | 214.5 | 9 | 551.4 | 234.0 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 293 315
269 247 225

R

089 067° 045
091 113 135

R ou φm

R

TABELA 1

R ou φm

359 336° 315
181 204 225

TÁBUAS DE CARTEAÇÃO

091 024 045
179 156 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 45.7 | 20.3 | 100 | 91.4 | 40.7 | 150 | 137.0 | 61.0 | 200 | 182.7 | 81.3 | 250 | 228.4 | 101.7 |
| 1 | 0.9 | 0.4 | 1 | 46.6 | 20.7 | 1 | 92.3 | 41.1 | 1 | 137.9 | 61.4 | 1 | 183.6 | 81.8 | 1 | 229.3 | 102.1 |
| 2 | 1.8 | 0.8 | 2 | 47.5 | 21.2 | 2 | 93.2 | 41.5 | 2 | 138.9 | 61.8 | 2 | 184.5 | 82.2 | 2 | 230.2 | 102.5 |
| 3 | 2.7 | 1.2 | 3 | 48.4 | 21.6 | 3 | 94.1 | 41.9 | 3 | 139.8 | 62.2 | 3 | 185.4 | 82.6 | 3 | 231.1 | 102.9 |
| 4 | 3.7 | 1.6 | 4 | 49.3 | 22.0 | 4 | 95.0 | 42.3 | 4 | 140.7 | 62.6 | 4 | 186.4 | 83.0 | 4 | 232.0 | 103.3 |
| 5 | 4.6 | 2.0 | 5 | 50.2 | 22.4 | 5 | 95.9 | 42.7 | 5 | 141.6 | 63.0 | 5 | 187.3 | 83.4 | 5 | 233.0 | 103.7 |
| 6 | 5.5 | 2.4 | 6 | 51.2 | 22.8 | 6 | 96.8 | 43.1 | 6 | 142.5 | 63.5 | 6 | 188.2 | 83.8 | 6 | 233.9 | 104.1 |
| 7 | 6.4 | 2.8 | 7 | 52.1 | 23.2 | 7 | 97.7 | 43.5 | 7 | 143.4 | 63.9 | 7 | 189.1 | 84.2 | 7 | 234.8 | 104.5 |
| 8 | 7.3 | 3.3 | 8 | 53.0 | 23.6 | 8 | 98.7 | 43.9 | 8 | 144.3 | 64.3 | 8 | 190.0 | 84.6 | 8 | 235.7 | 104.9 |
| 9 | 8.2 | 3.7 | 9 | 53.9 | 24.0 | 9 | 99.6 | 44.3 | 9 | 145.3 | 64.7 | 9 | 190.9 | 85.0 | 9 | 236.6 | 105.3 |
| 10 | 9.1 | 4.1 | 60 | 54.8 | 24.4 | 110 | 100.5 | 44.7 | 160 | 146.2 | 65.1 | 210 | 191.8 | 85.4 | 260 | 237.5 | 105.8 |
| 1 | 10.0 | 4.5 | 1 | 55.7 | 24.8 | 1 | 101.4 | 45.1 | 1 | 147.1 | 65.5 | 1 | 192.8 | 85.8 | 1 | 238.4 | 106.2 |
| 2 | 11.0 | 4.9 | 2 | 56.6 | 25.2 | 2 | 102.3 | 45.6 | 2 | 148.0 | 65.9 | 2 | 193.7 | 86.2 | 2 | 239.3 | 106.6 |
| 3 | 11.9 | 5.3 | 3 | 57.6 | 25.6 | 3 | 103.2 | 46.0 | 3 | 148.9 | 66.3 | 3 | 194.6 | 86.6 | 3 | 240.3 | 107.0 |
| 4 | 12.8 | 5.7 | 4 | 58.5 | 26.0 | 4 | 104.1 | 46.4 | 4 | 149.8 | 66.7 | 4 | 195.5 | 87.0 | 4 | 241.2 | 107.4 |
| 5 | 13.7 | 6.1 | 5 | 59.4 | 26.4 | 5 | 105.1 | 46.8 | 5 | 150.7 | 67.1 | 5 | 196.4 | 87.4 | 5 | 242.1 | 107.8 |
| 6 | 14.6 | 6.5 | 6 | 60.3 | 26.8 | 6 | 106.0 | 47.2 | 6 | 151.6 | 67.5 | 6 | 197.3 | 87.9 | 6 | 243.0 | 108.2 |
| 7 | 15.5 | 6.9 | 7 | 61.2 | 27.3 | 7 | 106.9 | 47.6 | 7 | 152.6 | 67.9 | 7 | 198.2 | 88.3 | 7 | 243.9 | 108.6 |
| 8 | 16.4 | 7.3 | 8 | 62.1 | 27.7 | 8 | 107.8 | 48.0 | 8 | 153.5 | 68.3 | 8 | 199.2 | 88.7 | 8 | 244.8 | 109.0 |
| 9 | 17.4 | 7.7 | 9 | 63.0 | 28.1 | 9 | 108.7 | 48.4 | 9 | 154.4 | 68.7 | 9 | 200.1 | 89.1 | 9 | 245.7 | 109.4 |
| 20 | 18.3 | 8.1 | 70 | 63.9 | 28.5 | 120 | 109.6 | 48.8 | 170 | 155.3 | 69.1 | 220 | 201.0 | 89.5 | 270 | 246.7 | 109.8 |
| 1 | 19.2 | 8.5 | 1 | 64.9 | 28.9 | 1 | 110.5 | 49.2 | 1 | 156.2 | 69.6 | 1 | 201.9 | 89.9 | 1 | 247.6 | 110.2 |
| 2 | 20.1 | 8.9 | 2 | 65.8 | 29.3 | 2 | 111.5 | 49.6 | 2 | 157.1 | 70.0 | 2 | 202.8 | 90.3 | 2 | 248.5 | 110.6 |
| 3 | 21.0 | 9.4 | 3 | 66.7 | 29.7 | 3 | 112.4 | 50.0 | 3 | 158.0 | 70.4 | 3 | 203.7 | 90.7 | 3 | 249.4 | 111.0 |
| 4 | 21.9 | 9.8 | 4 | 67.6 | 30.1 | 4 | 113.3 | 50.4 | 4 | 159.0 | 70.8 | 4 | 204.6 | 91.1 | 4 | 250.3 | 111.4 |
| 5 | 22.8 | 10.2 | 5 | 68.5 | 30.5 | 5 | 114.2 | 50.8 | 5 | 159.9 | 71.2 | 5 | 205.5 | 91.5 | 5 | 251.2 | 111.9 |
| 6 | 23.8 | 10.6 | 6 | 69.4 | 30.9 | 6 | 115.1 | 51.2 | 6 | 160.8 | 71.6 | 6 | 206.5 | 91.9 | 6 | 252.1 | 112.3 |
| 7 | 24.7 | 11.0 | 7 | 70.3 | 31.3 | 7 | 116.0 | 51.7 | 7 | 161.7 | 72.0 | 7 | 207.4 | 92.3 | 7 | 253.1 | 112.7 |
| 8 | 25.6 | 11.4 | 8 | 71.3 | 31.7 | 8 | 116.9 | 52.1 | 8 | 162.6 | 72.4 | 8 | 208.3 | 92.7 | 8 | 254.0 | 113.1 |
| 9 | 26.5 | 11.8 | 9 | 72.2 | 32.1 | 9 | 117.8 | 52.5 | 9 | 163.5 | 72.8 | 9 | 209.2 | 93.1 | 9 | 254.9 | 113.5 |
| 30 | 27.4 | 12.2 | 80 | 73.1 | 32.5 | 130 | 118.8 | 52.9 | 180 | 164.4 | 73.2 | 230 | 210.1 | 93.5 | 280 | 255.8 | 113.9 |
| 1 | 28.3 | 12.6 | 1 | 74.0 | 32.9 | 1 | 119.7 | 53.3 | 1 | 165.4 | 73.6 | 1 | 211.0 | 94.0 | 1 | 256.7 | 114.3 |
| 2 | 29.2 | 13.0 | 2 | 74.9 | 33.4 | 2 | 120.6 | 53.7 | 2 | 166.3 | 74.0 | 2 | 211.9 | 94.4 | 2 | 257.6 | 114.7 |
| 3 | 30.1 | 13.4 | 3 | 75.8 | 33.8 | 3 | 121.5 | 54.1 | 3 | 167.2 | 74.4 | 3 | 212.9 | 94.8 | 3 | 258.5 | 115.1 |
| 4 | 31.1 | 13.8 | 4 | 76.7 | 34.2 | 4 | 122.4 | 54.5 | 4 | 168.1 | 74.8 | 4 | 213.8 | 95.2 | 4 | 259.4 | 115.5 |
| 5 | 32.0 | 14.2 | 5 | 77.7 | 34.6 | 5 | 123.3 | 54.9 | 5 | 169.0 | 75.2 | 5 | 214.7 | 95.6 | 5 | 260.4 | 115.9 |
| 6 | 32.9 | 14.6 | 6 | 78.6 | 35.0 | 6 | 124.2 | 55.3 | 6 | 169.9 | 75.7 | 6 | 215.6 | 96.0 | 6 | 261.3 | 116.3 |
| 7 | 33.8 | 15.0 | 7 | 79.5 | 35.4 | 7 | 125.2 | 55.7 | 7 | 170.8 | 76.1 | 7 | 216.5 | 96.4 | 7 | 262.2 | 116.7 |
| 8 | 34.7 | 15.5 | 8 | 80.4 | 35.8 | 8 | 126.1 | 56.1 | 8 | 171.7 | 76.5 | 8 | 217.4 | 96.8 | 8 | 263.1 | 117.1 |
| 9 | 35.6 | 15.9 | 9 | 81.3 | 36.2 | 9 | 127.0 | 56.5 | 9 | 172.7 | 76.9 | 9 | 218.3 | 97.2 | 9 | 264.0 | 117.5 |
| 40 | 36.5 | 16.3 | 90 | 82.2 | 36.6 | 140 | 127.9 | 56.9 | 190 | 173.6 | 77.3 | 240 | 219.3 | 97.6 | 290 | 264.9 | 118.0 |
| 1 | 37.5 | 16.7 | 1 | 83.1 | 37.0 | 1 | 128.8 | 57.3 | 1 | 174.5 | 77.7 | 1 | 220.2 | 98.0 | 1 | 265.8 | 118.4 |
| 2 | 38.4 | 17.1 | 2 | 84.0 | 37.4 | 2 | 129.7 | 57.8 | 2 | 175.4 | 78.1 | 2 | 221.1 | 98.4 | 2 | 266.8 | 118.8 |
| 3 | 39.3 | 17.5 | 3 | 85.0 | 37.8 | 3 | 130.6 | 58.2 | 3 | 176.3 | 78.5 | 3 | 222.0 | 98.8 | 3 | 267.7 | 119.2 |
| 4 | 40.2 | 17.9 | 4 | 85.9 | 38.2 | 4 | 131.6 | 58.6 | 4 | 177.2 | 78.9 | 4 | 222.9 | 99.2 | 4 | 268.6 | 119.6 |
| 5 | 41.1 | 18.3 | 5 | 86.8 | 38.6 | 5 | 132.5 | 59.0 | 5 | 178.1 | 79.3 | 5 | 223.8 | 99.7 | 5 | 269.5 | 120.0 |
| 6 | 42.0 | 18.7 | 6 | 87.7 | 39.0 | 6 | 133.4 | 59.4 | 6 | 179.1 | 79.7 | 6 | 224.7 | 100.1 | 6 | 270.4 | 120.4 |
| 7 | 42.9 | 19.1 | 7 | 88.6 | 39.5 | 7 | 134.3 | 59.8 | 7 | 180.0 | 80.1 | 7 | 225.6 | 100.5 | 7 | 271.3 | 120.8 |
| 8 | 43.9 | 19.5 | 8 | 89.5 | 39.9 | 8 | 135.2 | 60.2 | 8 | 180.9 | 80.5 | 8 | 226.6 | 100.9 | 8 | 272.2 | 121.2 |
| 9 | 44.8 | 19.9 | 9 | 90.4 | 40.3 | 9 | 136.1 | 60.6 | 9 | 181.8 | 80.9 | 9 | 227.5 | 101.3 | 9 | 273.1 | 121.6 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 294 315
269 246 225

R

089 066° 045
091 114 135

R ou φm

R

TABELA 1

R ou φm

359 336° 315

181 204 225

TÁBUAS DE CARTEAÇÃO

001 024 045

479 156 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 274.1 | 122.0 | 350 | 319.7 | 142.4 | 400 | 365.4 | 162.7 | 450 | 411.1 | 183.0 | 500 | 456.8 | 203.4 | 550 | 502.4 | 223.7 |
| 1 | 275.0 | 122.4 | 1 | 320.7 | 142.8 | 1 | 366.3 | 163.1 | 1 | 412.0 | 183.4 | 1 | 457.7 | 203.8 | 1 | 503.4 | 224.1 |
| 2 | 275.9 | 122.8 | 2 | 321.6 | 143.2 | 2 | 367.2 | 163.5 | 2 | 412.9 | 183.8 | 2 | 458.6 | 204.2 | 2 | 504.3 | 224.5 |
| 3 | 276.8 | 123.2 | 3 | 322.5 | 143.6 | 3 | 368.2 | 163.9 | 3 | 413.8 | 184.3 | 3 | 459.5 | 204.6 | 3 | 505.2 | 224.9 |
| 4 | 277.7 | 123.6 | 4 | 323.4 | 144.0 | 4 | 369.1 | 164.3 | 4 | 414.7 | 184.7 | 4 | 460.4 | 205.0 | 4 | 506.1 | 225.3 |
| 5 | 278.6 | 124.1 | 5 | 324.3 | 144.4 | 5 | 370.0 | 164.7 | 5 | 415.7 | 185.1 | 5 | 461.3 | 205.4 | 5 | 507.0 | 225.7 |
| 6 | 279.5 | 124.5 | 6 | 325.2 | 144.8 | 6 | 370.9 | 165.1 | 6 | 416.6 | 185.5 | 6 | 462.3 | 205.8 | 6 | 507.9 | 226.1 |
| 7 | 280.5 | 124.9 | 7 | 326.1 | 145.2 | 7 | 371.8 | 165.5 | 7 | 417.5 | 185.9 | 7 | 463.2 | 206.2 | 7 | 508.8 | 226.6 |
| 8 | 281.4 | 125.3 | 8 | 327.0 | 145.6 | 8 | 372.7 | 165.9 | 8 | 418.4 | 186.3 | 8 | 464.1 | 206.6 | 8 | 509.8 | 227.0 |
| 9 | 282.3 | 125.7 | 9 | 328.0 | 146.0 | 9 | 373.6 | 166.4 | 9 | 419.3 | 186.7 | 9 | 465.0 | 207.0 | 9 | 510.7 | 227.4 |
| 310 | 283.2 | 126.1 | 360 | 328.9 | 146.4 | 410 | 374.6 | 166.8 | 460 | 420.2 | 187.1 | 510 | 465.9 | 207.4 | 560 | 511.6 | 227.8 |
| 1 | 284.1 | 126.5 | 1 | 329.8 | 146.8 | 1 | 375.5 | 167.2 | 1 | 421.1 | 187.5 | 1 | 466.8 | 207.8 | 1 | 512.5 | 228.2 |
| 2 | 285.0 | 126.9 | 2 | 330.7 | 147.2 | 2 | 376.4 | 167.6 | 2 | 422.1 | 187.9 | 2 | 467.7 | 208.2 | 2 | 513.4 | 228.6 |
| 3 | 285.9 | 127.3 | 3 | 331.6 | 147.6 | 3 | 377.3 | 168.0 | 3 | 423.0 | 188.3 | 3 | 468.6 | 208.7 | 3 | 514.3 | 229.0 |
| 4 | 286.9 | 127.7 | 4 | 332.5 | 148.1 | 4 | 378.2 | 168.4 | 4 | 423.9 | 188.7 | 4 | 469.6 | 209.1 | 4 | 515.2 | 229.4 |
| 5 | 287.8 | 128.1 | 5 | 333.4 | 148.5 | 5 | 379.1 | 168.8 | 5 | 424.8 | 189.1 | 5 | 470.5 | 209.5 | 5 | 516.2 | 229.8 |
| 6 | 288.7 | 128.5 | 6 | 334.4 | 148.9 | 6 | 380.0 | 169.2 | 6 | 425.7 | 189.5 | 6 | 471.4 | 209.9 | 6 | 517.1 | 230.2 |
| 7 | 289.6 | 128.9 | 7 | 335.3 | 149.3 | 7 | 380.9 | 169.6 | 7 | 426.6 | 189.9 | 7 | 472.3 | 210.3 | 7 | 518.0 | 230.6 |
| 8 | 290.5 | 129.3 | 8 | 336.2 | 149.7 | 8 | 381.9 | 170.0 | 8 | 427.5 | 190.4 | 8 | 473.2 | 210.7 | 8 | 518.9 | 231.0 |
| 9 | 291.4 | 129.7 | 9 | 337.1 | 150.1 | 9 | 382.8 | 170.4 | 9 | 428.5 | 190.8 | 9 | 474.1 | 211.1 | 9 | 519.8 | 231.4 |
| 320 | 292.3 | 130.2 | 370 | 338.0 | 150.5 | 420 | 383.7 | 170.8 | 470 | 429.4 | 191.2 | 520 | 475.0 | 211.5 | 570 | 520.7 | 231.8 |
| 1 | 293.2 | 130.6 | 1 | 338.9 | 150.9 | 1 | 384.6 | 171.2 | 1 | 430.3 | 191.6 | 1 | 476.0 | 211.9 | 1 | 521.6 | 232.2 |
| 2 | 294.2 | 131.0 | 2 | 339.8 | 151.3 | 2 | 385.5 | 171.6 | 2 | 431.2 | 192.0 | 2 | 476.9 | 212.3 | 2 | 522.5 | 232.7 |
| 3 | 295.1 | 131.4 | 3 | 340.8 | 151.7 | 3 | 386.4 | 172.0 | 3 | 432.1 | 192.4 | 3 | 477.8 | 212.7 | 3 | 523.5 | 233.1 |
| 4 | 296.0 | 131.8 | 4 | 341.7 | 152.1 | 4 | 387.3 | 172.5 | 4 | 433.0 | 192.8 | 4 | 478.7 | 213.1 | 4 | 524.4 | 233.5 |
| 5 | 296.9 | 132.2 | 5 | 342.6 | 152.5 | 5 | 388.3 | 172.9 | 5 | 433.9 | 193.2 | 5 | 479.6 | 213.5 | 5 | 525.3 | 233.9 |
| 6 | 297.8 | 132.6 | 6 | 343.5 | 152.9 | 6 | 389.2 | 173.3 | 6 | 434.8 | 193.6 | 6 | 480.5 | 213.9 | 6 | 526.2 | 234.3 |
| 7 | 298.7 | 133.0 | 7 | 344.4 | 153.3 | 7 | 390.1 | 173.7 | 7 | 435.8 | 194.0 | 7 | 481.4 | 214.4 | 7 | 527.1 | 234.7 |
| 8 | 299.6 | 133.4 | 8 | 345.3 | 153.7 | 8 | 391.0 | 174.1 | 8 | 436.7 | 194.4 | 8 | 482.4 | 214.8 | 8 | 528.0 | 235.1 |
| 9 | 300.6 | 133.8 | 9 | 346.2 | 154.2 | 9 | 391.9 | 174.5 | 9 | 437.6 | 194.8 | 9 | 483.3 | 215.2 | 9 | 528.9 | 235.5 |
| 330 | 301.5 | 134.2 | 380 | 347.1 | 154.6 | 430 | 392.8 | 174.9 | 480 | 438.5 | 195.2 | 530 | 484.2 | 215.6 | 580 | 529.9 | 235.9 |
| 1 | 302.4 | 134.6 | 1 | 348.1 | 155.0 | 1 | 393.7 | 175.3 | 1 | 439.4 | 195.6 | 1 | 485.1 | 216.0 | 1 | 530.8 | 236.3 |
| 2 | 303.3 | 135.0 | 2 | 349.0 | 155.4 | 2 | 394.7 | 175.7 | 2 | 440.3 | 196.0 | 2 | 486.0 | 216.4 | 2 | 531.7 | 236.7 |
| 3 | 304.2 | 135.4 | 3 | 349.9 | 155.8 | 3 | 395.6 | 176.1 | 3 | 441.2 | 196.5 | 3 | 486.9 | 216.8 | 3 | 532.6 | 237.1 |
| 4 | 305.1 | 135.9 | 4 | 350.8 | 156.2 | 4 | 396.5 | 176.5 | 4 | 442.2 | 196.9 | 4 | 487.8 | 217.2 | 4 | 533.5 | 237.5 |
| 5 | 306.0 | 136.3 | 5 | 351.7 | 156.6 | 5 | 397.4 | 176.9 | 5 | 443.1 | 197.3 | 5 | 488.7 | 217.6 | 5 | 534.4 | 237.9 |
| 6 | 307.0 | 136.7 | 6 | 352.6 | 157.0 | 6 | 398.3 | 177.3 | 6 | 444.0 | 197.7 | 6 | 489.7 | 218.0 | 6 | 535.3 | 238.3 |
| 7 | 307.9 | 137.1 | 7 | 353.5 | 157.4 | 7 | 399.2 | 177.7 | 7 | 444.9 | 198.1 | 7 | 490.6 | 218.4 | 7 | 536.3 | 238.8 |
| 8 | 308.8 | 137.5 | 8 | 354.5 | 157.8 | 8 | 400.1 | 178.2 | 8 | 445.8 | 198.5 | 8 | 491.5 | 218.8 | 8 | 537.2 | 239.2 |
| 9 | 309.7 | 137.9 | 9 | 355.4 | 158.2 | 9 | 401.0 | 178.6 | 9 | 446.7 | 198.9 | 9 | 492.4 | 219.2 | 9 | 538.1 | 239.6 |
| 340 | 310.6 | 138.3 | 390 | 356.3 | 158.6 | 440 | 402.0 | 179.0 | 490 | 447.6 | 199.3 | 540 | 493.3 | 219.6 | 590 | 539.0 | 240.0 |
| 1 | 311.5 | 138.7 | 1 | 357.2 | 159.0 | 1 | 402.9 | 179.4 | 1 | 448.6 | 199.7 | 1 | 494.2 | 220.0 | 1 | 539.9 | 240.4 |
| 2 | 312.4 | 139.1 | 2 | 358.1 | 159.4 | 2 | 403.8 | 179.8 | 2 | 449.5 | 200.1 | 2 | 495.1 | 220.5 | 2 | 540.8 | 240.8 |
| 3 | 313.3 | 139.5 | 3 | 359.0 | 159.8 | 3 | 404.7 | 180.2 | 3 | 450.4 | 200.5 | 3 | 496.1 | 220.9 | 3 | 541.7 | 241.2 |
| 4 | 314.3 | 139.9 | 4 | 359.9 | 160.3 | 4 | 405.6 | 180.6 | 4 | 451.3 | 200.9 | 4 | 497.0 | 221.3 | 4 | 542.6 | 241.6 |
| 5 | 315.2 | 140.3 | 5 | 360.9 | 160.7 | 5 | 406.5 | 181.0 | 5 | 452.2 | 201.3 | 5 | 497.9 | 221.7 | 5 | 543.6 | 242.0 |
| 6 | 316.1 | 140.7 | 6 | 361.8 | 161.1 | 6 | 407.4 | 181.4 | 6 | 453.1 | 201.7 | 6 | 498.8 | 222.1 | 6 | 544.5 | 242.4 |
| 7 | 317.0 | 141.1 | 7 | 362.7 | 161.5 | 7 | 408.4 | 181.8 | 7 | 454.0 | 202.1 | 7 | 499.7 | 222.5 | 7 | 545.4 | 242.8 |
| 8 | 317.9 | 141.5 | 8 | 363.6 | 161.9 | 8 | 409.3 | 182.2 | 8 | 454.9 | 202.6 | 8 | 500.6 | 222.9 | 8 | 546.3 | 243.2 |
| 9 | 318.8 | 142.0 | 9 | 364.5 | 162.3 | 9 | 410.2 | 182.6 | 9 | 455.9 | 203.0 | 9 | 501.5 | 223.3 | 9 | 547.2 | 243.6 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 294 315

269 246 225

R

089 066° 045

091 114 135

R ou φm

R

TABELA 1

R ou φm

359 335° 315
181 205 225

TÁBUAS DE CARTEAÇÃO

001 025 045
179 155 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 45.3 | 21.1 | 100 | 90.6 | 42.3 | 150 | 135.9 | 63.4 | 200 | 181.3 | 84.5 | 250 | 226.6 | 105.7 |
| 1 | 0.9 | 0.4 | 1 | 46.2 | 21.6 | 1 | 91.5 | 42.7 | 1 | 136.9 | 63.8 | 1 | 182.2 | 84.9 | 1 | 227.5 | 106.1 |
| 2 | 1.8 | 0.8 | 2 | 47.1 | 22.0 | 2 | 92.4 | 43.1 | 2 | 137.8 | 64.2 | 2 | 183.1 | 85.4 | 2 | 228.4 | 106.5 |
| 3 | 2.7 | 1.3 | 3 | 48.0 | 22.4 | 3 | 93.3 | 43.5 | 3 | 138.7 | 64.7 | 3 | 184.0 | 85.8 | 3 | 229.3 | 106.9 |
| 4 | 3.6 | 1.7 | 4 | 48.9 | 22.8 | 4 | 94.3 | 44.0 | 4 | 139.6 | 65.1 | 4 | 184.9 | 86.2 | 4 | 230.2 | 107.3 |
| 5 | 4.5 | 2.1 | 5 | 49.8 | 23.2 | 5 | 95.2 | 44.4 | 5 | 140.5 | 65.5 | 5 | 185.8 | 86.6 | 5 | 231.1 | 107.8 |
| 6 | 5.4 | 2.5 | 6 | 50.8 | 23.7 | 6 | 96.1 | 44.8 | 6 | 141.4 | 65.9 | 6 | 186.7 | 87.1 | 6 | 232.0 | 108.2 |
| 7 | 6.3 | 3.0 | 7 | 51.7 | 24.1 | 7 | 97.0 | 45.2 | 7 | 142.3 | 66.4 | 7 | 187.6 | 87.5 | 7 | 232.9 | 108.6 |
| 8 | 7.3 | 3.4 | 8 | 52.6 | 24.5 | 8 | 97.9 | 45.6 | 8 | 143.2 | 66.8 | 8 | 188.5 | 87.9 | 8 | 233.8 | 109.0 |
| 9 | 8.2 | 3.8 | 9 | 53.5 | 24.9 | 9 | 98.8 | 46.1 | 9 | 144.1 | 67.2 | 9 | 189.4 | 88.3 | 9 | 234.7 | 109.5 |
| 10 | 9.1 | 4.2 | 60 | 54.4 | 25.4 | 110 | 99.7 | 46.5 | 160 | 145.0 | 67.6 | 210 | 190.3 | 88.7 | 260 | 235.6 | 109.9 |
| 1 | 10.0 | 4.6 | 1 | 55.3 | 25.8 | 1 | 100.6 | 46.9 | 1 | 145.9 | 68.0 | 1 | 191.2 | 89.2 | 1 | 236.5 | 110.3 |
| 2 | 10.9 | 5.1 | 2 | 56.2 | 26.2 | 2 | 101.5 | 47.3 | 2 | 146.8 | 68.5 | 2 | 192.1 | 89.6 | 2 | 237.5 | 110.7 |
| 3 | 11.8 | 5.5 | 3 | 57.1 | 26.6 | 3 | 102.4 | 47.8 | 3 | 147.7 | 68.9 | 3 | 193.0 | 90.0 | 3 | 238.4 | 111.1 |
| 4 | 12.7 | 5.9 | 4 | 58.0 | 27.0 | 4 | 103.3 | 48.2 | 4 | 148.6 | 69.3 | 4 | 193.9 | 90.4 | 4 | 239.3 | 111.6 |
| 5 | 13.6 | 6.3 | 5 | 58.9 | 27.5 | 5 | 104.2 | 48.6 | 5 | 149.5 | 69.7 | 5 | 194.9 | 90.9 | 5 | 240.2 | 112.0 |
| 6 | 14.5 | 6.8 | 6 | 59.8 | 27.9 | 6 | 105.1 | 49.0 | 6 | 150.4 | 70.2 | 6 | 195.8 | 91.3 | 6 | 241.1 | 112.4 |
| 7 | 15.4 | 7.2 | 7 | 60.7 | 28.3 | 7 | 106.0 | 49.4 | 7 | 151.4 | 70.6 | 7 | 196.7 | 91.7 | 7 | 242.0 | 112.8 |
| 8 | 16.3 | 7.6 | 8 | 61.6 | 28.7 | 8 | 106.9 | 49.9 | 8 | 152.3 | 71.0 | 8 | 197.6 | 92.1 | 8 | 242.9 | 113.3 |
| 9 | 17.2 | 8.0 | 9 | 62.5 | 29.2 | 9 | 107.9 | 50.3 | 9 | 153.2 | 71.4 | 9 | 198.5 | 92.6 | 9 | 243.8 | 113.7 |
| 20 | 18.1 | 8.5 | 70 | 63.4 | 29.6 | 120 | 108.8 | 50.7 | 170 | 154.1 | 71.8 | 220 | 199.4 | 93.0 | 270 | 244.7 | 114.1 |
| 1 | 19.0 | 8.9 | 1 | 64.3 | 30.0 | 1 | 109.7 | 51.1 | 1 | 155.0 | 72.3 | 1 | 200.3 | 93.4 | 1 | 245.6 | 114.5 |
| 2 | 19.9 | 9.3 | 2 | 65.3 | 30.4 | 2 | 110.6 | 51.6 | 2 | 155.9 | 72.7 | 2 | 201.2 | 93.8 | 2 | 246.5 | 115.0 |
| 3 | 20.8 | 9.7 | 3 | 66.2 | 30.9 | 3 | 111.5 | 52.0 | 3 | 156.8 | 73.1 | 3 | 202.1 | 94.2 | 3 | 247.4 | 115.4 |
| 4 | 21.8 | 10.1 | 4 | 67.1 | 31.3 | 4 | 112.4 | 52.4 | 4 | 157.7 | 73.5 | 4 | 203.0 | 94.7 | 4 | 248.3 | 115.8 |
| 5 | 22.7 | 10.6 | 5 | 68.0 | 31.7 | 5 | 113.3 | 52.8 | 5 | 158.6 | 74.0 | 5 | 203.9 | 95.1 | 5 | 249.2 | 116.2 |
| 6 | 23.6 | 11.0 | 6 | 68.9 | 32.1 | 6 | 114.2 | 53.2 | 6 | 159.5 | 74.4 | 6 | 204.8 | 95.5 | 6 | 250.1 | 116.6 |
| 7 | 24.5 | 11.4 | 7 | 69.8 | 32.5 | 7 | 115.1 | 53.7 | 7 | 160.4 | 74.8 | 7 | 205.7 | 95.9 | 7 | 251.0 | 117.1 |
| 8 | 25.4 | 11.8 | 8 | 70.7 | 33.0 | 8 | 116.0 | 54.1 | 8 | 161.3 | 75.2 | 8 | 206.6 | 96.4 | 8 | 252.0 | 117.5 |
| 9 | 26.3 | 12.3 | 9 | 71.6 | 33.4 | 9 | 116.9 | 54.5 | 9 | 162.2 | 75.6 | 9 | 207.5 | 96.8 | 9 | 252.9 | 117.9 |
| 30 | 27.2 | 12.7 | 80 | 72.5 | 33.8 | 130 | 117.8 | 54.9 | 180 | 163.1 | 76.1 | 230 | 208.5 | 97.2 | 280 | 253.8 | 118.3 |
| 1 | 28.1 | 13.1 | 1 | 73.4 | 34.2 | 1 | 118.7 | 55.4 | 1 | 164.0 | 76.5 | 1 | 209.4 | 97.6 | 1 | 254.7 | 118.8 |
| 2 | 29.0 | 13.5 | 2 | 74.3 | 34.7 | 2 | 119.6 | 55.8 | 2 | 164.9 | 76.9 | 2 | 210.3 | 98.0 | 2 | 255.6 | 119.2 |
| 3 | 29.9 | 13.9 | 3 | 75.2 | 35.1 | 3 | 120.5 | 56.2 | 3 | 165.9 | 77.3 | 3 | 211.2 | 98.5 | 3 | 256.5 | 119.6 |
| 4 | 30.8 | 14.4 | 4 | 76.1 | 35.5 | 4 | 121.4 | 56.6 | 4 | 166.8 | 77.8 | 4 | 212.1 | 98.9 | 4 | 257.4 | 120.0 |
| 5 | 31.7 | 14.8 | 5 | 77.0 | 35.9 | 5 | 122.4 | 57.1 | 5 | 167.7 | 78.2 | 5 | 213.0 | 99.3 | 5 | 258.3 | 120.4 |
| 6 | 32.6 | 15.2 | 6 | 77.9 | 36.3 | 6 | 123.3 | 57.5 | 6 | 168.6 | 78.6 | 6 | 213.9 | 99.7 | 6 | 259.2 | 120.9 |
| 7 | 33.5 | 15.6 | 7 | 78.8 | 36.8 | 7 | 124.2 | 57.9 | 7 | 169.5 | 79.0 | 7 | 214.8 | 100.2 | 7 | 260.1 | 121.3 |
| 8 | 34.4 | 16.1 | 8 | 79.8 | 37.2 | 8 | 125.1 | 58.3 | 8 | 170.4 | 79.5 | 8 | 215.7 | 100.6 | 8 | 261.0 | 121.7 |
| 9 | 35.3 | 16.5 | 9 | 80.7 | 37.6 | 9 | 126.0 | 58.7 | 9 | 171.3 | 79.9 | 9 | 216.6 | 101.0 | 9 | 261.9 | 122.1 |
| 40 | 36.3 | 16.9 | 90 | 81.6 | 38.0 | 140 | 126.9 | 59.2 | 190 | 172.2 | 80.3 | 240 | 217.5 | 101.4 | 290 | 262.8 | 122.6 |
| 1 | 37.2 | 17.3 | 1 | 82.5 | 38.5 | 1 | 127.8 | 59.6 | 1 | 173.1 | 80.7 | 1 | 218.4 | 101.9 | 1 | 263.7 | 123.0 |
| 2 | 38.1 | 17.7 | 2 | 83.4 | 38.9 | 2 | 128.7 | 60.0 | 2 | 174.0 | 81.1 | 2 | 219.3 | 102.3 | 2 | 264.6 | 123.4 |
| 3 | 39.0 | 18.2 | 3 | 84.3 | 39.3 | 3 | 129.6 | 60.4 | 3 | 174.9 | 81.6 | 3 | 220.2 | 102.7 | 3 | 265.5 | 123.8 |
| 4 | 39.9 | 18.6 | 4 | 85.2 | 39.7 | 4 | 130.5 | 60.9 | 4 | 175.8 | 82.0 | 4 | 221.1 | 103.1 | 4 | 266.5 | 124.2 |
| 5 | 40.8 | 19.0 | 5 | 86.1 | 40.1 | 5 | 131.4 | 61.3 | 5 | 176.7 | 82.4 | 5 | 222.0 | 103.5 | 5 | 267.4 | 124.7 |
| 6 | 41.7 | 19.4 | 6 | 87.0 | 40.6 | 6 | 132.3 | 61.7 | 6 | 177.6 | 82.8 | 6 | 223.0 | 104.0 | 6 | 268.3 | 125.1 |
| 7 | 42.6 | 19.9 | 7 | 87.9 | 41.0 | 7 | 133.2 | 62.1 | 7 | 178.5 | 83.3 | 7 | 223.9 | 104.4 | 7 | 269.2 | 125.5 |
| 8 | 43.5 | 20.3 | 8 | 88.8 | 41.4 | 8 | 134.1 | 62.5 | 8 | 179.4 | 83.7 | 8 | 224.8 | 104.8 | 8 | 270.1 | 125.9 |
| 9 | 44.4 | 20.7 | 9 | 89.7 | 41.8 | 9 | 135.0 | 63.0 | 9 | 180.4 | 84.1 | 9 | 225.7 | 105.2 | 9 | 271.0 | 126.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 295 315
269 245 225

R

089 065° 045
091 115 135

R ou φm

R

TABELA 1

R ou φm

359 335° 315
181 205 225

TÁBUAS DE CARTEAÇÃO

001 025 045
179 155 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 271.9 | 126.8 | 350 | 317.2 | 147.9 | 400 | 362.5 | 169.0 | 450 | 407.8 | 190.2 | 500 | 453.2 | 211.3 | 550 | 498.5 | 232.4 |
| 1 | 272.8 | 127.2 | 1 | 318.1 | 148.3 | 1 | 363.4 | 169.5 | 1 | 408.7 | 190.6 | 1 | 454.1 | 211.7 | 1 | 499.4 | 232.9 |
| 2 | 273.7 | 127.6 | 2 | 319.0 | 148.8 | 2 | 364.3 | 169.9 | 2 | 409.7 | 191.0 | 2 | 455.0 | 212.2 | 2 | 500.3 | 233.3 |
| 3 | 274.6 | 128.1 | 3 | 319.9 | 149.2 | 3 | 365.2 | 170.3 | 3 | 410.6 | 191.4 | 3 | 455.9 | 212.6 | 3 | 501.2 | 233.7 |
| 4 | 275.5 | 128.5 | 4 | 320.8 | 149.6 | 4 | 366.1 | 170.7 | 4 | 411.5 | 191.9 | 4 | 456.8 | 213.0 | 4 | 502.1 | 234.1 |
| 5 | 276.4 | 128.9 | 5 | 321.7 | 150.0 | 5 | 367.1 | 171.2 | 5 | 412.4 | 192.3 | 5 | 457.7 | 213.4 | 5 | 503.0 | 234.6 |
| 6 | 277.3 | 129.3 | 6 | 322.6 | 150.5 | 6 | 368.0 | 171.6 | 6 | 413.3 | 192.7 | 6 | 458.6 | 213.8 | 6 | 503.9 | 235.0 |
| 7 | 278.2 | 129.7 | 7 | 323.6 | 150.9 | 7 | 368.9 | 172.0 | 7 | 414.2 | 193.1 | 7 | 459.5 | 214.3 | 7 | 504.8 | 235.4 |
| 8 | 279.1 | 130.2 | 8 | 324.5 | 151.3 | 8 | 369.8 | 172.4 | 8 | 415.1 | 193.6 | 8 | 460.4 | 214.7 | 8 | 505.7 | 235.8 |
| 9 | 280.0 | 130.6 | 9 | 325.4 | 151.7 | 9 | 370.7 | 172.9 | 9 | 416.0 | 194.0 | 9 | 461.3 | 215.1 | 9 | 506.6 | 236.2 |
| 310 | 281.0 | 131.0 | 360 | 326.3 | 152.1 | 410 | 371.6 | 173.3 | 460 | 416.9 | 194.4 | 510 | 462.2 | 215.5 | 560 | 507.5 | 236.7 |
| 1 | 281.9 | 131.4 | 1 | 327.2 | 152.6 | 1 | 372.5 | 173.7 | 1 | 417.8 | 194.8 | 1 | 463.1 | 216.0 | 1 | 508.4 | 237.1 |
| 2 | 282.8 | 131.9 | 2 | 328.1 | 153.0 | 2 | 373.4 | 174.1 | 2 | 418.7 | 195.2 | 2 | 464.0 | 216.4 | 2 | 509.3 | 237.5 |
| 3 | 283.7 | 132.3 | 3 | 329.0 | 153.4 | 3 | 374.3 | 174.5 | 3 | 419.6 | 195.7 | 3 | 464.9 | 216.8 | 3 | 510.3 | 237.9 |
| 4 | 284.6 | 132.7 | 4 | 329.9 | 153.8 | 4 | 375.2 | 175.0 | 4 | 420.5 | 196.1 | 4 | 465.8 | 217.2 | 4 | 511.2 | 238.4 |
| 5 | 285.5 | 133.1 | 5 | 330.8 | 154.3 | 5 | 376.1 | 175.4 | 5 | 421.4 | 196.5 | 5 | 466.7 | 217.6 | 5 | 512.1 | 238.8 |
| 6 | 286.4 | 133.5 | 6 | 331.7 | 154.7 | 6 | 377.0 | 175.8 | 6 | 422.3 | 196.9 | 6 | 467.7 | 218.1 | 6 | 513.0 | 239.2 |
| 7 | 287.3 | 134.0 | 7 | 332.6 | 155.1 | 7 | 377.9 | 176.2 | 7 | 423.2 | 197.4 | 7 | 468.6 | 218.5 | 7 | 513.9 | 239.6 |
| 8 | 288.2 | 134.4 | 8 | 333.5 | 155.5 | 8 | 378.8 | 176.7 | 8 | 424.2 | 197.8 | 8 | 469.5 | 218.9 | 8 | 514.8 | 240.0 |
| 9 | 289.1 | 134.8 | 9 | 334.4 | 155.9 | 9 | 379.7 | 177.1 | 9 | 425.1 | 198.2 | 9 | 470.4 | 219.3 | 9 | 515.7 | 240.5 |
| 320 | 290.0 | 135.2 | 370 | 335.3 | 156.4 | 420 | 380.6 | 177.5 | 470 | 426.0 | 198.6 | 520 | 471.3 | 219.8 | 570 | 516.6 | 240.9 |
| 1 | 290.9 | 135.7 | 1 | 336.2 | 156.8 | 1 | 381.6 | 177.9 | 1 | 426.9 | 199.1 | 1 | 472.2 | 220.2 | 1 | 517.5 | 241.3 |
| 2 | 291.8 | 136.1 | 2 | 337.1 | 157.2 | 2 | 382.5 | 178.3 | 2 | 427.8 | 199.5 | 2 | 473.1 | 220.6 | 2 | 518.4 | 241.7 |
| 3 | 292.7 | 136.5 | 3 | 338.1 | 157.6 | 3 | 383.4 | 178.8 | 3 | 428.7 | 199.9 | 3 | 474.0 | 221.0 | 3 | 519.3 | 242.2 |
| 4 | 293.6 | 136.9 | 4 | 339.0 | 158.1 | 4 | 384.3 | 179.2 | 4 | 429.6 | 200.3 | 4 | 474.9 | 221.5 | 4 | 520.2 | 242.6 |
| 5 | 294.5 | 137.4 | 5 | 339.9 | 158.5 | 5 | 385.2 | 179.6 | 5 | 430.5 | 200.7 | 5 | 475.8 | 221.9 | 5 | 521.1 | 243.0 |
| 6 | 295.5 | 137.8 | 6 | 340.8 | 158.9 | 6 | 386.1 | 180.0 | 6 | 431.4 | 201.2 | 6 | 476.7 | 222.3 | 6 | 522.0 | 243.4 |
| 7 | 296.4 | 138.2 | 7 | 341.7 | 159.3 | 7 | 387.0 | 180.5 | 7 | 432.3 | 201.6 | 7 | 477.6 | 222.7 | 7 | 522.9 | 243.9 |
| 8 | 297.3 | 138.6 | 8 | 342.6 | 159.7 | 8 | 387.9 | 180.9 | 8 | 433.2 | 202.0 | 8 | 478.5 | 223.1 | 8 | 523.8 | 244.3 |
| 9 | 298.2 | 139.0 | 9 | 343.5 | 160.2 | 9 | 388.8 | 181.3 | 9 | 434.1 | 202.4 | 9 | 479.4 | 223.6 | 9 | 524.8 | 244.7 |
| 330 | 299.1 | 139.5 | 380 | 344.4 | 160.6 | 430 | 389.7 | 181.7 | 480 | 435.0 | 202.9 | 530 | 480.3 | 224.0 | 580 | 525.7 | 245.1 |
| 1 | 300.0 | 139.9 | 1 | 345.3 | 161.0 | 1 | 390.6 | 182.1 | 1 | 435.9 | 203.3 | 1 | 481.2 | 224.4 | 1 | 526.6 | 245.5 |
| 2 | 300.9 | 140.3 | 2 | 346.2 | 161.4 | 2 | 391.5 | 182.6 | 2 | 436.8 | 203.7 | 2 | 482.2 | 224.8 | 2 | 527.5 | 246.0 |
| 3 | 301.8 | 140.7 | 3 | 347.1 | 161.9 | 3 | 392.4 | 183.0 | 3 | 437.7 | 204.1 | 3 | 483.1 | 225.3 | 3 | 528.4 | 246.4 |
| 4 | 302.7 | 141.2 | 4 | 348.0 | 162.3 | 4 | 393.3 | 183.4 | 4 | 438.7 | 204.5 | 4 | 484.0 | 225.7 | 4 | 529.3 | 246.8 |
| 5 | 303.6 | 141.6 | 5 | 348.9 | 162.7 | 5 | 394.2 | 183.8 | 5 | 439.6 | 205.0 | 5 | 484.9 | 226.1 | 5 | 530.2 | 247.2 |
| 6 | 304.5 | 142.0 | 6 | 349.8 | 163.1 | 6 | 395.2 | 184.3 | 6 | 440.5 | 205.4 | 6 | 485.8 | 226.5 | 6 | 531.1 | 247.7 |
| 7 | 305.4 | 142.4 | 7 | 350.7 | 163.6 | 7 | 396.1 | 184.7 | 7 | 441.4 | 205.8 | 7 | 486.7 | 226.9 | 7 | 532.0 | 248.1 |
| 8 | 306.3 | 142.8 | 8 | 351.6 | 164.0 | 8 | 397.0 | 185.1 | 8 | 442.3 | 206.2 | 8 | 487.6 | 227.4 | 8 | 532.9 | 248.5 |
| 9 | 307.2 | 143.3 | 9 | 352.6 | 164.4 | 9 | 397.9 | 185.5 | 9 | 443.2 | 206.7 | 9 | 488.5 | 227.8 | 9 | 533.8 | 248.9 |
| 340 | 308.1 | 143.7 | 390 | 353.5 | 164.8 | 440 | 398.8 | 186.0 | 490 | 444.1 | 207.1 | 540 | 489.4 | 228.2 | 590 | 534.7 | 249.3 |
| 1 | 309.1 | 144.1 | 1 | 354.4 | 165.2 | 1 | 399.7 | 186.4 | 1 | 445.0 | 207.5 | 1 | 490.3 | 228.6 | 1 | 535.6 | 249.8 |
| 2 | 310.0 | 144.5 | 2 | 355.3 | 165.7 | 2 | 400.6 | 186.8 | 2 | 445.9 | 207.9 | 2 | 491.2 | 229.1 | 2 | 536.5 | 250.2 |
| 3 | 310.9 | 145.0 | 3 | 356.2 | 166.1 | 3 | 401.5 | 187.2 | 3 | 446.8 | 208.4 | 3 | 492.1 | 229.5 | 3 | 537.4 | 250.6 |
| 4 | 311.8 | 145.4 | 4 | 357.1 | 166.5 | 4 | 402.4 | 187.6 | 4 | 447.7 | 208.8 | 4 | 493.0 | 229.9 | 4 | 538.3 | 251.0 |
| 5 | 312.7 | 145.8 | 5 | 358.0 | 166.9 | 5 | 403.3 | 188.1 | 5 | 448.6 | 209.2 | 5 | 493.9 | 230.3 | 5 | 539.3 | 251.5 |
| 6 | 313.6 | 146.2 | 6 | 358.9 | 167.4 | 6 | 404.2 | 188.5 | 6 | 449.5 | 209.6 | 6 | 494.8 | 230.7 | 6 | 540.2 | 251.9 |
| 7 | 314.5 | 146.6 | 7 | 359.8 | 167.8 | 7 | 405.1 | 188.9 | 7 | 450.4 | 210.0 | 7 | 495.8 | 231.2 | 7 | 541.1 | 252.3 |
| 8 | 315.4 | 147.1 | 8 | 360.7 | 168.2 | 8 | 406.0 | 189.3 | 8 | 451.3 | 210.5 | 8 | 496.7 | 231.6 | 8 | 542.0 | 252.7 |
| 9 | 316.3 | 147.5 | 9 | 361.6 | 168.6 | 9 | 406.9 | 189.8 | 9 | 452.2 | 210.9 | 9 | 497.6 | 232.0 | 9 | 542.9 | 253.1 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 295 315
269 245 225

R

089 065° 045
091 115 135

R ou φm

R

TABELA 1

R ou φm

359 334° 315
181 206 225

TÁBUAS DE CARTEAÇÃO

001 026 045
179 154 135

| ΔL | ap | Δφ | ΔL | ap | Δφ | ΔL | ap | Δφ | ΔL | ap | Δφ | ΔL | ap | Δφ | ΔL | ap | Δφ |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 44.9 | 21.9 | 100 | 89.9 | 43.8 | 150 | 134.8 | 65.8 | 200 | 179.8 | 87.7 | 250 | 224.7 | 109.6 |
| 1 | 0.9 | 0.4 | 1 | 45.8 | 22.4 | 1 | 90.8 | 44.3 | 1 | 135.7 | 66.2 | 1 | 180.7 | 88.1 | 1 | 225.6 | 110.0 |
| 2 | 1.8 | 0.9 | 2 | 46.7 | 22.8 | 2 | 91.7 | 44.7 | 2 | 136.6 | 66.6 | 2 | 181.6 | 88.6 | 2 | 226.5 | 110.5 |
| 3 | 2.7 | 1.3 | 3 | 47.6 | 23.2 | 3 | 92.6 | 45.2 | 3 | 137.5 | 67.1 | 3 | 182.5 | 89.0 | 3 | 227.4 | 110.9 |
| 4 | 3.6 | 1.8 | 4 | 48.5 | 23.7 | 4 | 93.5 | 45.6 | 4 | 138.4 | 67.5 | 4 | 183.4 | 89.4 | 4 | 228.3 | 111.3 |
| 5 | 4.5 | 2.2 | 5 | 49.4 | 24.1 | 5 | 94.4 | 46.0 | 5 | 139.3 | 67.9 | 5 | 184.3 | 89.9 | 5 | 229.2 | 111.8 |
| 6 | 5.4 | 2.6 | 6 | 50.3 | 24.5 | 6 | 95.3 | 46.5 | 6 | 140.2 | 68.4 | 6 | 185.2 | 90.3 | 6 | 230.1 | 112.2 |
| 7 | 6.3 | 3.1 | 7 | 51.2 | 25.0 | 7 | 96.2 | 46.9 | 7 | 141.1 | 68.8 | 7 | 186.1 | 90.7 | 7 | 231.0 | 112.7 |
| 8 | 7.2 | 3.5 | 8 | 52.1 | 25.4 | 8 | 97.1 | 47.3 | 8 | 142.0 | 69.3 | 8 | 186.9 | 91.2 | 8 | 231.9 | 113.1 |
| 9 | 8.1 | 3.9 | 9 | 53.0 | 25.9 | 9 | 98.0 | 47.8 | 9 | 142.9 | 69.7 | 9 | 187.8 | 91.6 | 9 | 232.8 | 113.5 |
| 10 | 9.0 | 4.4 | 60 | 53.9 | 26.3 | 110 | 98.9 | 48.2 | 160 | 143.8 | 70.1 | 210 | 188.7 | 92.1 | 260 | 233.7 | 114.0 |
| 1 | 9.9 | 4.8 | 1 | 54.8 | 26.7 | 1 | 99.8 | 48.7 | 1 | 144.7 | 70.6 | 1 | 189.6 | 92.5 | 1 | 234.6 | 114.4 |
| 2 | 10.8 | 5.3 | 2 | 55.7 | 27.2 | 2 | 100.7 | 49.1 | 2 | 145.6 | 71.0 | 2 | 190.5 | 92.9 | 2 | 235.5 | 114.9 |
| 3 | 11.7 | 5.7 | 3 | 56.6 | 27.6 | 3 | 101.6 | 49.5 | 3 | 146.5 | 71.5 | 3 | 191.4 | 93.4 | 3 | 236.4 | 115.3 |
| 4 | 12.6 | 6.1 | 4 | 57.5 | 28.1 | 4 | 102.5 | 50.0 | 4 | 147.4 | 71.9 | 4 | 192.3 | 93.8 | 4 | 237.3 | 115.7 |
| 5 | 13.5 | 6.6 | 5 | 58.4 | 28.5 | 5 | 103.4 | 50.4 | 5 | 148.3 | 72.3 | 5 | 193.2 | 94.2 | 5 | 238.2 | 116.2 |
| 6 | 14.4 | 7.0 | 6 | 59.3 | 28.9 | 6 | 104.3 | 50.9 | 6 | 149.2 | 72.8 | 6 | 194.1 | 94.7 | 6 | 239.1 | 116.6 |
| 7 | 15.3 | 7.5 | 7 | 60.2 | 29.4 | 7 | 105.2 | 51.3 | 7 | 150.1 | 73.2 | 7 | 195.0 | 95.1 | 7 | 240.0 | 117.0 |
| 8 | 16.2 | 7.9 | 8 | 61.1 | 29.8 | 8 | 106.1 | 51.7 | 8 | 151.0 | 73.6 | 8 | 195.9 | 95.6 | 8 | 240.9 | 117.5 |
| 9 | 17.1 | 8.3 | 9 | 62.0 | 30.2 | 9 | 107.0 | 52.2 | 9 | 151.9 | 74.1 | 9 | 196.8 | 96.0 | 9 | 241.8 | 117.9 |
| 20 | 18.0 | 8.8 | 70 | 62.9 | 30.7 | 120 | 107.9 | 52.6 | 170 | 152.8 | 74.5 | 220 | 197.7 | 96.4 | 270 | 242.7 | 118.4 |
| 1 | 18.9 | 9.2 | 1 | 63.8 | 31.1 | 1 | 108.8 | 53.0 | 1 | 153.7 | 75.0 | 1 | 198.6 | 96.9 | 1 | 243.6 | 118.8 |
| 2 | 19.8 | 9.6 | 2 | 64.7 | 31.6 | 2 | 109.7 | 53.5 | 2 | 154.6 | 75.4 | 2 | 199.5 | 97.3 | 2 | 244.5 | 119.2 |
| 3 | 20.7 | 10.1 | 3 | 65.6 | 32.0 | 3 | 110.6 | 53.9 | 3 | 155.5 | 75.8 | 3 | 200.4 | 97.8 | 3 | 245.4 | 119.7 |
| 4 | 21.6 | 10.5 | 4 | 66.5 | 32.4 | 4 | 111.5 | 54.4 | 4 | 156.4 | 76.3 | 4 | 201.3 | 98.2 | 4 | 246.3 | 120.1 |
| 5 | 22.5 | 11.0 | 5 | 67.4 | 32.9 | 5 | 112.3 | 54.8 | 5 | 157.3 | 76.7 | 5 | 202.2 | 98.6 | 5 | 247.2 | 120.6 |
| 6 | 23.4 | 11.4 | 6 | 68.3 | 33.3 | 6 | 113.2 | 55.2 | 6 | 158.2 | 77.2 | 6 | 203.1 | 99.1 | 6 | 248.1 | 121.0 |
| 7 | 24.3 | 11.8 | 7 | 69.2 | 33.8 | 7 | 114.1 | 55.7 | 7 | 159.1 | 77.6 | 7 | 204.0 | 99.5 | 7 | 249.0 | 121.4 |
| 8 | 25.2 | 12.3 | 8 | 70.1 | 34.2 | 8 | 115.0 | 56.1 | 8 | 160.0 | 78.0 | 8 | 204.9 | 99.9 | 8 | 249.9 | 121.9 |
| 9 | 26.1 | 12.7 | 9 | 71.0 | 34.6 | 9 | 115.9 | 56.5 | 9 | 160.9 | 78.5 | 9 | 205.8 | 100.4 | 9 | 250.8 | 122.3 |
| 30 | 27.0 | 13.2 | 80 | 71.9 | 35.1 | 130 | 116.8 | 57.0 | 180 | 161.8 | 78.9 | 230 | 206.7 | 100.8 | 280 | 251.7 | 122.7 |
| 1 | 27.9 | 13.6 | 1 | 72.8 | 35.5 | 1 | 117.7 | 57.4 | 1 | 162.7 | 79.3 | 1 | 207.6 | 101.3 | 1 | 252.6 | 123.2 |
| 2 | 28.8 | 14.0 | 2 | 73.7 | 35.9 | 2 | 118.6 | 57.9 | 2 | 163.6 | 79.8 | 2 | 208.5 | 101.7 | 2 | 253.5 | 123.6 |
| 3 | 29.7 | 14.5 | 3 | 74.6 | 36.4 | 3 | 119.5 | 58.3 | 3 | 164.5 | 80.2 | 3 | 209.4 | 102.1 | 3 | 254.4 | 124.1 |
| 4 | 30.6 | 14.9 | 4 | 75.5 | 36.8 | 4 | 120.4 | 58.7 | 4 | 165.4 | 80.7 | 4 | 210.3 | 102.6 | 4 | 255.3 | 124.5 |
| 5 | 31.5 | 15.3 | 5 | 76.4 | 37.3 | 5 | 121.3 | 59.2 | 5 | 166.3 | 81.1 | 5 | 211.2 | 103.0 | 5 | 256.2 | 124.9 |
| 6 | 32.4 | 15.8 | 6 | 77.3 | 37.7 | 6 | 122.2 | 59.6 | 6 | 167.2 | 81.5 | 6 | 212.1 | 103.5 | 6 | 257.1 | 125.4 |
| 7 | 33.3 | 16.2 | 7 | 78.2 | 38.1 | 7 | 123.1 | 60.1 | 7 | 168.1 | 82.0 | 7 | 213.0 | 103.9 | 7 | 258.0 | 125.8 |
| 8 | 34.2 | 16.7 | 8 | 79.1 | 38.6 | 8 | 124.0 | 60.5 | 8 | 169.0 | 82.4 | 8 | 213.9 | 104.3 | 8 | 258.9 | 126.3 |
| 9 | 35.1 | 17.1 | 9 | 80.0 | 39.0 | 9 | 124.9 | 60.9 | 9 | 169.9 | 82.9 | 9 | 214.8 | 104.8 | 9 | 259.8 | 126.7 |
| 40 | 36.0 | 17.5 | 90 | 80.9 | 39.5 | 140 | 125.8 | 61.4 | 190 | 170.8 | 83.3 | 240 | 215.7 | 105.2 | 290 | 260.7 | 127.1 |
| 1 | 36.9 | 18.0 | 1 | 81.8 | 39.9 | 1 | 126.7 | 61.8 | 1 | 171.7 | 83.7 | 1 | 216.6 | 105.6 | 1 | 261.5 | 127.6 |
| 2 | 37.7 | 18.4 | 2 | 82.7 | 40.3 | 2 | 127.6 | 62.2 | 2 | 172.6 | 84.2 | 2 | 217.5 | 106.1 | 2 | 262.4 | 128.0 |
| 3 | 38.6 | 18.8 | 3 | 83.6 | 40.8 | 3 | 128.5 | 62.7 | 3 | 173.5 | 84.6 | 3 | 218.4 | 106.5 | 3 | 263.3 | 128.4 |
| 4 | 39.5 | 19.3 | 4 | 84.5 | 41.2 | 4 | 129.4 | 63.1 | 4 | 174.4 | 85.0 | 4 | 219.3 | 107.0 | 4 | 264.2 | 128.9 |
| 5 | 40.4 | 19.7 | 5 | 85.4 | 41.6 | 5 | 130.3 | 63.6 | 5 | 175.3 | 85.5 | 5 | 220.2 | 107.4 | 5 | 265.1 | 129.3 |
| 6 | 41.3 | 20.2 | 6 | 86.3 | 42.1 | 6 | 131.2 | 64.0 | 6 | 176.2 | 85.9 | 6 | 221.1 | 107.8 | 6 | 266.0 | 129.8 |
| 7 | 42.2 | 20.6 | 7 | 87.2 | 42.5 | 7 | 132.1 | 64.4 | 7 | 177.1 | 86.4 | 7 | 222.0 | 108.3 | 7 | 266.9 | 130.2 |
| 8 | 43.1 | 21.0 | 8 | 88.1 | 43.0 | 8 | 133.0 | 64.9 | 8 | 178.0 | 86.8 | 8 | 222.9 | 108.7 | 8 | 267.8 | 130.6 |
| 9 | 44.0 | 21.5 | 9 | 89.0 | 43.4 | 9 | 133.9 | 65.3 | 9 | 178.9 | 87.2 | 9 | 223.8 | 109.2 | 9 | 268.7 | 131.1 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 296 315
269 244 225

089 064° 045
091 116 135

R

R ou φm

R

TABELA 1

R ou φm

359 334° 315
181 206 225

TÁBUAS DE CARTEAÇÃO

001 026 045
179 154 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 269.6 | 131.5 | 350 | 314.6 | 153.4 | 400 | 359.5 | 175.3 | 450 | 404.5 | 197.3 | 500 | 449.4 | 219.2 | 550 | 494.3 | 241.1 |
| 1 | 270.5 | 131.9 | 1 | 315.5 | 153.9 | 1 | 360.4 | 175.8 | 1 | 405.4 | 197.7 | 1 | 450.3 | 219.6 | 1 | 495.2 | 241.5 |
| 2 | 271.4 | 132.4 | 2 | 316.4 | 154.3 | 2 | 361.3 | 176.2 | 2 | 406.3 | 198.1 | 2 | 451.2 | 220.1 | 2 | 496.1 | 242.0 |
| 3 | 272.3 | 132.8 | 3 | 317.3 | 154.7 | 3 | 362.2 | 176.7 | 3 | 407.2 | 198.6 | 3 | 452.1 | 220.5 | 3 | 497.0 | 242.4 |
| 4 | 273.2 | 133.3 | 4 | 318.2 | 155.2 | 4 | 363.1 | 177.1 | 4 | 408.1 | 199.0 | 4 | 453.0 | 220.9 | 4 | 497.9 | 242.9 |
| 5 | 274.1 | 133.7 | 5 | 319.1 | 155.6 | 5 | 364.0 | 177.5 | 5 | 409.0 | 199.5 | 5 | 453.9 | 221.4 | 5 | 498.8 | 243.3 |
| 6 | 275.0 | 134.1 | 6 | 320.0 | 156.1 | 6 | 364.9 | 178.0 | 6 | 409.8 | 199.9 | 6 | 454.8 | 221.8 | 6 | 499.7 | 243.7 |
| 7 | 275.9 | 134.6 | 7 | 320.9 | 156.5 | 7 | 365.8 | 178.4 | 7 | 410.7 | 200.3 | 7 | 455.7 | 222.3 | 7 | 500.6 | 244.2 |
| 8 | 276.8 | 135.0 | 8 | 321.8 | 156.9 | 8 | 366.7 | 178.9 | 8 | 411.6 | 200.8 | 8 | 456.6 | 222.7 | 8 | 501.5 | 244.6 |
| 9 | 277.7 | 135.5 | 9 | 322.7 | 157.4 | 9 | 367.6 | 179.3 | 9 | 412.5 | 201.2 | 9 | 457.5 | 223.1 | 9 | 502.4 | 245.0 |
| 310 | 278.6 | 135.9 | 360 | 323.6 | 157.8 | 410 | 368.5 | 179.7 | 460 | 413.4 | 201.7 | 510 | 458.4 | 223.6 | 560 | 503.3 | 245.5 |
| 1 | 279.5 | 136.3 | 1 | 324.5 | 158.3 | 1 | 369.4 | 180.2 | 1 | 414.3 | 202.1 | 1 | 459.3 | 224.0 | 1 | 504.2 | 245.9 |
| 2 | 280.4 | 136.8 | 2 | 325.4 | 158.7 | 2 | 370.3 | 180.6 | 2 | 415.2 | 202.5 | 2 | 460.2 | 224.4 | 2 | 505.1 | 246.4 |
| 3 | 281.3 | 137.2 | 3 | 326.3 | 159.1 | 3 | 371.2 | 181.0 | 3 | 416.1 | 203.0 | 3 | 461.1 | 224.9 | 3 | 506.0 | 246.8 |
| 4 | 282.2 | 137.6 | 4 | 327.2 | 159.6 | 4 | 372.1 | 181.5 | 4 | 417.0 | 203.4 | 4 | 462.0 | 225.3 | 4 | 506.9 | 247.2 |
| 5 | 283.1 | 138.1 | 5 | 328.1 | 160.0 | 5 | 373.0 | 181.9 | 5 | 417.9 | 203.8 | 5 | 462.9 | 225.8 | 5 | 507.8 | 247.7 |
| 6 | 284.0 | 138.5 | 6 | 329.0 | 160.4 | 6 | 373.9 | 182.4 | 6 | 418.8 | 204.3 | 6 | 463.8 | 226.2 | 6 | 508.7 | 248.1 |
| 7 | 284.9 | 139.0 | 7 | 329.9 | 160.9 | 7 | 374.8 | 182.8 | 7 | 419.7 | 204.7 | 7 | 464.7 | 226.6 | 7 | 509.6 | 248.6 |
| 8 | 285.8 | 139.4 | 8 | 330.8 | 161.3 | 8 | 375.7 | 183.2 | 8 | 420.6 | 205.2 | 8 | 465.6 | 227.1 | 8 | 510.5 | 249.0 |
| 9 | 286.7 | 139.8 | 9 | 331.7 | 161.8 | 9 | 376.6 | 183.7 | 9 | 421.5 | 205.6 | 9 | 466.5 | 227.5 | 9 | 511.4 | 249.4 |
| 320 | 287.6 | 140.3 | 370 | 332.6 | 162.2 | 420 | 377.5 | 184.1 | 470 | 422.4 | 206.0 | 520 | 467.4 | 228.0 | 570 | 512.3 | 249.9 |
| 1 | 288.5 | 140.7 | 1 | 333.5 | 162.6 | 1 | 378.4 | 184.6 | 1 | 423.3 | 206.5 | 1 | 468.3 | 228.4 | 1 | 513.2 | 250.3 |
| 2 | 289.4 | 141.2 | 2 | 334.4 | 163.1 | 2 | 379.3 | 185.0 | 2 | 424.2 | 206.9 | 2 | 469.2 | 228.8 | 2 | 514.1 | 250.7 |
| 3 | 290.3 | 141.6 | 3 | 335.3 | 163.5 | 3 | 380.2 | 185.4 | 3 | 425.1 | 207.3 | 3 | 470.1 | 229.3 | 3 | 515.0 | 251.2 |
| 4 | 291.2 | 142.0 | 4 | 336.1 | 164.0 | 4 | 381.1 | 185.9 | 4 | 426.0 | 207.8 | 4 | 471.0 | 229.7 | 4 | 515.9 | 251.6 |
| 5 | 292.1 | 142.5 | 5 | 337.0 | 164.4 | 5 | 382.0 | 186.3 | 5 | 426.9 | 208.2 | 5 | 471.9 | 230.1 | 5 | 516.8 | 252.1 |
| 6 | 293.0 | 142.9 | 6 | 337.9 | 164.8 | 6 | 382.9 | 186.7 | 6 | 427.8 | 208.7 | 6 | 472.8 | 230.6 | 6 | 517.7 | 252.5 |
| 7 | 293.9 | 143.3 | 7 | 338.8 | 165.3 | 7 | 383.8 | 187.2 | 7 | 428.7 | 209.1 | 7 | 473.7 | 231.0 | 7 | 518.6 | 252.9 |
| 8 | 294.8 | 143.8 | 8 | 339.7 | 165.7 | 8 | 384.7 | 187.6 | 8 | 429.6 | 209.5 | 8 | 474.6 | 231.5 | 8 | 519.5 | 253.4 |
| 9 | 295.7 | 144.2 | 9 | 340.6 | 166.1 | 9 | 385.6 | 188.1 | 9 | 430.5 | 210.0 | 9 | 475.5 | 231.9 | 9 | 520.4 | 253.8 |
| 330 | 296.6 | 144.7 | 380 | 341.5 | 166.6 | 430 | 386.5 | 188.5 | 480 | 431.4 | 210.4 | 530 | 476.4 | 232.3 | 580 | 521.3 | 254.3 |
| 1 | 297.5 | 145.1 | 1 | 342.4 | 167.0 | 1 | 387.4 | 188.9 | 1 | 432.3 | 210.9 | 1 | 477.3 | 232.8 | 1 | 522.2 | 254.7 |
| 2 | 298.4 | 145.5 | 2 | 343.3 | 167.5 | 2 | 388.3 | 189.4 | 2 | 433.2 | 211.3 | 2 | 478.2 | 233.2 | 2 | 523.1 | 255.1 |
| 3 | 299.3 | 146.0 | 3 | 344.2 | 167.9 | 3 | 389.2 | 189.8 | 3 | 434.1 | 211.7 | 3 | 479.1 | 233.7 | 3 | 524.0 | 255.6 |
| 4 | 300.2 | 146.4 | 4 | 345.1 | 168.3 | 4 | 390.1 | 190.3 | 4 | 435.0 | 212.2 | 4 | 480.0 | 234.1 | 4 | 524.9 | 256.0 |
| 5 | 301.1 | 146.9 | 5 | 346.0 | 168.8 | 5 | 391.0 | 190.7 | 5 | 435.9 | 212.6 | 5 | 480.9 | 234.5 | 5 | 525.8 | 256.4 |
| 6 | 302.0 | 147.3 | 6 | 346.9 | 169.2 | 6 | 391.9 | 191.1 | 6 | 436.8 | 213.0 | 6 | 481.8 | 235.0 | 6 | 526.7 | 256.9 |
| 7 | 302.9 | 147.7 | 7 | 347.8 | 169.6 | 7 | 392.8 | 191.6 | 7 | 437.7 | 213.5 | 7 | 482.7 | 235.4 | 7 | 527.6 | 257.3 |
| 8 | 303.8 | 148.2 | 8 | 348.7 | 170.1 | 8 | 393.7 | 192.0 | 8 | 438.6 | 213.9 | 8 | 483.6 | 235.8 | 8 | 528.5 | 257.8 |
| 9 | 304.7 | 148.6 | 9 | 349.6 | 170.5 | 9 | 394.6 | 192.4 | 9 | 439.5 | 214.4 | 9 | 484.4 | 236.3 | 9 | 529.4 | 258.2 |
| 340 | 305.6 | 149.0 | 390 | 350.5 | 171.0 | 440 | 395.5 | 192.9 | 490 | 440.4 | 214.8 | 540 | 485.3 | 236.7 | 590 | 530.3 | 258.6 |
| 1 | 306.5 | 149.5 | 1 | 351.4 | 171.4 | 1 | 396.4 | 193.3 | 1 | 441.3 | 215.2 | 1 | 486.2 | 237.2 | 1 | 531.2 | 259.1 |
| 2 | 307.4 | 149.9 | 2 | 352.3 | 171.8 | 2 | 397.3 | 193.8 | 2 | 442.2 | 215.7 | 2 | 487.1 | 237.6 | 2 | 532.1 | 259.5 |
| 3 | 308.3 | 150.4 | 3 | 353.2 | 172.3 | 3 | 398.2 | 194.2 | 3 | 443.1 | 216.1 | 3 | 488.0 | 238.0 | 3 | 533.0 | 260.0 |
| 4 | 309.2 | 150.8 | 4 | 354.1 | 172.7 | 4 | 399.1 | 194.6 | 4 | 444.0 | 216.6 | 4 | 488.9 | 238.5 | 4 | 533.9 | 260.4 |
| 5 | 310.1 | 151.2 | 5 | 355.0 | 173.2 | 5 | 400.0 | 195.1 | 5 | 444.9 | 217.0 | 5 | 489.8 | 238.9 | 5 | 534.8 | 260.8 |
| 6 | 311.0 | 151.7 | 6 | 355.9 | 173.6 | 6 | 400.9 | 195.5 | 6 | 445.8 | 217.4 | 6 | 490.7 | 239.4 | 6 | 535.7 | 261.3 |
| 7 | 311.9 | 152.1 | 7 | 356.8 | 174.0 | 7 | 401.8 | 196.0 | 7 | 446.7 | 217.9 | 7 | 491.6 | 239.8 | 7 | 536.6 | 261.7 |
| 8 | 312.8 | 152.6 | 8 | 357.7 | 174.5 | 8 | 402.7 | 196.4 | 8 | 447.6 | 218.3 | 8 | 492.5 | 240.2 | 8 | 537.5 | 262.1 |
| 9 | 313.7 | 153.0 | 9 | 358.6 | 174.9 | 9 | 403.6 | 196.8 | 9 | 448.5 | 218.7 | 9 | 493.4 | 240.7 | 9 | 538.4 | 262.6 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 296 315
269 244 225

R

089 064° 045
091 116 135

R ou φm

R

TABELA 1

R ou φm

359 333° 315
181 207 225

TÁBUAS DE CARTEAÇÃO

002 027 045
179 153 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 44.6 | 22.7 | 100 | 89.1 | 45.4 | 150 | 133.7 | 68.1 | 200 | 178.2 | 90.8 | 250 | 222.8 | 113.5 |
| 1 | 0.9 | 0.5 | 1 | 45.4 | 23.2 | 1 | 90.0 | 45.9 | 1 | 134.5 | 68.6 | 1 | 179.1 | 91.3 | 1 | 223.6 | 114.0 |
| 2 | 1.8 | 0.9 | 2 | 46.3 | 23.6 | 2 | 90.9 | 46.3 | 2 | 135.4 | 69.0 | 2 | 180.0 | 91.7 | 2 | 224.5 | 114.4 |
| 3 | 2.7 | 1.4 | 3 | 47.2 | 24.1 | 3 | 91.8 | 46.8 | 3 | 136.3 | 69.5 | 3 | 180.9 | 92.2 | 3 | 225.4 | 114.9 |
| 4 | 3.6 | 1.8 | 4 | 48.1 | 24.5 | 4 | 92.7 | 47.2 | 4 | 137.2 | 69.9 | 4 | 181.8 | 92.6 | 4 | 226.3 | 115.3 |
| 5 | 4.5 | 2.3 | 5 | 49.0 | 25.0 | 5 | 93.6 | 47.7 | 5 | 138.1 | 70.4 | 5 | 182.7 | 93.1 | 5 | 227.2 | 115.8 |
| 6 | 5.3 | 2.7 | 6 | 49.9 | 25.4 | 6 | 94.4 | 48.1 | 6 | 139.0 | 70.8 | 6 | 183.5 | 93.5 | 6 | 228.1 | 116.2 |
| 7 | 6.2 | 3.2 | 7 | 50.8 | 25.9 | 7 | 95.3 | 48.6 | 7 | 139.9 | 71.3 | 7 | 184.4 | 94.0 | 7 | 229.0 | 116.7 |
| 8 | 7.1 | 3.6 | 8 | 51.7 | 26.3 | 8 | 96.2 | 49.0 | 8 | 140.8 | 71.7 | 8 | 185.3 | 94.4 | 8 | 229.9 | 117.1 |
| 9 | 8.0 | 4.1 | 9 | 52.6 | 26.8 | 9 | 97.1 | 49.5 | 9 | 141.7 | 72.2 | 9 | 186.2 | 94.9 | 9 | 230.8 | 117.6 |
| 10 | 8.9 | 4.5 | 60 | 53.5 | 27.2 | 110 | 98.0 | 49.9 | 160 | 142.6 | 72.6 | 210 | 187.1 | 95.3 | 260 | 231.7 | 118.0 |
| 1 | 9.8 | 5.0 | 1 | 54.4 | 27.7 | 1 | 98.9 | 50.4 | 1 | 143.5 | 73.1 | 1 | 188.0 | 95.8 | 1 | 232.6 | 118.5 |
| 2 | 10.7 | 5.4 | 2 | 55.2 | 28.1 | 2 | 99.8 | 50.8 | 2 | 144.3 | 73.5 | 2 | 188.9 | 96.2 | 2 | 233.4 | 118.9 |
| 3 | 11.6 | 5.9 | 3 | 56.1 | 28.6 | 3 | 100.7 | 51.3 | 3 | 145.2 | 74.0 | 3 | 189.8 | 96.7 | 3 | 234.3 | 119.4 |
| 4 | 12.5 | 6.4 | 4 | 57.0 | 29.1 | 4 | 101.6 | 51.8 | 4 | 146.1 | 74.5 | 4 | 190.7 | 97.2 | 4 | 235.2 | 119.9 |
| 5 | 13.4 | 6.8 | 5 | 57.9 | 29.5 | 5 | 102.5 | 52.2 | 5 | 147.0 | 74.9 | 5 | 191.6 | 97.6 | 5 | 236.1 | 120.3 |
| 6 | 14.3 | 7.3 | 6 | 58.8 | 30.0 | 6 | 103.4 | 52.7 | 6 | 147.9 | 75.4 | 6 | 192.5 | 98.1 | 6 | 237.0 | 120.8 |
| 7 | 15.1 | 7.7 | 7 | 59.7 | 30.4 | 7 | 104.2 | 53.1 | 7 | 148.8 | 75.8 | 7 | 193.3 | 98.5 | 7 | 237.9 | 121.2 |
| 8 | 16.0 | 8.2 | 8 | 60.6 | 30.9 | 8 | 105.1 | 53.6 | 8 | 149.7 | 76.3 | 8 | 194.2 | 99.0 | 8 | 238.8 | 121.7 |
| 9 | 16.9 | 8.6 | 9 | 61.5 | 31.3 | 9 | 106.0 | 54.0 | 9 | 150.6 | 76.7 | 9 | 195.1 | 99.4 | 9 | 239.7 | 122.1 |
| 20 | 17.8 | 9.1 | 70 | 62.4 | 31.8 | 120 | 106.9 | 54.5 | 170 | 151.5 | 77.2 | 220 | 196.0 | 99.9 | 270 | 240.6 | 122.6 |
| 1 | 18.7 | 9.5 | 1 | 63.3 | 32.2 | 1 | 107.8 | 54.9 | 1 | 152.4 | 77.6 | 1 | 196.9 | 100.3 | 1 | 241.5 | 123.0 |
| 2 | 19.6 | 10.0 | 2 | 64.2 | 32.7 | 2 | 108.7 | 55.4 | 2 | 153.3 | 78.1 | 2 | 197.8 | 100.8 | 2 | 242.4 | 123.5 |
| 3 | 20.5 | 10.4 | 3 | 65.0 | 33.1 | 3 | 109.6 | 55.8 | 3 | 154.1 | 78.5 | 3 | 198.7 | 101.2 | 3 | 243.2 | 123.9 |
| 4 | 21.4 | 10.9 | 4 | 65.9 | 33.6 | 4 | 110.5 | 56.3 | 4 | 155.0 | 79.0 | 4 | 199.6 | 101.7 | 4 | 244.1 | 124.4 |
| 5 | 22.3 | 11.3 | 5 | 66.8 | 34.0 | 5 | 111.4 | 56.7 | 5 | 155.9 | 79.4 | 5 | 200.5 | 102.1 | 5 | 245.0 | 124.8 |
| 6 | 23.2 | 11.8 | 6 | 67.7 | 34.5 | 6 | 112.3 | 57.2 | 6 | 156.8 | 79.9 | 6 | 201.4 | 102.6 | 6 | 245.9 | 125.3 |
| 7 | 24.1 | 12.3 | 7 | 68.6 | 35.0 | 7 | 113.2 | 57.7 | 7 | 157.7 | 80.4 | 7 | 202.3 | 103.1 | 7 | 246.8 | 125.8 |
| 8 | 24.9 | 12.7 | 8 | 69.5 | 35.4 | 8 | 114.0 | 58.1 | 8 | 158.6 | 80.8 | 8 | 203.1 | 103.5 | 8 | 247.7 | 126.2 |
| 9 | 25.8 | 13.2 | 9 | 70.4 | 35.9 | 9 | 114.9 | 58.6 | 9 | 159.5 | 81.3 | 9 | 204.0 | 104.0 | 9 | 248.6 | 126.7 |
| 30 | 26.7 | 13.6 | 80 | 71.3 | 36.3 | 130 | 115.8 | 59.0 | 180 | 160.4 | 81.7 | 230 | 204.9 | 104.4 | 280 | 249.5 | 127.1 |
| 1 | 27.6 | 14.1 | 1 | 72.2 | 36.8 | 1 | 116.7 | 59.5 | 1 | 161.3 | 82.2 | 1 | 205.8 | 104.9 | 1 | 250.4 | 127.6 |
| 2 | 28.5 | 14.5 | 2 | 73.1 | 37.2 | 2 | 117.6 | 59.9 | 2 | 162.2 | 82.6 | 2 | 206.7 | 105.3 | 2 | 251.3 | 128.0 |
| 3 | 29.4 | 15.0 | 3 | 74.0 | 37.7 | 3 | 118.5 | 60.4 | 3 | 163.1 | 83.1 | 3 | 207.6 | 105.8 | 3 | 252.2 | 128.5 |
| 4 | 30.3 | 15.4 | 4 | 74.8 | 38.1 | 4 | 119.4 | 60.8 | 4 | 163.9 | 83.5 | 4 | 208.5 | 106.2 | 4 | 253.0 | 128.9 |
| 5 | 31.2 | 15.9 | 5 | 75.7 | 38.6 | 5 | 120.3 | 61.3 | 5 | 164.8 | 84.0 | 5 | 209.4 | 106.7 | 5 | 253.9 | 129.4 |
| 6 | 32.1 | 16.3 | 6 | 76.6 | 39.0 | 6 | 121.2 | 61.7 | 6 | 165.7 | 84.4 | 6 | 210.3 | 107.1 | 6 | 254.8 | 129.8 |
| 7 | 33.0 | 16.8 | 7 | 77.5 | 39.5 | 7 | 122.1 | 62.2 | 7 | 166.6 | 84.9 | 7 | 211.2 | 107.6 | 7 | 255.7 | 130.3 |
| 8 | 33.9 | 17.3 | 8 | 78.4 | 40.0 | 8 | 123.0 | 62.7 | 8 | 167.5 | 85.4 | 8 | 212.1 | 108.0 | 8 | 256.6 | 130.7 |
| 9 | 34.7 | 17.7 | 9 | 79.3 | 40.4 | 9 | 123.8 | 63.1 | 9 | 168.4 | 85.8 | 9 | 213.0 | 108.5 | 9 | 257.5 | 131.2 |
| 40 | 35.6 | 18.2 | 90 | 80.2 | 40.9 | 140 | 124.7 | 63.6 | 190 | 169.3 | 86.3 | 240 | 213.8 | 109.0 | 290 | 258.4 | 131.7 |
| 1 | 36.5 | 18.6 | 1 | 81.1 | 41.3 | 1 | 125.6 | 64.0 | 1 | 170.2 | 86.7 | 1 | 214.7 | 109.4 | 1 | 259.3 | 132.1 |
| 2 | 37.4 | 19.1 | 2 | 82.0 | 41.8 | 2 | 126.5 | 64.5 | 2 | 171.1 | 87.2 | 2 | 215.6 | 109.9 | 2 | 260.2 | 132.6 |
| 3 | 38.3 | 19.5 | 3 | 82.9 | 42.2 | 3 | 127.4 | 64.9 | 3 | 172.0 | 87.6 | 3 | 216.5 | 110.3 | 3 | 261.1 | 133.0 |
| 4 | 39.2 | 20.0 | 4 | 83.8 | 42.7 | 4 | 128.3 | 65.4 | 4 | 172.9 | 88.1 | 4 | 217.4 | 110.8 | 4 | 262.0 | 133.5 |
| 5 | 40.1 | 20.4 | 5 | 84.6 | 43.1 | 5 | 129.2 | 65.8 | 5 | 173.7 | 88.5 | 5 | 218.3 | 111.2 | 5 | 262.8 | 133.9 |
| 6 | 41.0 | 20.9 | 6 | 85.5 | 43.6 | 6 | 130.1 | 66.3 | 6 | 174.6 | 89.0 | 6 | 219.2 | 111.7 | 6 | 263.7 | 134.4 |
| 7 | 41.9 | 21.3 | 7 | 86.4 | 44.0 | 7 | 131.0 | 66.7 | 7 | 175.5 | 89.4 | 7 | 220.1 | 112.1 | 7 | 264.6 | 134.8 |
| 8 | 42.8 | 21.8 | 8 | 87.3 | 44.5 | 8 | 131.9 | 67.2 | 8 | 176.4 | 89.9 | 8 | 221.0 | 112.6 | 8 | 265.5 | 135.3 |
| 9 | 43.7 | 22.2 | 9 | 88.2 | 44.9 | 9 | 132.8 | 67.6 | 9 | 177.3 | 90.3 | 9 | 221.9 | 113.0 | 9 | 266.4 | 135.7 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 297 315
269 243 225

R

089 063° 045
091 117 135

R ou φm

R
359 333° 315
181 207 225

TABELA 1
TÁBUAS DE CARTEAÇÃO

R ou φ m
001 027 045
179 153 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|
| D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap |
| 300 | 267.3 | 136.2 | 350 | 311.9 | 158.9 | 400 | 356.4 | 181.6 | 450 | 401.0 | 204.3 | 500 | 445.5 | 227.0 | 550 | 490.1 | 249.7 |
| 1 | 268.2 | 136.7 | 1 | 312.7 | 159.4 | 1 | 357.3 | 182.1 | 1 | 401.8 | 204.7 | 1 | 446.4 | 227.4 | 1 | 490.9 | 250.1 |
| 2 | 269.1 | 137.1 | 2 | 313.6 | 159.8 | 2 | 358.2 | 182.5 | 2 | 402.7 | 205.2 | 2 | 447.3 | 227.9 | 2 | 491.8 | 250.6 |
| 3 | 270.0 | 137.6 | 3 | 314.5 | 160.3 | 3 | 359.1 | 183.0 | 3 | 403.6 | 205.7 | 3 | 448.2 | 228.4 | 3 | 492.7 | 251.1 |
| 4 | 270.9 | 138.0 | 4 | 315.4 | 160.7 | 4 | 360.0 | 183.4 | 4 | 404.5 | 206.1 | 4 | 449.1 | 228.8 | 4 | 493.6 | 251.5 |
| 5 | 271.8 | 138.5 | 5 | 316.3 | 161.2 | 5 | 360.9 | 183.9 | 5 | 405.4 | 206.6 | 5 | 450.0 | 229.3 | 5 | 494.5 | 252.0 |
| 6 | 272.6 | 138.9 | 6 | 317.2 | 161.6 | 6 | 361.7 | 184.3 | 6 | 406.3 | 207.0 | 6 | 450.8 | 229.7 | 6 | 495.4 | 252.4 |
| 7 | 273.5 | 139.4 | 7 | 318.1 | 162.1 | 7 | 362.6 | 184.8 | 7 | 407.2 | 207.5 | 7 | 451.7 | 230.2 | 7 | 496.3 | 252.9 |
| 8 | 274.4 | 139.8 | 8 | 319.0 | 162.5 | 8 | 363.5 | 185.2 | 8 | 408.1 | 207.9 | 8 | 452.6 | 230.6 | 8 | 497.2 | 253.3 |
| 9 | 275.3 | 140.3 | 9 | 319.9 | 163.0 | 9 | 364.4 | 185.7 | 9 | 409.0 | 208.4 | 9 | 453.5 | 231.1 | 9 | 498.1 | 253.8 |
| 310 | 276.2 | 140.7 | 360 | 320.8 | 163.4 | 410 | 365.3 | 186.1 | 460 | 409.9 | 208.8 | 510 | 454.4 | 231.5 | 560 | 499.0 | 254.2 |
| 1 | 277.1 | 141.2 | 1 | 321.7 | 163.9 | 1 | 366.2 | 186.6 | 1 | 410.8 | 209.3 | 1 | 455.3 | 232.0 | 1 | 499.9 | 254.7 |
| 2 | 278.0 | 141.6 | 2 | 322.5 | 164.3 | 2 | 367.1 | 187.0 | 2 | 411.6 | 209.7 | 2 | 456.2 | 232.4 | 2 | 500.7 | 255.1 |
| 3 | 278.9 | 142.1 | 3 | 323.4 | 164.8 | 3 | 368.0 | 187.5 | 3 | 412.5 | 210.2 | 3 | 457.1 | 232.9 | 3 | 501.6 | 255.6 |
| 4 | 279.8 | 142.6 | 4 | 324.3 | 165.3 | 4 | 368.9 | 188.0 | 4 | 413.4 | 210.7 | 4 | 458.0 | 233.4 | 4 | 502.5 | 256.1 |
| 5 | 280.7 | 143.0 | 5 | 325.2 | 165.7 | 5 | 369.8 | 188.4 | 5 | 414.3 | 211.1 | 5 | 458.9 | 233.8 | 5 | 503.4 | 256.5 |
| 6 | 281.6 | 143.5 | 6 | 326.1 | 166.2 | 6 | 370.7 | 188.9 | 6 | 415.2 | 211.6 | 6 | 459.8 | 234.3 | 6 | 504.3 | 257.0 |
| 7 | 282.4 | 143.9 | 7 | 327.0 | 166.6 | 7 | 371.5 | 189.3 | 7 | 416.1 | 212.0 | 7 | 460.7 | 234.7 | 7 | 505.2 | 257.4 |
| 8 | 283.3 | 144.4 | 8 | 327.9 | 167.1 | 8 | 372.4 | 189.8 | 8 | 417.0 | 212.5 | 8 | 461.5 | 235.2 | 8 | 506.1 | 257.9 |
| 9 | 284.2 | 144.8 | 9 | 328.8 | 167.5 | 9 | 373.3 | 190.2 | 9 | 417.9 | 212.9 | 9 | 462.4 | 235.6 | 9 | 507.0 | 258.3 |
| 320 | 285.1 | 145.3 | 370 | 329.7 | 168.0 | 420 | 374.2 | 190.7 | 470 | 418.8 | 213.4 | 520 | 463.3 | 236.1 | 570 | 507.9 | 258.8 |
| 1 | 286.0 | 145.7 | 1 | 330.6 | 168.4 | 1 | 375.1 | 191.1 | 1 | 419.7 | 213.8 | 1 | 464.2 | 236.5 | 1 | 508.8 | 259.2 |
| 2 | 286.9 | 146.2 | 2 | 331.5 | 168.9 | 2 | 376.0 | 191.6 | 2 | 420.6 | 214.3 | 2 | 465.1 | 237.0 | 2 | 509.7 | 259.7 |
| 3 | 287.8 | 146.6 | 3 | 332.3 | 169.3 | 3 | 376.9 | 192.0 | 3 | 421.4 | 214.7 | 3 | 466.0 | 237.4 | 3 | 510.5 | 260.1 |
| 4 | 288.7 | 147.1 | 4 | 333.2 | 169.8 | 4 | 377.8 | 192.5 | 4 | 422.3 | 215.2 | 4 | 466.9 | 237.9 | 4 | 511.4 | 260.6 |
| 5 | 289.6 | 147.5 | 5 | 334.1 | 170.2 | 5 | 378.7 | 192.9 | 5 | 423.2 | 215.6 | 5 | 467.8 | 238.3 | 5 | 512.3 | 261.0 |
| 6 | 290.5 | 148.0 | 6 | 335.0 | 170.7 | 6 | 379.6 | 193.4 | 6 | 424.1 | 216.1 | 6 | 468.7 | 238.8 | 6 | 513.2 | 261.5 |
| 7 | 291.4 | 148.5 | 7 | 335.9 | 171.2 | 7 | 380.5 | 193.9 | 7 | 425.0 | 216.6 | 7 | 469.6 | 239.3 | 7 | 514.1 | 262.0 |
| 8 | 292.3 | 148.9 | 8 | 336.8 | 171.6 | 8 | 381.4 | 194.3 | 8 | 425.9 | 217.0 | 8 | 470.5 | 239.7 | 8 | 515.0 | 262.4 |
| 9 | 293.1 | 149.4 | 9 | 337.7 | 172.1 | 9 | 382.2 | 194.8 | 9 | 426.8 | 217.5 | 9 | 471.3 | 240.2 | 9 | 515.9 | 262.9 |
| 330 | 294.0 | 149.8 | 380 | 338.6 | 172.5 | 430 | 383.1 | 195.2 | 480 | 427.7 | 217.9 | 530 | 472.2 | 240.6 | 580 | 516.8 | 263.3 |
| 1 | 294.9 | 150.3 | 1 | 339.5 | 173.0 | 1 | 384.0 | 195.7 | 1 | 428.6 | 218.4 | 1 | 473.1 | 241.1 | 1 | 517.7 | 263.8 |
| 2 | 295.8 | 150.7 | 2 | 340.4 | 173.4 | 2 | 384.9 | 196.1 | 2 | 429.5 | 218.8 | 2 | 474.0 | 241.5 | 2 | 518.6 | 264.2 |
| 3 | 296.7 | 151.2 | 3 | 341.3 | 173.9 | 3 | 385.8 | 196.6 | 3 | 430.4 | 219.3 | 3 | 474.9 | 242.0 | 3 | 519.5 | 264.7 |
| 4 | 297.6 | 151.6 | 4 | 342.1 | 174.3 | 4 | 386.7 | 197.0 | 4 | 431.2 | 219.7 | 4 | 475.8 | 242.4 | 4 | 520.3 | 265.1 |
| 5 | 298.5 | 152.1 | 5 | 343.0 | 174.8 | 5 | 387.6 | 197.5 | 5 | 432.1 | 220.2 | 5 | 476.7 | 242.9 | 5 | 521.2 | 265.6 |
| 6 | 299.4 | 152.5 | 6 | 343.9 | 175.2 | 6 | 388.5 | 197.9 | 6 | 433.0 | 220.6 | 6 | 477.6 | 243.3 | 6 | 522.1 | 266.0 |
| 7 | 300.3 | 153.0 | 7 | 344.8 | 175.7 | 7 | 389.4 | 198.4 | 7 | 433.9 | 221.1 | 7 | 478.5 | 243.8 | 7 | 523.0 | 266.5 |
| 8 | 301.2 | 153.4 | 8 | 345.7 | 176.1 | 8 | 390.3 | 198.8 | 8 | 434.8 | 221.5 | 8 | 479.4 | 244.2 | 8 | 523.9 | 266.9 |
| 9 | 302.1 | 153.9 | 9 | 346.6 | 176.6 | 9 | 391.2 | 199.3 | 9 | 435.7 | 222.0 | 9 | 480.3 | 244.7 | 9 | 524.8 | 267.4 |
| 340 | 302.9 | 154.4 | 390 | 347.5 | 177.1 | 440 | 392.0 | 199.8 | 490 | 436.6 | 222.5 | 540 | 481.1 | 245.2 | 590 | 525.7 | 267.9 |
| 1 | 303.8 | 154.8 | 1 | 348.4 | 177.5 | 1 | 392.9 | 200.2 | 1 | 437.5 | 222.9 | 1 | 482.0 | 245.6 | 1 | 526.6 | 268.3 |
| 2 | 304.7 | 155.3 | 2 | 349.3 | 178.0 | 2 | 393.8 | 200.7 | 2 | 438.4 | 223.4 | 2 | 482.9 | 246.1 | 2 | 527.5 | 268.8 |
| 3 | 305.6 | 155.7 | 3 | 350.2 | 178.4 | 3 | 394.7 | 201.1 | 3 | 439.3 | 223.8 | 3 | 483.8 | 246.5 | 3 | 528.4 | 269.2 |
| 4 | 306.5 | 156.2 | 4 | 351.1 | 178.9 | 4 | 395.6 | 201.6 | 4 | 440.2 | 224.3 | 4 | 484.7 | 247.0 | 4 | 529.3 | 269.7 |
| 5 | 307.4 | 156.6 | 5 | 351.9 | 179.3 | 5 | 396.5 | 202.0 | 5 | 441.0 | 224.7 | 5 | 485.6 | 247.4 | 5 | 530.1 | 270.1 |
| 6 | 308.3 | 157.1 | 6 | 352.8 | 179.8 | 6 | 397.4 | 202.5 | 6 | 441.9 | 225.2 | 6 | 486.5 | 247.9 | 6 | 531.0 | 270.6 |
| 7 | 309.2 | 157.5 | 7 | 353.7 | 180.2 | 7 | 398.3 | 202.9 | 7 | 442.8 | 225.6 | 7 | 487.4 | 248.3 | 7 | 531.9 | 271.0 |
| 8 | 310.1 | 158.0 | 8 | 354.6 | 180.7 | 8 | 399.2 | 203.4 | 8 | 443.7 | 226.1 | 8 | 488.3 | 248.8 | 8 | 532.8 | 271.5 |
| 9 | 311.0 | 158.4 | 9 | 355.5 | 181.1 | 9 | 400.1 | 203.8 | 9 | 444.6 | 226.5 | 9 | 489.2 | 249.2 | 9 | 533.7 | 271.9 |
| D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 297 315
269 243 225
R

089 063° 045
091 117 135
R ou φ m

R

TABELA 1

R ou φm

359 332° 315
181 208 225

TÁBUAS DE CARTEAÇÃO

001 028 045
179 152 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 44.1 | 23.5 | 100 | 88.3 | 46.9 | 150 | 132.4 | 70.4 | 200 | 176.6 | 93.9 | 250 | 220.7 | 117.4 |
| 1 | 0.9 | 0.5 | 1 | 45.0 | 23.9 | 1 | 89.2 | 47.4 | 1 | 133.3 | 70.9 | 1 | 177.5 | 94.4 | 1 | 221.6 | 117.8 |
| 2 | 1.8 | 0.9 | 2 | 45.9 | 24.4 | 2 | 90.1 | 47.9 | 2 | 134.2 | 71.4 | 2 | 178.4 | 94.8 | 2 | 222.5 | 118.3 |
| 3 | 2.6 | 1.4 | 3 | 46.8 | 24.9 | 3 | 90.9 | 48.4 | 3 | 135.1 | 71.8 | 3 | 179.2 | 95.3 | 3 | 223.4 | 118.8 |
| 4 | 3.5 | 1.9 | 4 | 47.7 | 25.4 | 4 | 91.8 | 48.8 | 4 | 136.0 | 72.3 | 4 | 180.1 | 95.8 | 4 | 224.3 | 119.2 |
| 5 | 4.4 | 2.3 | 5 | 48.6 | 25.8 | 5 | 92.7 | 49.3 | 5 | 136.9 | 72.8 | 5 | 181.0 | 96.2 | 5 | 225.2 | 119.7 |
| 6 | 5.3 | 2.8 | 6 | 49.4 | 26.3 | 6 | 93.6 | 49.8 | 6 | 137.7 | 73.2 | 6 | 181.9 | 96.7 | 6 | 226.0 | 120.2 |
| 7 | 6.2 | 3.3 | 7 | 50.3 | 26.8 | 7 | 94.5 | 50.2 | 7 | 138.6 | 73.7 | 7 | 182.8 | 97.2 | 7 | 226.9 | 120.7 |
| 8 | 7.1 | 3.8 | 8 | 51.2 | 27.2 | 8 | 95.4 | 50.7 | 8 | 139.5 | 74.2 | 8 | 183.7 | 97.7 | 8 | 227.8 | 121.1 |
| 9 | 7.9 | 4.2 | 9 | 52.1 | 27.7 | 9 | 96.2 | 51.2 | 9 | 140.4 | 74.6 | 9 | 184.5 | 98.1 | 9 | 228.7 | 121.6 |
| 10 | 8.8 | 4.7 | 60 | 53.0 | 28.2 | 110 | 97.1 | 51.6 | 160 | 141.3 | 75.1 | 210 | 185.4 | 98.6 | 260 | 229.6 | 122.1 |
| 1 | 9.7 | 5.2 | 1 | 53.9 | 28.6 | 1 | 98.0 | 52.1 | 1 | 142.2 | 75.6 | 1 | 186.3 | 99.1 | 1 | 230.4 | 122.5 |
| 2 | 10.6 | 5.6 | 2 | 54.7 | 29.1 | 2 | 98.9 | 52.6 | 2 | 143.0 | 76.1 | 2 | 187.2 | 99.5 | 2 | 231.3 | 123.0 |
| 3 | 11.5 | 6.1 | 3 | 55.6 | 29.6 | 3 | 99.8 | 53.1 | 3 | 143.9 | 76.5 | 3 | 188.1 | 100.0 | 3 | 232.2 | 123.5 |
| 4 | 12.4 | 6.6 | 4 | 56.5 | 30.0 | 4 | 100.7 | 53.5 | 4 | 144.8 | 77.0 | 4 | 189.0 | 100.5 | 4 | 233.1 | 123.9 |
| 5 | 13.2 | 7.0 | 5 | 57.4 | 30.5 | 5 | 101.5 | 54.0 | 5 | 145.7 | 77.5 | 5 | 189.8 | 100.9 | 5 | 234.0 | 124.4 |
| 6 | 14.1 | 7.5 | 6 | 58.3 | 31.0 | 6 | 102.4 | 54.5 | 6 | 146.6 | 77.9 | 6 | 190.7 | 101.4 | 6 | 234.9 | 124.9 |
| 7 | 15.0 | 8.0 | 7 | 59.2 | 31.5 | 7 | 103.3 | 54.9 | 7 | 147.5 | 78.4 | 7 | 191.6 | 101.9 | 7 | 235.7 | 125.3 |
| 8 | 15.9 | 8.5 | 8 | 60.0 | 31.9 | 8 | 104.2 | 55.4 | 8 | 148.3 | 78.9 | 8 | 192.5 | 102.3 | 8 | 236.6 | 125.8 |
| 9 | 16.8 | 8.9 | 9 | 60.9 | 32.4 | 9 | 105.1 | 55.9 | 9 | 149.2 | 79.3 | 9 | 193.4 | 102.8 | 9 | 237.5 | 126.3 |
| 20 | 17.7 | 9.4 | 70 | 61.8 | 32.9 | 120 | 106.0 | 56.3 | 170 | 150.1 | 79.8 | 220 | 194.2 | 103.3 | 270 | 238.4 | 126.8 |
| 1 | 18.5 | 9.9 | 1 | 62.7 | 33.3 | 1 | 106.8 | 56.8 | 1 | 151.0 | 80.3 | 1 | 195.1 | 103.8 | 1 | 239.3 | 127.2 |
| 2 | 19.4 | 10.3 | 2 | 63.6 | 33.8 | 2 | 107.7 | 57.3 | 2 | 151.9 | 80.7 | 2 | 196.0 | 104.2 | 2 | 240.2 | 127.7 |
| 3 | 20.3 | 10.8 | 3 | 64.5 | 34.3 | 3 | 108.6 | 57.7 | 3 | 152.7 | 81.2 | 3 | 196.9 | 104.7 | 3 | 241.0 | 128.2 |
| 4 | 21.2 | 11.3 | 4 | 65.3 | 34.7 | 4 | 109.5 | 58.2 | 4 | 153.6 | 81.7 | 4 | 197.8 | 105.2 | 4 | 241.9 | 128.6 |
| 5 | 22.1 | 11.7 | 5 | 66.2 | 35.2 | 5 | 110.4 | 58.7 | 5 | 154.5 | 82.2 | 5 | 198.7 | 105.6 | 5 | 242.8 | 129.1 |
| 6 | 23.0 | 12.2 | 6 | 67.1 | 35.7 | 6 | 111.3 | 59.2 | 6 | 155.4 | 82.6 | 6 | 199.5 | 106.1 | 6 | 243.7 | 129.6 |
| 7 | 23.8 | 12.7 | 7 | 68.0 | 36.1 | 7 | 112.1 | 59.6 | 7 | 156.3 | 83.1 | 7 | 200.4 | 106.6 | 7 | 244.6 | 130.0 |
| 8 | 24.7 | 13.1 | 8 | 68.9 | 36.6 | 8 | 113.0 | 60.1 | 8 | 157.2 | 83.6 | 8 | 201.3 | 107.0 | 8 | 245.5 | 130.5 |
| 9 | 25.6 | 13.6 | 9 | 69.8 | 37.1 | 9 | 113.9 | 60.6 | 9 | 158.0 | 84.0 | 9 | 202.2 | 107.5 | 9 | 246.3 | 131.0 |
| 30 | 26.5 | 14.1 | 80 | 70.6 | 37.6 | 130 | 114.8 | 61.0 | 180 | 158.9 | 84.5 | 230 | 203.1 | 108.0 | 280 | 247.2 | 131.5 |
| 1 | 27.4 | 14.6 | 1 | 71.5 | 38.0 | 1 | 115.7 | 61.5 | 1 | 159.8 | 85.0 | 1 | 204.0 | 108.4 | 1 | 248.1 | 131.9 |
| 2 | 28.3 | 15.0 | 2 | 72.4 | 38.5 | 2 | 116.5 | 62.0 | 2 | 160.7 | 85.4 | 2 | 204.8 | 108.9 | 2 | 249.0 | 132.4 |
| 3 | 29.1 | 15.5 | 3 | 73.3 | 39.0 | 3 | 117.4 | 62.4 | 3 | 161.6 | 85.9 | 3 | 205.7 | 109.4 | 3 | 249.9 | 132.9 |
| 4 | 30.0 | 16.0 | 4 | 74.2 | 39.4 | 4 | 118.3 | 62.9 | 4 | 162.5 | 86.4 | 4 | 206.6 | 109.9 | 4 | 250.8 | 133.3 |
| 5 | 30.9 | 16.4 | 5 | 75.1 | 39.9 | 5 | 119.2 | 63.4 | 5 | 163.3 | 86.9 | 5 | 207.5 | 110.3 | 5 | 251.6 | 133.8 |
| 6 | 31.8 | 16.9 | 6 | 75.9 | 40.4 | 6 | 120.1 | 63.8 | 6 | 164.2 | 87.3 | 6 | 208.4 | 110.8 | 6 | 252.5 | 134.3 |
| 7 | 32.7 | 17.4 | 7 | 76.8 | 40.8 | 7 | 121.0 | 64.3 | 7 | 165.1 | 87.8 | 7 | 209.3 | 111.3 | 7 | 253.4 | 134.7 |
| 8 | 33.6 | 17.8 | 8 | 77.7 | 41.3 | 8 | 121.8 | 64.8 | 8 | 166.0 | 88.3 | 8 | 210.1 | 111.7 | 8 | 254.3 | 135.2 |
| 9 | 34.4 | 18.3 | 9 | 78.6 | 41.8 | 9 | 122.7 | 65.3 | 9 | 166.9 | 88.7 | 9 | 211.0 | 112.2 | 9 | 255.2 | 135.7 |
| 40 | 35.3 | 18.8 | 90 | 79.5 | 42.3 | 140 | 123.6 | 65.7 | 190 | 167.8 | 89.2 | 240 | 211.9 | 112.7 | 290 | 256.1 | 136.1 |
| 1 | 36.2 | 19.2 | 1 | 80.3 | 42.7 | 1 | 124.5 | 66.2 | 1 | 168.6 | 89.7 | 1 | 212.8 | 113.1 | 1 | 256.9 | 136.6 |
| 2 | 37.1 | 19.7 | 2 | 81.2 | 43.2 | 2 | 125.4 | 66.7 | 2 | 169.5 | 90.1 | 2 | 213.7 | 113.6 | 2 | 257.8 | 137.1 |
| 3 | 38.0 | 20.2 | 3 | 82.1 | 43.7 | 3 | 126.3 | 67.1 | 3 | 170.4 | 90.6 | 3 | 214.6 | 114.1 | 3 | 258.7 | 137.6 |
| 4 | 38.8 | 20.7 | 4 | 83.0 | 44.1 | 4 | 127.1 | 67.6 | 4 | 171.3 | 91.1 | 4 | 215.4 | 114.6 | 4 | 259.6 | 138.0 |
| 5 | 39.7 | 21.1 | 5 | 83.9 | 44.6 | 5 | 128.0 | 68.1 | 5 | 172.2 | 91.5 | 5 | 216.3 | 115.0 | 5 | 260.5 | 138.5 |
| 6 | 40.6 | 21.6 | 6 | 84.8 | 45.1 | 6 | 128.9 | 68.5 | 6 | 173.1 | 92.0 | 6 | 217.2 | 115.5 | 6 | 261.4 | 139.0 |
| 7 | 41.5 | 22.1 | 7 | 85.6 | 45.5 | 7 | 129.8 | 69.0 | 7 | 173.9 | 92.5 | 7 | 218.1 | 116.0 | 7 | 262.2 | 139.4 |
| 8 | 42.4 | 22.5 | 8 | 86.5 | 46.0 | 8 | 130.7 | 69.5 | 8 | 174.8 | 93.0 | 8 | 219.0 | 116.4 | 8 | 263.1 | 139.9 |
| 9 | 43.3 | 23.0 | 9 | 87.4 | 46.5 | 9 | 131.6 | 70.0 | 9 | 175.7 | 93.4 | 9 | 219.9 | 116.9 | 9 | 264.0 | 140.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 298 315
269 242 225

R

089 062° 045
091 118 135

R ou φm

R

TABELA 1

R ou φm

359 332° 315
181 208 225

TÁBUAS DE CARTEAÇÃO

001 028 045
179 152 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 264.9 | 140.8 | 350 | 309.0 | 164.3 | 400 | 353.2 | 187.8 | 450 | 397.3 | 211.3 | 500 | 441.5 | 234.7 | 550 | 485.6 | 258.2 |
| 1 | 265.8 | 141.3 | 1 | 309.9 | 164.8 | 1 | 354.1 | 188.3 | 1 | 398.2 | 211.7 | 1 | 442.4 | 235.2 | 1 | 486.5 | 258.7 |
| 2 | 266.7 | 141.8 | 2 | 310.8 | 165.3 | 2 | 354.9 | 188.7 | 2 | 399.1 | 212.2 | 2 | 443.2 | 235.7 | 2 | 487.4 | 259.1 |
| 3 | 267.5 | 142.2 | 3 | 311.7 | 165.7 | 3 | 355.8 | 189.2 | 3 | 400.0 | 212.7 | 3 | 444.1 | 236.1 | 3 | 488.3 | 259.6 |
| 4 | 268.4 | 142.7 | 4 | 312.6 | 166.2 | 4 | 356.7 | 189.7 | 4 | 400.9 | 213.1 | 4 | 445.0 | 236.6 | 4 | 489.2 | 260.1 |
| 5 | 269.3 | 143.2 | 5 | 313.4 | 166.7 | 5 | 357.6 | 190.1 | 5 | 401.7 | 213.6 | 5 | 445.9 | 237.1 | 5 | 490.0 | 260.6 |
| 6 | 270.2 | 143.7 | 6 | 314.3 | 167.1 | 6 | 358.5 | 190.6 | 6 | 402.6 | 214.1 | 6 | 446.8 | 237.6 | 6 | 490.9 | 261.0 |
| 7 | 271.1 | 144.1 | 7 | 315.2 | 167.6 | 7 | 359.4 | 191.1 | 7 | 403.5 | 214.5 | 7 | 447.7 | 238.0 | 7 | 491.8 | 261.5 |
| 8 | 271.9 | 144.6 | 8 | 316.1 | 168.1 | 8 | 360.2 | 191.5 | 8 | 404.4 | 215.0 | 8 | 448.5 | 238.5 | 8 | 492.7 | 262.0 |
| 9 | 272.8 | 145.1 | 9 | 317.0 | 168.5 | 9 | 361.1 | 192.0 | 9 | 405.3 | 215.5 | 9 | 449.4 | 239.0 | 9 | 493.6 | 262.4 |
| 310 | 273.7 | 145.5 | 360 | 317.9 | 169.0 | 410 | 362.0 | 192.5 | 460 | 406.2 | 216.0 | 510 | 450.3 | 239.4 | 560 | 494.5 | 262.9 |
| 1 | 274.6 | 146.0 | 1 | 318.7 | 169.5 | 1 | 362.9 | 193.0 | 1 | 407.0 | 216.4 | 1 | 451.2 | 239.9 | 1 | 495.3 | 263.4 |
| 2 | 275.5 | 146.5 | 2 | 319.6 | 169.9 | 2 | 363.8 | 193.4 | 2 | 407.9 | 216.9 | 2 | 452.1 | 240.4 | 2 | 496.2 | 263.8 |
| 3 | 276.4 | 146.9 | 3 | 320.5 | 170.4 | 3 | 364.7 | 193.9 | 3 | 408.8 | 217.4 | 3 | 453.0 | 240.8 | 3 | 497.1 | 264.3 |
| 4 | 277.2 | 147.4 | 4 | 321.4 | 170.9 | 4 | 365.5 | 194.4 | 4 | 409.7 | 217.8 | 4 | 453.8 | 241.3 | 4 | 498.0 | 264.8 |
| 5 | 278.1 | 147.9 | 5 | 322.3 | 171.4 | 5 | 366.4 | 194.8 | 5 | 410.6 | 218.3 | 5 | 454.7 | 241.8 | 5 | 498.9 | 265.3 |
| 6 | 279.0 | 148.4 | 6 | 323.2 | 171.8 | 6 | 367.3 | 195.3 | 6 | 411.5 | 218.8 | 6 | 455.6 | 242.2 | 6 | 499.7 | 265.7 |
| 7 | 279.9 | 148.8 | 7 | 324.0 | 172.3 | 7 | 368.2 | 195.8 | 7 | 412.3 | 219.2 | 7 | 456.5 | 242.7 | 7 | 500.6 | 266.2 |
| 8 | 280.8 | 149.3 | 8 | 324.9 | 172.8 | 8 | 369.1 | 196.2 | 8 | 413.2 | 219.7 | 8 | 457.4 | 243.2 | 8 | 501.5 | 266.7 |
| 9 | 281.7 | 149.8 | 9 | 325.8 | 173.2 | 9 | 370.0 | 196.7 | 9 | 414.1 | 220.2 | 9 | 458.2 | 243.7 | 9 | 502.4 | 267.1 |
| 320 | 282.5 | 150.2 | 370 | 326.7 | 173.7 | 420 | 370.8 | 197.2 | 470 | 415.0 | 220.7 | 520 | 459.1 | 244.1 | 570 | 503.3 | 267.6 |
| 1 | 283.4 | 150.7 | 1 | 327.6 | 174.2 | 1 | 371.7 | 197.6 | 1 | 415.9 | 221.1 | 1 | 460.0 | 244.6 | 1 | 504.2 | 268.1 |
| 2 | 284.3 | 151.2 | 2 | 328.5 | 174.6 | 2 | 372.6 | 198.1 | 2 | 416.8 | 221.6 | 2 | 460.9 | 245.1 | 2 | 505.0 | 268.5 |
| 3 | 285.2 | 151.6 | 3 | 329.3 | 175.1 | 3 | 373.5 | 198.6 | 3 | 417.6 | 222.1 | 3 | 461.8 | 245.5 | 3 | 505.9 | 269.0 |
| 4 | 286.1 | 152.1 | 4 | 330.2 | 175.6 | 4 | 374.4 | 199.1 | 4 | 418.5 | 222.5 | 4 | 462.7 | 246.0 | 4 | 506.8 | 269.5 |
| 5 | 287.0 | 152.6 | 5 | 331.1 | 176.1 | 5 | 375.3 | 199.5 | 5 | 419.4 | 223.0 | 5 | 463.5 | 246.5 | 5 | 507.7 | 269.9 |
| 6 | 287.8 | 153.0 | 6 | 332.0 | 176.5 | 6 | 376.1 | 200.0 | 6 | 420.3 | 223.5 | 6 | 464.4 | 246.9 | 6 | 508.6 | 270.4 |
| 7 | 288.7 | 153.5 | 7 | 332.9 | 177.0 | 7 | 377.0 | 200.5 | 7 | 421.2 | 223.9 | 7 | 465.3 | 247.4 | 7 | 509.5 | 270.9 |
| 8 | 289.6 | 154.0 | 8 | 333.8 | 177.5 | 8 | 377.9 | 200.9 | 8 | 422.0 | 224.4 | 8 | 466.2 | 247.9 | 8 | 510.3 | 271.4 |
| 9 | 290.5 | 154.5 | 9 | 334.6 | 177.9 | 9 | 378.8 | 201.4 | 9 | 422.9 | 224.9 | 9 | 467.1 | 248.4 | 9 | 511.2 | 271.8 |
| 330 | 291.4 | 154.9 | 380 | 335.5 | 178.4 | 430 | 379.7 | 201.9 | 480 | 423.8 | 225.3 | 530 | 468.0 | 248.8 | 580 | 512.1 | 272.3 |
| 1 | 292.3 | 155.4 | 1 | 336.4 | 178.9 | 1 | 380.6 | 202.3 | 1 | 424.7 | 225.8 | 1 | 468.8 | 249.3 | 1 | 513.0 | 272.8 |
| 2 | 293.1 | 155.9 | 2 | 337.3 | 179.3 | 2 | 381.4 | 202.8 | 2 | 425.6 | 226.3 | 2 | 469.7 | 249.8 | 2 | 513.9 | 273.2 |
| 3 | 294.0 | 156.3 | 3 | 338.2 | 179.8 | 3 | 382.3 | 203.3 | 3 | 426.5 | 226.8 | 3 | 470.6 | 250.2 | 3 | 514.8 | 273.7 |
| 4 | 294.9 | 156.8 | 4 | 339.1 | 180.3 | 4 | 383.2 | 203.8 | 4 | 427.3 | 227.2 | 4 | 471.5 | 250.7 | 4 | 515.6 | 274.2 |
| 5 | 295.8 | 157.3 | 5 | 339.9 | 180.7 | 5 | 384.1 | 204.2 | 5 | 428.2 | 227.7 | 5 | 472.4 | 251.2 | 5 | 516.5 | 274.6 |
| 6 | 296.7 | 157.7 | 6 | 340.8 | 181.2 | 6 | 385.0 | 204.7 | 6 | 429.1 | 228.2 | 6 | 473.3 | 251.6 | 6 | 517.4 | 275.1 |
| 7 | 297.6 | 158.2 | 7 | 341.7 | 181.7 | 7 | 385.8 | 205.2 | 7 | 430.0 | 228.6 | 7 | 474.1 | 252.1 | 7 | 518.3 | 275.6 |
| 8 | 298.4 | 158.7 | 8 | 342.6 | 182.2 | 8 | 386.7 | 205.6 | 8 | 430.9 | 229.1 | 8 | 475.0 | 252.6 | 8 | 519.2 | 276.0 |
| 9 | 299.3 | 159.2 | 9 | 343.5 | 182.6 | 9 | 387.6 | 206.1 | 9 | 431.8 | 229.6 | 9 | 475.9 | 253.0 | 9 | 520.1 | 276.5 |
| 340 | 300.2 | 159.6 | 390 | 344.3 | 183.1 | 440 | 388.5 | 206.6 | 490 | 432.6 | 230.0 | 540 | 476.8 | 253.5 | 590 | 520.9 | 277.0 |
| 1 | 301.1 | 160.1 | 1 | 345.2 | 183.6 | 1 | 389.4 | 207.0 | 1 | 433.5 | 230.5 | 1 | 477.7 | 254.0 | 1 | 521.8 | 277.5 |
| 2 | 302.0 | 160.6 | 2 | 346.1 | 184.0 | 2 | 390.3 | 207.5 | 2 | 434.4 | 231.0 | 2 | 478.6 | 254.5 | 2 | 522.7 | 277.9 |
| 3 | 302.9 | 161.0 | 3 | 347.0 | 184.5 | 3 | 391.1 | 208.0 | 3 | 435.3 | 231.4 | 3 | 479.4 | 254.9 | 3 | 523.6 | 278.4 |
| 4 | 303.7 | 161.5 | 4 | 347.9 | 185.0 | 4 | 392.0 | 208.4 | 4 | 436.2 | 231.9 | 4 | 480.3 | 255.4 | 4 | 524.5 | 278.9 |
| 5 | 304.6 | 162.0 | 5 | 348.8 | 185.4 | 5 | 392.9 | 208.9 | 5 | 437.1 | 232.4 | 5 | 481.2 | 255.9 | 5 | 525.4 | 279.3 |
| 6 | 305.5 | 162.4 | 6 | 349.6 | 185.9 | 6 | 393.8 | 209.4 | 6 | 437.9 | 232.9 | 6 | 482.1 | 256.3 | 6 | 526.2 | 279.8 |
| 7 | 306.4 | 162.9 | 7 | 350.5 | 186.4 | 7 | 394.7 | 209.9 | 7 | 438.8 | 233.3 | 7 | 483.0 | 256.8 | 7 | 527.1 | 280.3 |
| 8 | 307.3 | 163.4 | 8 | 351.4 | 186.8 | 8 | 395.6 | 210.3 | 8 | 439.7 | 233.8 | 8 | 483.9 | 257.3 | 8 | 528.0 | 280.7 |
| 9 | 308.1 | 163.8 | 9 | 352.3 | 187.3 | 9 | 396.4 | 210.8 | 9 | 440.6 | 234.3 | 9 | 484.7 | 257.7 | 9 | 528.9 | 281.2 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 298 315
269 242 225

R

089 062° 045
091 118 135

R ou φm

R

TABELA 1

R ou φ m

359 331° 315
181 209 225

TÁBUAS DE CARTEAÇÃO

001 029 045
179 151 135

| ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | | |
|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|
| D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap |
| 0 | 0.0 | 0.0 | 50 | 43.7 | 24.2 | 100 | 87.5 | 48.5 | 150 | 131.2 | 72.7 | 200 | 174.9 | 97.0 | 250 | 218.7 | 121.2 |
| 1 | 0.9 | 0.5 | 1 | 44.6 | 24.7 | 1 | 88.3 | 49.0 | 1 | 132.1 | 73.2 | 1 | 175.8 | 97.4 | 1 | 219.5 | 121.7 |
| 2 | 1.7 | 1.0 | 2 | 45.5 | 25.2 | 2 | 89.2 | 49.5 | 2 | 132.9 | 73.7 | 2 | 176.7 | 97.9 | 2 | 220.4 | 122.2 |
| 3 | 2.6 | 1.5 | 3 | 46.4 | 25.7 | 3 | 90.1 | 49.9 | 3 | 133.8 | 74.2 | 3 | 177.5 | 98.4 | 3 | 221.3 | 122.7 |
| 4 | 3.5 | 1.9 | 4 | 47.2 | 26.2 | 4 | 91.0 | 50.4 | 4 | 134.7 | 74.7 | 4 | 178.4 | 98.9 | 4 | 222.2 | 123.1 |
| 5 | 4.4 | 2.4 | 5 | 48.1 | 26.7 | 5 | 91.8 | 50.9 | 5 | 135.6 | 75.1 | 5 | 179.3 | 99.4 | 5 | 223.0 | 123.6 |
| 6 | 5.2 | 2.9 | 6 | 49.0 | 27.1 | 6 | 92.7 | 51.4 | 6 | 136.4 | 75.6 | 6 | 180.2 | 99.9 | 6 | 223.9 | 124.1 |
| 7 | 6.1 | 3.4 | 7 | 49.9 | 27.6 | 7 | 93.6 | 51.9 | 7 | 137.3 | 76.1 | 7 | 181.0 | 100.4 | 7 | 224.8 | 124.6 |
| 8 | 7.0 | 3.9 | 8 | 50.7 | 28.1 | 8 | 94.5 | 52.4 | 8 | 138.2 | 76.6 | 8 | 181.9 | 100.8 | 8 | 225.7 | 125.1 |
| 9 | 7.9 | 4.4 | 9 | 51.6 | 28.6 | 9 | 95.3 | 52.8 | 9 | 139.1 | 77.1 | 9 | 182.8 | 101.3 | 9 | 226.5 | 125.6 |
| 10 | 8.7 | 4.8 | 60 | 52.5 | 29.1 | 110 | 96.2 | 53.3 | 160 | 139.9 | 77.6 | 210 | 183.7 | 101.8 | 260 | 227.4 | 126.1 |
| 1 | 9.6 | 5.3 | 1 | 53.4 | 29.6 | 1 | 97.1 | 53.8 | 1 | 140.8 | 78.1 | 1 | 184.5 | 102.3 | 1 | 228.3 | 126.5 |
| 2 | 10.5 | 5.8 | 2 | 54.2 | 30.1 | 2 | 98.0 | 54.3 | 2 | 141.7 | 78.5 | 2 | 185.4 | 102.8 | 2 | 229.2 | 127.0 |
| 3 | 11.4 | 6.3 | 3 | 55.1 | 30.5 | 3 | 98.8 | 54.8 | 3 | 142.6 | 79.0 | 3 | 186.3 | 103.3 | 3 | 230.0 | 127.5 |
| 4 | 12.2 | 6.8 | 4 | 56.0 | 31.0 | 4 | 99.7 | 55.3 | 4 | 143.4 | 79.5 | 4 | 187.2 | 103.7 | 4 | 230.9 | 128.0 |
| 5 | 13.1 | 7.3 | 5 | 56.9 | 31.5 | 5 | 100.6 | 55.8 | 5 | 144.3 | 80.0 | 5 | 188.0 | 104.2 | 5 | 231.8 | 128.5 |
| 6 | 14.0 | 7.8 | 6 | 57.7 | 32.0 | 6 | 101.5 | 56.2 | 6 | 145.2 | 80.5 | 6 | 188.9 | 104.7 | 6 | 232.6 | 129.0 |
| 7 | 14.9 | 8.2 | 7 | 58.6 | 32.5 | 7 | 102.3 | 56.7 | 7 | 146.1 | 81.0 | 7 | 189.8 | 105.2 | 7 | 233.5 | 129.4 |
| 8 | 15.7 | 8.7 | 8 | 59.5 | 33.0 | 8 | 103.2 | 57.2 | 8 | 146.9 | 81.4 | 8 | 190.7 | 105.7 | 8 | 234.4 | 129.9 |
| 9 | 16.6 | 9.2 | 9 | 60.3 | 33.5 | 9 | 104.1 | 57.7 | 9 | 147.8 | 81.9 | 9 | 191.5 | 106.2 | 9 | 235.3 | 130.4 |
| 20 | 17.5 | 9.7 | 70 | 61.2 | 33.9 | 120 | 105.0 | 58.2 | 170 | 148.7 | 82.4 | 220 | 192.4 | 106.7 | 270 | 236.1 | 130.9 |
| 1 | 18.4 | 10.2 | 1 | 62.1 | 34.4 | 1 | 105.8 | 58.7 | 1 | 149.6 | 82.9 | 1 | 193.3 | 107.1 | 1 | 237.0 | 131.4 |
| 2 | 19.2 | 10.7 | 2 | 63.0 | 34.9 | 2 | 106.7 | 59.1 | 2 | 150.4 | 83.4 | 2 | 194.2 | 107.6 | 2 | 237.9 | 131.9 |
| 3 | 20.1 | 11.2 | 3 | 63.8 | 35.4 | 3 | 107.6 | 59.6 | 3 | 151.3 | 83.9 | 3 | 195.0 | 108.1 | 3 | 238.8 | 132.4 |
| 4 | 21.0 | 11.6 | 4 | 64.7 | 35.9 | 4 | 108.5 | 60.1 | 4 | 152.2 | 84.4 | 4 | 195.9 | 108.6 | 4 | 239.6 | 132.8 |
| 5 | 21.9 | 12.1 | 5 | 65.6 | 36.4 | 5 | 109.3 | 60.6 | 5 | 153.1 | 84.8 | 5 | 196.8 | 109.1 | 5 | 240.5 | 133.3 |
| 6 | 22.7 | 12.6 | 6 | 66.5 | 36.8 | 6 | 110.2 | 61.1 | 6 | 153.9 | 85.3 | 6 | 197.7 | 109.6 | 6 | 241.4 | 133.8 |
| 7 | 23.6 | 13.1 | 7 | 67.3 | 37.3 | 7 | 111.1 | 61.6 | 7 | 154.8 | 85.8 | 7 | 198.5 | 110.1 | 7 | 242.3 | 134.3 |
| 8 | 24.5 | 13.6 | 8 | 68.2 | 37.8 | 8 | 112.0 | 62.1 | 8 | 155.7 | 86.3 | 8 | 199.4 | 110.5 | 8 | 243.1 | 134.8 |
| 9 | 25.4 | 14.1 | 9 | 69.1 | 38.3 | 9 | 112.8 | 62.5 | 9 | 156.6 | 86.8 | 9 | 200.3 | 111.0 | 9 | 244.0 | 135.3 |
| 30 | 26.2 | 14.5 | 80 | 70.0 | 38.8 | 130 | 113.7 | 63.0 | 180 | 157.4 | 87.3 | 230 | 201.2 | 111.5 | 280 | 244.9 | 135.7 |
| 1 | 27.1 | 15.0 | 1 | 70.8 | 39.3 | 1 | 114.6 | 63.5 | 1 | 158.3 | 87.8 | 1 | 202.0 | 112.0 | 1 | 245.8 | 136.2 |
| 2 | 28.0 | 15.5 | 2 | 71.7 | 39.8 | 2 | 115.4 | 64.0 | 2 | 159.2 | 88.2 | 2 | 202.9 | 112.5 | 2 | 246.6 | 136.7 |
| 3 | 28.9 | 16.0 | 3 | 72.6 | 40.2 | 3 | 116.3 | 64.5 | 3 | 160.1 | 88.7 | 3 | 203.8 | 113.0 | 3 | 247.5 | 137.2 |
| 4 | 29.7 | 16.5 | 4 | 73.5 | 40.7 | 4 | 117.2 | 65.0 | 4 | 160.9 | 89.2 | 4 | 204.7 | 113.4 | 4 | 248.4 | 137.7 |
| 5 | 30.6 | 17.0 | 5 | 74.3 | 41.2 | 5 | 118.1 | 65.4 | 5 | 161.8 | 89.7 | 5 | 205.5 | 113.9 | 5 | 249.3 | 138.2 |
| 6 | 31.5 | 17.5 | 6 | 75.2 | 41.7 | 6 | 118.9 | 65.9 | 6 | 162.7 | 90.2 | 6 | 206.4 | 114.4 | 6 | 250.1 | 138.7 |
| 7 | 32.4 | 17.9 | 7 | 76.1 | 42.2 | 7 | 119.8 | 66.4 | 7 | 163.6 | 90.7 | 7 | 207.3 | 114.9 | 7 | 251.0 | 139.1 |
| 8 | 33.2 | 18.4 | 8 | 77.0 | 42.7 | 8 | 120.7 | 66.9 | 8 | 164.4 | 91.1 | 8 | 208.2 | 115.4 | 8 | 251.9 | 139.6 |
| 9 | 34.1 | 18.9 | 9 | 77.8 | 43.1 | 9 | 121.6 | 67.4 | 9 | 165.3 | 91.6 | 9 | 209.0 | 115.9 | 9 | 252.8 | 140.1 |
| 40 | 35.0 | 19.4 | 90 | 78.7 | 43.6 | 140 | 122.4 | 67.9 | 190 | 166.2 | 92.1 | 240 | 209.9 | 116.4 | 290 | 253.6 | 140.6 |
| 1 | 35.9 | 19.9 | 1 | 79.6 | 44.1 | 1 | 123.3 | 68.4 | 1 | 167.1 | 92.6 | 1 | 210.8 | 116.8 | 1 | 254.5 | 141.1 |
| 2 | 36.7 | 20.4 | 2 | 80.5 | 44.6 | 2 | 124.2 | 68.8 | 2 | 167.9 | 93.1 | 2 | 211.7 | 117.3 | 2 | 255.4 | 141.6 |
| 3 | 37.6 | 20.8 | 3 | 81.3 | 45.1 | 3 | 125.1 | 69.3 | 3 | 168.8 | 93.6 | 3 | 212.5 | 117.8 | 3 | 256.3 | 142.0 |
| 4 | 38.5 | 21.3 | 4 | 82.2 | 45.6 | 4 | 125.9 | 69.8 | 4 | 169.7 | 94.1 | 4 | 213.4 | 118.3 | 4 | 257.1 | 142.5 |
| 5 | 39.4 | 21.8 | 5 | 83.1 | 46.1 | 5 | 126.8 | 70.3 | 5 | 170.6 | 94.5 | 5 | 214.3 | 118.8 | 5 | 258.0 | 143.0 |
| 6 | 40.2 | 22.3 | 6 | 84.0 | 46.5 | 6 | 127.7 | 70.8 | 6 | 171.4 | 95.0 | 6 | 215.2 | 119.3 | 6 | 258.9 | 143.5 |
| 7 | 41.1 | 22.8 | 7 | 84.8 | 47.0 | 7 | 128.6 | 71.3 | 7 | 172.3 | 95.5 | 7 | 216.0 | 119.7 | 7 | 259.8 | 144.0 |
| 8 | 42.0 | 23.3 | 8 | 85.7 | 47.5 | 8 | 129.4 | 71.8 | 8 | 173.2 | 96.0 | 8 | 216.9 | 120.2 | 8 | 260.6 | 144.5 |
| 9 | 42.9 | 23.8 | 9 | 86.6 | 48.0 | 9 | 130.3 | 72.2 | 9 | 174.0 | 96.5 | 9 | 217.8 | 120.7 | 9 | 261.5 | 145.0 |
| D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 299 315
269 241 225

R

089 061° 045
091 119 135

R ou φ m

R

TABELA 1

R ou φm

359 331° 315

181 209 225

TÁBUAS DE CARTEAÇÃO

001 029 045

151 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 262.4 | 145.4 | 350 | 306.1 | 169.7 | 400 | 349.8 | 193.9 | 450 | 393.6 | 218.2 | 500 | 437.3 | 242.4 | 550 | 481.0 | 266.6 |
| 1 | 263.3 | 145.9 | 1 | 307.0 | 170.2 | 1 | 350.7 | 194.4 | 1 | 394.5 | 218.6 | 1 | 438.2 | 242.9 | 1 | 481.9 | 267.1 |
| 2 | 264.1 | 146.4 | 2 | 307.9 | 170.7 | 2 | 351.6 | 194.9 | 2 | 395.3 | 219.1 | 2 | 439.1 | 243.4 | 2 | 482.8 | 267.6 |
| 3 | 265.0 | 146.9 | 3 | 308.7 | 171.1 | 3 | 352.5 | 195.4 | 3 | 396.2 | 219.6 | 3 | 439.9 | 243.9 | 3 | 483.7 | 268.1 |
| 4 | 265.9 | 147.4 | 4 | 309.6 | 171.6 | 4 | 353.3 | 195.9 | 4 | 397.1 | 220.1 | 4 | 440.8 | 244.3 | 4 | 484.5 | 268.6 |
| 5 | 266.8 | 147.9 | 5 | 310.5 | 172.1 | 5 | 354.2 | 196.3 | 5 | 398.0 | 220.6 | 5 | 441.7 | 244.8 | 5 | 485.4 | 269.1 |
| 6 | 267.6 | 148.4 | 6 | 311.4 | 172.6 | 6 | 355.1 | 196.8 | 6 | 398.8 | 221.1 | 6 | 442.6 | 245.3 | 6 | 486.3 | 269.6 |
| 7 | 268.5 | 148.8 | 7 | 312.2 | 173.1 | 7 | 356.0 | 197.3 | 7 | 399.7 | 221.6 | 7 | 443.4 | 245.8 | 7 | 487.2 | 270.0 |
| 8 | 269.4 | 149.3 | 8 | 313.1 | 173.6 | 8 | 356.8 | 197.8 | 8 | 400.6 | 222.0 | 8 | 444.3 | 246.3 | 8 | 488.0 | 270.5 |
| 9 | 270.3 | 149.8 | 9 | 314.0 | 174.0 | 9 | 357.7 | 198.3 | 9 | 401.5 | 222.5 | 9 | 445.2 | 246.8 | 9 | 488.9 | 271.0 |
| 310 | 271.1 | 150.3 | 360 | 314.9 | 174.5 | 410 | 358.6 | 198.8 | 460 | 402.3 | 223.0 | 510 | 446.1 | 247.3 | 560 | 489.8 | 271.5 |
| 1 | 272.0 | 150.8 | 1 | 315.7 | 175.0 | 1 | 359.5 | 199.3 | 1 | 403.2 | 223.5 | 1 | 446.9 | 247.7 | 1 | 490.7 | 272.0 |
| 2 | 272.9 | 151.3 | 2 | 316.6 | 175.5 | 2 | 360.3 | 199.7 | 2 | 404.1 | 224.0 | 2 | 447.8 | 248.2 | 2 | 491.5 | 272.5 |
| 3 | 273.8 | 151.7 | 3 | 317.5 | 176.0 | 3 | 361.2 | 200.2 | 3 | 404.9 | 224.5 | 3 | 448.7 | 248.7 | 3 | 492.4 | 272.9 |
| 4 | 274.6 | 152.2 | 4 | 318.4 | 176.5 | 4 | 362.1 | 200.7 | 4 | 405.8 | 225.0 | 4 | 449.6 | 249.2 | 4 | 493.3 | 273.4 |
| 5 | 275.5 | 152.7 | 5 | 319.2 | 177.0 | 5 | 363.0 | 201.2 | 5 | 406.7 | 225.4 | 5 | 450.4 | 249.7 | 5 | 494.2 | 273.9 |
| 6 | 276.4 | 153.2 | 6 | 320.1 | 177.4 | 6 | 363.8 | 201.7 | 6 | 407.6 | 225.9 | 6 | 451.3 | 250.2 | 6 | 495.0 | 274.4 |
| 7 | 277.3 | 153.7 | 7 | 321.0 | 177.9 | 7 | 364.7 | 202.2 | 7 | 408.4 | 226.4 | 7 | 452.2 | 250.6 | 7 | 495.9 | 274.9 |
| 8 | 278.1 | 154.2 | 8 | 321.9 | 178.4 | 8 | 365.6 | 202.7 | 8 | 409.3 | 226.9 | 8 | 453.1 | 251.1 | 8 | 496.8 | 275.4 |
| 9 | 279.0 | 154.7 | 9 | 322.7 | 178.9 | 9 | 366.5 | 203.1 | 9 | 410.2 | 227.4 | 9 | 453.9 | 251.6 | 9 | 497.7 | 275.9 |
| 320 | 279.9 | 155.1 | 370 | 323.6 | 179.4 | 420 | 367.3 | 203.6 | 470 | 411.1 | 227.9 | 520 | 454.8 | 252.1 | 570 | 498.5 | 276.3 |
| 1 | 280.8 | 155.6 | 1 | 324.5 | 179.9 | 1 | 368.2 | 204.1 | 1 | 411.9 | 228.3 | 1 | 455.7 | 252.6 | 1 | 499.4 | 276.8 |
| 2 | 281.6 | 156.1 | 2 | 325.4 | 180.3 | 2 | 369.1 | 204.6 | 2 | 412.8 | 228.8 | 2 | 456.6 | 253.1 | 2 | 500.3 | 277.3 |
| 3 | 282.5 | 156.6 | 3 | 326.2 | 180.8 | 3 | 370.0 | 205.1 | 3 | 413.7 | 229.3 | 3 | 457.4 | 253.6 | 3 | 501.2 | 277.8 |
| 4 | 283.4 | 157.1 | 4 | 327.1 | 181.3 | 4 | 370.8 | 205.6 | 4 | 414.6 | 229.8 | 4 | 458.3 | 254.0 | 4 | 502.0 | 278.3 |
| 5 | 284.3 | 157.6 | 5 | 328.0 | 181.8 | 5 | 371.7 | 206.0 | 5 | 415.4 | 230.3 | 5 | 459.2 | 254.5 | 5 | 502.9 | 278.8 |
| 6 | 285.1 | 158.0 | 6 | 328.9 | 182.3 | 6 | 372.6 | 206.5 | 6 | 416.3 | 230.8 | 6 | 460.0 | 255.0 | 6 | 503.8 | 279.3 |
| 7 | 286.0 | 158.5 | 7 | 329.7 | 182.8 | 7 | 373.5 | 207.0 | 7 | 417.2 | 231.3 | 7 | 460.9 | 255.5 | 7 | 504.7 | 279.7 |
| 8 | 286.9 | 159.0 | 8 | 330.6 | 183.3 | 8 | 374.3 | 207.5 | 8 | 418.1 | 231.7 | 8 | 461.8 | 256.0 | 8 | 505.5 | 280.2 |
| 9 | 287.7 | 159.5 | 9 | 331.5 | 183.7 | 9 | 375.2 | 208.0 | 9 | 418.9 | 232.2 | 9 | 462.7 | 256.5 | 9 | 506.4 | 280.7 |
| 330 | 288.6 | 160.0 | 380 | 332.4 | 184.2 | 430 | 376.1 | 208.5 | 480 | 419.8 | 232.7 | 530 | 463.5 | 256.9 | 580 | 507.3 | 281.2 |
| 1 | 289.5 | 160.5 | 1 | 333.2 | 184.7 | 1 | 377.0 | 209.0 | 1 | 420.7 | 233.2 | 1 | 464.4 | 257.4 | 1 | 508.2 | 281.7 |
| 2 | 290.4 | 161.0 | 2 | 334.1 | 185.2 | 2 | 377.8 | 209.4 | 2 | 421.6 | 233.7 | 2 | 465.3 | 257.9 | 2 | 509.0 | 282.2 |
| 3 | 291.2 | 161.4 | 3 | 335.0 | 185.7 | 3 | 378.7 | 209.9 | 3 | 422.4 | 234.2 | 3 | 466.2 | 258.4 | 3 | 509.9 | 282.6 |
| 4 | 292.1 | 161.9 | 4 | 335.9 | 186.2 | 4 | 379.6 | 210.4 | 4 | 423.3 | 234.6 | 4 | 467.0 | 258.9 | 4 | 510.8 | 283.1 |
| 5 | 293.0 | 162.4 | 5 | 336.7 | 186.7 | 5 | 380.5 | 210.9 | 5 | 424.2 | 235.1 | 5 | 467.9 | 259.4 | 5 | 511.7 | 283.6 |
| 6 | 293.9 | 162.9 | 6 | 337.6 | 187.1 | 6 | 381.3 | 211.4 | 6 | 425.1 | 235.6 | 6 | 468.8 | 259.9 | 6 | 512.5 | 284.1 |
| 7 | 294.7 | 163.4 | 7 | 338.5 | 187.6 | 7 | 382.2 | 211.9 | 7 | 425.9 | 236.1 | 7 | 469.7 | 260.3 | 7 | 513.4 | 284.6 |
| 8 | 295.6 | 163.9 | 8 | 339.4 | 188.1 | 8 | 383.1 | 212.3 | 8 | 426.8 | 236.6 | 8 | 470.5 | 260.8 | 8 | 514.3 | 285.1 |
| 9 | 296.5 | 164.4 | 9 | 340.2 | 188.6 | 9 | 384.0 | 212.8 | 9 | 427.7 | 237.1 | 9 | 471.4 | 261.3 | 9 | 515.2 | 285.6 |
| 340 | 297.4 | 164.8 | 390 | 341.1 | 189.1 | 440 | 384.8 | 213.3 | 490 | 428.6 | 237.6 | 540 | 472.3 | 261.8 | 590 | 516.0 | 286.0 |
| 1 | 298.2 | 165.3 | 1 | 342.0 | 189.6 | 1 | 385.7 | 213.8 | 1 | 429.4 | 238.0 | 1 | 473.2 | 262.3 | 1 | 516.9 | 286.5 |
| 2 | 299.1 | 165.8 | 2 | 342.9 | 190.0 | 2 | 386.6 | 214.3 | 2 | 430.3 | 238.5 | 2 | 474.0 | 262.8 | 2 | 517.8 | 287.0 |
| 3 | 300.0 | 166.3 | 3 | 343.7 | 190.5 | 3 | 387.5 | 214.8 | 3 | 431.2 | 239.0 | 3 | 474.9 | 263.3 | 3 | 518.6 | 287.5 |
| 4 | 300.9 | 166.8 | 4 | 344.6 | 191.0 | 4 | 388.3 | 215.3 | 4 | 432.1 | 239.5 | 4 | 475.8 | 263.7 | 4 | 519.5 | 288.0 |
| 5 | 301.7 | 167.3 | 5 | 345.5 | 191.5 | 5 | 389.2 | 215.7 | 5 | 432.9 | 240.0 | 5 | 476.7 | 264.2 | 5 | 520.4 | 288.5 |
| 6 | 302.6 | 167.7 | 6 | 346.3 | 192.0 | 6 | 390.1 | 216.2 | 6 | 433.8 | 240.5 | 6 | 477.5 | 264.7 | 6 | 521.3 | 288.9 |
| 7 | 303.5 | 168.2 | 7 | 347.2 | 192.5 | 7 | 391.0 | 216.7 | 7 | 434.7 | 241.0 | 7 | 478.4 | 265.2 | 7 | 522.1 | 289.4 |
| 8 | 304.4 | 168.7 | 8 | 348.1 | 193.0 | 8 | 391.8 | 217.2 | 8 | 435.6 | 241.4 | 8 | 479.3 | 265.7 | 8 | 523.0 | 289.9 |
| 9 | 305.2 | 169.2 | 9 | 349.0 | 193.4 | 9 | 392.7 | 217.7 | 9 | 436.4 | 241.9 | 9 | 480.2 | 266.2 | 9 | 523.9 | 290.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 299 315

269 241 225

089 061° 045

091 119 135

R

R ou φm

R

TABELA 1

R ou φm

359 330° 315
181 210 225

TÁBUAS DE CARTEAÇÃO

001 030 045
179 150 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 43.3 | 25.0 | 100 | 86.6 | 50.0 | 150 | 129.9 | 75.0 | 200 | 173.2 | 100.0 | 250 | 216.5 | 125.0 |
| 1 | 0.9 | 0.5 | 1 | 44.2 | 25.5 | 1 | 87.5 | 50.5 | 1 | 130.8 | 75.5 | 1 | 174.1 | 100.5 | 1 | 217.4 | 125.5 |
| 2 | 1.7 | 1.0 | 2 | 45.0 | 26.0 | 2 | 88.3 | 51.0 | 2 | 131.6 | 76.0 | 2 | 174.9 | 101.0 | 2 | 218.2 | 126.0 |
| 3 | 2.6 | 1.5 | 3 | 45.9 | 26.5 | 3 | 89.2 | 51.5 | 3 | 132.5 | 76.5 | 3 | 175.8 | 101.5 | 3 | 219.1 | 126.5 |
| 4 | 3.5 | 2.0 | 4 | 46.8 | 27.0 | 4 | 90.1 | 52.0 | 4 | 133.4 | 77.0 | 4 | 176.7 | 102.0 | 4 | 220.0 | 127.0 |
| 5 | 4.3 | 2.5 | 5 | 47.6 | 27.5 | 5 | 90.9 | 52.5 | 5 | 134.2 | 77.5 | 5 | 177.5 | 102.5 | 5 | 220.8 | 127.5 |
| 6 | 5.2 | 3.0 | 6 | 48.5 | 28.0 | 6 | 91.8 | 53.0 | 6 | 135.1 | 78.0 | 6 | 178.4 | 103.0 | 6 | 221.7 | 128.0 |
| 7 | 6.1 | 3.5 | 7 | 49.4 | 28.5 | 7 | 92.7 | 53.5 | 7 | 136.0 | 78.5 | 7 | 179.3 | 103.5 | 7 | 222.6 | 128.5 |
| 8 | 6.9 | 4.0 | 8 | 50.2 | 29.0 | 8 | 93.5 | 54.0 | 8 | 136.8 | 79.0 | 8 | 180.1 | 104.0 | 8 | 223.4 | 129.0 |
| 9 | 7.8 | 4.5 | 9 | 51.1 | 29.5 | 9 | 94.4 | 54.5 | 9 | 137.7 | 79.5 | 9 | 181.0 | 104.5 | 9 | 224.3 | 129.5 |
| 10 | 8.7 | 5.0 | 60 | 52.0 | 30.0 | 110 | 95.3 | 55.0 | 160 | 138.6 | 80.0 | 210 | 181.9 | 105.0 | 260 | 225.2 | 130.0 |
| 1 | 9.5 | 5.5 | 1 | 52.8 | 30.5 | 1 | 96.1 | 55.5 | 1 | 139.4 | 80.5 | 1 | 182.7 | 105.5 | 1 | 226.0 | 130.5 |
| 2 | 10.4 | 6.0 | 2 | 53.7 | 31.0 | 2 | 97.0 | 56.0 | 2 | 140.3 | 81.0 | 2 | 183.6 | 106.0 | 2 | 226.9 | 131.0 |
| 3 | 11.3 | 6.5 | 3 | 54.6 | 31.5 | 3 | 97.9 | 56.5 | 3 | 141.2 | 81.5 | 3 | 184.5 | 106.5 | 3 | 227.8 | 131.5 |
| 4 | 12.1 | 7.0 | 4 | 55.4 | 32.0 | 4 | 98.7 | 57.0 | 4 | 142.0 | 82.0 | 4 | 185.3 | 107.0 | 4 | 228.6 | 132.0 |
| 5 | 13.0 | 7.5 | 5 | 56.3 | 32.5 | 5 | 99.6 | 57.5 | 5 | 142.9 | 82.5 | 5 | 186.2 | 107.5 | 5 | 229.5 | 132.5 |
| 6 | 13.9 | 8.0 | 6 | 57.2 | 33.0 | 6 | 100.5 | 58.0 | 6 | 143.8 | 83.0 | 6 | 187.1 | 108.0 | 6 | 230.4 | 133.0 |
| 7 | 14.7 | 8.5 | 7 | 58.0 | 33.5 | 7 | 101.3 | 58.5 | 7 | 144.6 | 83.5 | 7 | 187.9 | 108.5 | 7 | 231.2 | 133.5 |
| 8 | 15.6 | 9.0 | 8 | 58.9 | 34.0 | 8 | 102.2 | 59.0 | 8 | 145.5 | 84.0 | 8 | 188.8 | 109.0 | 8 | 232.1 | 134.0 |
| 9 | 16.5 | 9.5 | 9 | 59.8 | 34.5 | 9 | 103.1 | 59.5 | 9 | 146.4 | 84.5 | 9 | 189.7 | 109.5 | 9 | 233.0 | 134.5 |
| 20 | 17.3 | 10.0 | 70 | 60.6 | 35.0 | 120 | 103.9 | 60.0 | 170 | 147.2 | 85.0 | 220 | 190.5 | 110.0 | 270 | 233.8 | 135.0 |
| 1 | 18.2 | 10.5 | 1 | 61.5 | 35.5 | 1 | 104.8 | 60.5 | 1 | 148.1 | 85.5 | 1 | 191.4 | 110.5 | 1 | 234.7 | 135.5 |
| 2 | 19.1 | 11.0 | 2 | 62.4 | 36.0 | 2 | 105.7 | 61.0 | 2 | 149.0 | 86.0 | 2 | 192.3 | 111.0 | 2 | 235.6 | 136.0 |
| 3 | 19.9 | 11.5 | 3 | 63.2 | 36.5 | 3 | 106.5 | 61.5 | 3 | 149.8 | 86.5 | 3 | 193.1 | 111.5 | 3 | 236.4 | 136.5 |
| 4 | 20.8 | 12.0 | 4 | 64.1 | 37.0 | 4 | 107.4 | 62.0 | 4 | 150.7 | 87.0 | 4 | 194.0 | 112.0 | 4 | 237.3 | 137.0 |
| 5 | 21.7 | 12.5 | 5 | 65.0 | 37.5 | 5 | 108.3 | 62.5 | 5 | 151.6 | 87.5 | 5 | 194.9 | 112.5 | 5 | 238.2 | 137.5 |
| 6 | 22.5 | 13.0 | 6 | 65.8 | 38.0 | 6 | 109.1 | 63.0 | 6 | 152.4 | 88.0 | 6 | 195.7 | 113.0 | 6 | 239.0 | 138.0 |
| 7 | 23.4 | 13.5 | 7 | 66.7 | 38.5 | 7 | 110.0 | 63.5 | 7 | 153.3 | 88.5 | 7 | 196.6 | 113.5 | 7 | 239.9 | 138.5 |
| 8 | 24.2 | 14.0 | 8 | 67.5 | 39.0 | 8 | 110.9 | 64.0 | 8 | 154.2 | 89.0 | 8 | 197.5 | 114.0 | 8 | 240.8 | 139.0 |
| 9 | 25.1 | 14.5 | 9 | 68.4 | 39.5 | 9 | 111.7 | 64.5 | 9 | 155.0 | 89.5 | 9 | 198.3 | 114.5 | 9 | 241.6 | 139.5 |
| 30 | 26.0 | 15.0 | 80 | 69.3 | 40.0 | 130 | 112.6 | 65.0 | 180 | 155.9 | 90.0 | 230 | 199.2 | 115.0 | 280 | 242.5 | 140.0 |
| 1 | 26.8 | 15.5 | 1 | 70.1 | 40.5 | 1 | 113.4 | 65.5 | 1 | 156.8 | 90.5 | 1 | 200.1 | 115.5 | 1 | 243.4 | 140.5 |
| 2 | 27.7 | 16.0 | 2 | 71.0 | 41.0 | 2 | 114.3 | 66.0 | 2 | 157.6 | 91.0 | 2 | 200.9 | 116.0 | 2 | 244.2 | 141.0 |
| 3 | 28.6 | 16.5 | 3 | 71.9 | 41.5 | 3 | 115.2 | 66.5 | 3 | 158.5 | 91.5 | 3 | 201.8 | 116.5 | 3 | 245.1 | 141.5 |
| 4 | 29.4 | 17.0 | 4 | 72.7 | 42.0 | 4 | 116.0 | 67.0 | 4 | 159.3 | 92.0 | 4 | 202.6 | 117.0 | 4 | 246.0 | 142.0 |
| 5 | 30.3 | 17.5 | 5 | 73.6 | 42.5 | 5 | 116.9 | 67.5 | 5 | 160.2 | 92.5 | 5 | 203.5 | 117.5 | 5 | 246.8 | 142.5 |
| 6 | 31.2 | 18.0 | 6 | 74.5 | 43.0 | 6 | 117.8 | 68.0 | 6 | 161.1 | 93.0 | 6 | 204.4 | 118.0 | 6 | 247.7 | 143.0 |
| 7 | 32.0 | 18.5 | 7 | 75.3 | 43.5 | 7 | 118.6 | 68.5 | 7 | 161.9 | 93.5 | 7 | 205.2 | 118.5 | 7 | 248.5 | 143.5 |
| 8 | 32.9 | 19.0 | 8 | 76.2 | 44.0 | 8 | 119.5 | 69.0 | 8 | 162.8 | 94.0 | 8 | 206.1 | 119.0 | 8 | 249.4 | 144.0 |
| 9 | 33.8 | 19.5 | 9 | 77.1 | 44.5 | 9 | 120.4 | 69.5 | 9 | 163.7 | 94.5 | 9 | 207.0 | 119.5 | 9 | 250.3 | 144.5 |
| 40 | 34.6 | 20.0 | 90 | 77.9 | 45.0 | 140 | 121.2 | 70.0 | 190 | 164.5 | 95.0 | 240 | 207.8 | 120.0 | 290 | 251.1 | 145.0 |
| 1 | 35.5 | 20.5 | 1 | 78.8 | 45.5 | 1 | 122.1 | 70.5 | 1 | 165.4 | 95.5 | 1 | 208.7 | 120.5 | 1 | 252.0 | 145.5 |
| 2 | 36.4 | 21.0 | 2 | 79.7 | 46.0 | 2 | 123.0 | 71.0 | 2 | 166.3 | 96.0 | 2 | 209.6 | 121.0 | 2 | 252.9 | 146.0 |
| 3 | 37.2 | 21.5 | 3 | 80.5 | 46.5 | 3 | 123.8 | 71.5 | 3 | 167.1 | 96.5 | 3 | 210.4 | 121.5 | 3 | 253.7 | 146.5 |
| 4 | 38.1 | 22.0 | 4 | 81.4 | 47.0 | 4 | 124.7 | 72.0 | 4 | 168.0 | 97.0 | 4 | 211.3 | 122.0 | 4 | 254.6 | 147.0 |
| 5 | 39.0 | 22.5 | 5 | 82.3 | 47.5 | 5 | 125.6 | 72.5 | 5 | 168.9 | 97.5 | 5 | 212.2 | 122.5 | 5 | 255.5 | 147.5 |
| 6 | 39.8 | 23.0 | 6 | 83.1 | 48.0 | 6 | 126.4 | 73.0 | 6 | 169.7 | 98.0 | 6 | 213.0 | 123.0 | 6 | 256.3 | 148.0 |
| 7 | 40.7 | 23.5 | 7 | 84.0 | 48.5 | 7 | 127.3 | 73.5 | 7 | 170.6 | 98.5 | 7 | 213.9 | 123.5 | 7 | 257.2 | 148.5 |
| 8 | 41.6 | 24.0 | 8 | 84.9 | 49.0 | 8 | 128.2 | 74.0 | 8 | 171.5 | 99.0 | 8 | 214.8 | 124.0 | 8 | 258.1 | 149.0 |
| 9 | 42.4 | 24.5 | 9 | 85.7 | 49.5 | 9 | 129.0 | 74.5 | 9 | 172.3 | 99.5 | 9 | 215.6 | 124.5 | 9 | 258.9 | 149.5 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 300 315
269 240 225

R

089 060° 045
091 120 135

R ou φm

R

TABELA 1

R ou φm

359 330° 315
181 210 225

TÁBUAS DE CARTEAÇÃO

001 030 045
179 150 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 259.8 | 150.0 | 350 | 303.1 | 175.0 | 400 | 346.4 | 200.0 | 450 | 389.7 | 225.0 | 500 | 433.0 | 250.0 | 550 | 476.3 | 275.0 |
| 1 | 260.7 | 150.5 | 1 | 304.0 | 175.5 | 1 | 347.3 | 200.5 | 1 | 390.6 | 225.5 | 1 | 433.9 | 250.5 | 1 | 477.2 | 275.5 |
| 2 | 261.5 | 151.0 | 2 | 304.8 | 176.0 | 2 | 348.1 | 201.0 | 2 | 391.4 | 226.0 | 2 | 434.7 | 251.0 | 2 | 478.0 | 276.0 |
| 3 | 262.4 | 151.5 | 3 | 305.7 | 176.5 | 3 | 349.0 | 201.5 | 3 | 392.3 | 226.5 | 3 | 435.6 | 251.5 | 3 | 478.9 | 276.5 |
| 4 | 263.3 | 152.0 | 4 | 306.6 | 177.0 | 4 | 349.9 | 202.0 | 4 | 393.2 | 227.0 | 4 | 436.5 | 252.0 | 4 | 479.8 | 277.0 |
| 5 | 264.1 | 152.5 | 5 | 307.4 | 177.5 | 5 | 350.7 | 202.5 | 5 | 394.0 | 227.5 | 5 | 437.3 | 252.5 | 5 | 480.6 | 277.5 |
| 6 | 265.0 | 153.0 | 6 | 308.3 | 178.0 | 6 | 351.6 | 203.0 | 6 | 394.9 | 228.0 | 6 | 438.2 | 253.0 | 6 | 481.5 | 278.0 |
| 7 | 265.9 | 153.5 | 7 | 309.2 | 178.5 | 7 | 352.5 | 203.5 | 7 | 395.8 | 228.5 | 7 | 439.1 | 253.5 | 7 | 482.4 | 278.5 |
| 8 | 266.7 | 154.0 | 8 | 310.0 | 179.0 | 8 | 353.3 | 204.0 | 8 | 396.6 | 229.0 | 8 | 439.9 | 254.0 | 8 | 483.2 | 279.0 |
| 9 | 267.6 | 154.5 | 9 | 310.9 | 179.5 | 9 | 354.2 | 204.5 | 9 | 397.5 | 229.5 | 9 | 440.8 | 254.5 | 9 | 484.1 | 279.5 |
| 310 | 268.5 | 155.0 | 360 | 311.8 | 180.0 | 410 | 355.1 | 205.0 | 460 | 398.4 | 230.0 | 510 | 441.7 | 255.0 | 560 | 485.0 | 280.0 |
| 1 | 269.3 | 155.5 | 1 | 312.6 | 180.5 | 1 | 355.9 | 205.5 | 1 | 399.2 | 230.5 | 1 | 442.5 | 255.5 | 1 | 485.8 | 280.5 |
| 2 | 270.2 | 156.0 | 2 | 313.5 | 181.0 | 2 | 356.8 | 206.0 | 2 | 400.1 | 231.0 | 2 | 443.4 | 256.0 | 2 | 486.7 | 281.0 |
| 3 | 271.1 | 156.5 | 3 | 314.4 | 181.5 | 3 | 357.7 | 206.5 | 3 | 401.0 | 231.5 | 3 | 444.3 | 256.5 | 3 | 487.6 | 281.5 |
| 4 | 271.9 | 157.0 | 4 | 315.2 | 182.0 | 4 | 358.5 | 207.0 | 4 | 401.8 | 232.0 | 4 | 445.1 | 257.0 | 4 | 488.4 | 282.0 |
| 5 | 272.8 | 157.5 | 5 | 316.1 | 182.5 | 5 | 359.4 | 207.5 | 5 | 402.7 | 232.5 | 5 | 446.0 | 257.5 | 5 | 489.3 | 282.5 |
| 6 | 273.7 | 158.0 | 6 | 317.0 | 183.0 | 6 | 360.3 | 208.0 | 6 | 403.6 | 233.0 | 6 | 446.9 | 258.0 | 6 | 490.2 | 283.0 |
| 7 | 274.5 | 158.5 | 7 | 317.8 | 183.5 | 7 | 361.1 | 208.5 | 7 | 404.4 | 233.5 | 7 | 447.7 | 258.5 | 7 | 491.0 | 283.5 |
| 8 | 275.4 | 159.0 | 8 | 318.7 | 184.0 | 8 | 362.0 | 209.0 | 8 | 405.3 | 234.0 | 8 | 448.6 | 259.0 | 8 | 491.9 | 284.0 |
| 9 | 276.3 | 159.5 | 9 | 319.6 | 184.5 | 9 | 362.9 | 209.5 | 9 | 406.2 | 234.5 | 9 | 449.5 | 259.5 | 9 | 492.8 | 284.5 |
| 320 | 277.1 | 160.0 | 370 | 320.4 | 185.0 | 420 | 363.7 | 210.0 | 470 | 407.0 | 235.0 | 520 | 450.3 | 260.0 | 570 | 493.6 | 285.0 |
| 1 | 278.0 | 160.5 | 1 | 321.3 | 185.5 | 1 | 364.6 | 210.5 | 1 | 407.9 | 235.5 | 1 | 451.2 | 260.5 | 1 | 494.5 | 285.5 |
| 2 | 278.9 | 161.0 | 2 | 322.2 | 186.0 | 2 | 365.5 | 211.0 | 2 | 408.8 | 236.0 | 2 | 452.1 | 261.0 | 2 | 495.4 | 286.0 |
| 3 | 279.7 | 161.5 | 3 | 323.0 | 186.5 | 3 | 366.3 | 211.5 | 3 | 409.6 | 236.5 | 3 | 452.9 | 261.5 | 3 | 496.2 | 286.5 |
| 4 | 280.6 | 162.0 | 4 | 323.9 | 187.0 | 4 | 367.2 | 212.0 | 4 | 410.5 | 237.0 | 4 | 453.8 | 262.0 | 4 | 497.1 | 287.0 |
| 5 | 281.5 | 162.5 | 5 | 324.8 | 187.5 | 5 | 368.1 | 212.5 | 5 | 411.4 | 237.5 | 5 | 454.7 | 262.5 | 5 | 498.0 | 287.5 |
| 6 | 282.3 | 163.0 | 6 | 325.6 | 188.0 | 6 | 368.9 | 213.0 | 6 | 412.2 | 238.0 | 6 | 455.5 | 263.0 | 6 | 498.8 | 288.0 |
| 7 | 283.2 | 163.5 | 7 | 326.5 | 188.5 | 7 | 369.8 | 213.5 | 7 | 413.1 | 238.5 | 7 | 456.4 | 263.5 | 7 | 499.7 | 288.5 |
| 8 | 284.1 | 164.0 | 8 | 327.4 | 189.0 | 8 | 370.7 | 214.0 | 8 | 414.0 | 239.0 | 8 | 457.3 | 264.0 | 8 | 500.6 | 289.0 |
| 9 | 284.9 | 164.5 | 9 | 328.2 | 189.5 | 9 | 371.5 | 214.5 | 9 | 414.8 | 239.5 | 9 | 458.1 | 264.5 | 9 | 501.4 | 289.5 |
| 330 | 285.8 | 165.0 | 380 | 329.1 | 190.0 | 430 | 372.4 | 215.0 | 480 | 415.7 | 240.0 | 530 | 459.0 | 265.0 | 580 | 502.3 | 290.0 |
| 1 | 286.7 | 165.5 | 1 | 330.0 | 190.5 | 1 | 373.3 | 215.5 | 1 | 416.6 | 240.5 | 1 | 459.9 | 265.5 | 1 | 503.2 | 290.5 |
| 2 | 287.5 | 166.0 | 2 | 330.8 | 191.0 | 2 | 374.1 | 216.0 | 2 | 417.4 | 241.0 | 2 | 460.7 | 266.0 | 2 | 504.0 | 291.0 |
| 3 | 288.4 | 166.5 | 3 | 331.7 | 191.5 | 3 | 375.0 | 216.5 | 3 | 418.3 | 241.5 | 3 | 461.6 | 266.5 | 3 | 504.9 | 291.5 |
| 4 | 289.3 | 167.0 | 4 | 332.6 | 192.0 | 4 | 375.9 | 217.0 | 4 | 419.2 | 242.0 | 4 | 462.5 | 267.0 | 4 | 505.8 | 292.0 |
| 5 | 290.1 | 167.5 | 5 | 333.4 | 192.5 | 5 | 376.7 | 217.5 | 5 | 420.0 | 242.5 | 5 | 463.3 | 267.5 | 5 | 506.6 | 292.5 |
| 6 | 291.0 | 168.0 | 6 | 334.3 | 193.0 | 6 | 377.6 | 218.0 | 6 | 420.9 | 243.0 | 6 | 464.2 | 268.0 | 6 | 507.5 | 293.0 |
| 7 | 291.9 | 168.5 | 7 | 335.2 | 193.5 | 7 | 378.5 | 218.5 | 7 | 421.8 | 243.5 | 7 | 465.1 | 268.5 | 7 | 508.4 | 293.5 |
| 8 | 292.7 | 169.0 | 8 | 336.0 | 194.0 | 8 | 379.3 | 219.0 | 8 | 422.6 | 244.0 | 8 | 465.9 | 269.0 | 8 | 509.2 | 294.0 |
| 9 | 293.6 | 169.5 | 9 | 336.9 | 194.5 | 9 | 380.2 | 219.5 | 9 | 423.5 | 244.5 | 9 | 466.8 | 269.5 | 9 | 510.1 | 294.5 |
| 340 | 294.4 | 170.0 | 390 | 337.7 | 195.0 | 440 | 381.1 | 220.0 | 490 | 424.4 | 245.0 | 540 | 467.7 | 270.0 | 590 | 511.0 | 295.0 |
| 1 | 295.3 | 170.5 | 1 | 338.6 | 195.5 | 1 | 381.9 | 220.5 | 1 | 425.2 | 245.5 | 1 | 468.5 | 270.5 | 1 | 511.8 | 295.5 |
| 2 | 296.2 | 171.0 | 2 | 339.5 | 196.0 | 2 | 382.8 | 221.0 | 2 | 426.1 | 246.0 | 2 | 469.4 | 271.0 | 2 | 512.7 | 296.0 |
| 3 | 297.0 | 171.5 | 3 | 340.3 | 196.5 | 3 | 383.6 | 221.5 | 3 | 427.0 | 246.5 | 3 | 470.3 | 271.5 | 3 | 513.6 | 296.5 |
| 4 | 297.9 | 172.0 | 4 | 341.2 | 197.0 | 4 | 384.5 | 222.0 | 4 | 427.8 | 247.0 | 4 | 471.1 | 272.0 | 4 | 514.4 | 297.0 |
| 5 | 298.8 | 172.5 | 5 | 342.1 | 197.5 | 5 | 385.4 | 222.5 | 5 | 428.7 | 247.5 | 5 | 472.0 | 272.5 | 5 | 515.3 | 297.5 |
| 6 | 299.6 | 173.0 | 6 | 342.9 | 198.0 | 6 | 386.2 | 223.0 | 6 | 429.5 | 248.0 | 6 | 472.8 | 273.0 | 6 | 516.2 | 298.0 |
| 7 | 300.5 | 173.5 | 7 | 343.8 | 198.5 | 7 | 387.1 | 223.5 | 7 | 430.4 | 248.5 | 7 | 473.7 | 273.5 | 7 | 517.0 | 298.5 |
| 8 | 301.4 | 174.0 | 8 | 344.7 | 199.0 | 8 | 388.0 | 224.0 | 8 | 431.3 | 249.0 | 8 | 474.6 | 274.0 | 8 | 517.9 | 299.0 |
| 9 | 302.2 | 174.5 | 9 | 345.5 | 199.5 | 9 | 388.8 | 224.5 | 9 | 432.1 | 249.5 | 9 | 475.4 | 274.5 | 9 | 518.7 | 299.5 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 300 315
269 240 225

R

089 060° 045
091 120 135

R ou φm

R

TABELA 1

R ou φm

359 329° 315
181 211 225

TÁBUAS DE CARTEAÇÃO

001 031 045
179 149 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 42.9 | 25.8 | 100 | 85.7 | 51.5 | 150 | 128.6 | 77.3 | 200 | 171.4 | 103.0 | 250 | 214.3 | 128.8 |
| 1 | 0.9 | 0.5 | 1 | 43.7 | 26.3 | 1 | 86.6 | 52.0 | 1 | 129.4 | 77.8 | 1 | 172.3 | 103.5 | 1 | 215.1 | 129.3 |
| 2 | 1.7 | 1.0 | 2 | 44.6 | 26.8 | 2 | 87.4 | 52.5 | 2 | 130.3 | 78.3 | 2 | 173.1 | 104.0 | 2 | 216.0 | 129.8 |
| 3 | 2.6 | 1.5 | 3 | 45.4 | 27.3 | 3 | 88.3 | 53.0 | 3 | 131.1 | 78.8 | 3 | 174.0 | 104.6 | 3 | 216.9 | 130.3 |
| 4 | 3.4 | 2.1 | 4 | 46.3 | 27.8 | 4 | 89.1 | 53.6 | 4 | 132.0 | 79.3 | 4 | 174.9 | 105.1 | 4 | 217.7 | 130.8 |
| 5 | 4.3 | 2.6 | 5 | 47.1 | 28.3 | 5 | 90.0 | 54.1 | 5 | 132.9 | 79.8 | 5 | 175.7 | 105.6 | 5 | 218.6 | 131.3 |
| 6 | 5.1 | 3.1 | 6 | 48.0 | 28.8 | 6 | 90.9 | 54.6 | 6 | 133.7 | 80.3 | 6 | 176.6 | 106.1 | 6 | 219.4 | 131.8 |
| 7 | 6.0 | 3.6 | 7 | 48.9 | 29.4 | 7 | 91.7 | 55.1 | 7 | 134.6 | 80.9 | 7 | 177.4 | 106.6 | 7 | 220.3 | 132.4 |
| 8 | 6.9 | 4.1 | 8 | 49.7 | 29.9 | 8 | 92.6 | 55.6 | 8 | 135.4 | 81.4 | 8 | 178.3 | 107.1 | 8 | 221.1 | 132.9 |
| 9 | 7.7 | 4.6 | 9 | 50.6 | 30.4 | 9 | 93.4 | 56.1 | 9 | 136.3 | 81.9 | 9 | 179.1 | 107.6 | 9 | 222.0 | 133.4 |
| 10 | 8.6 | 5.2 | 60 | 51.4 | 30.9 | 110 | 94.3 | 56.7 | 160 | 137.1 | 82.4 | 210 | 180.0 | 108.2 | 260 | 222.9 | 133.9 |
| 1 | 9.4 | 5.7 | 1 | 52.3 | 31.4 | 1 | 95.1 | 57.2 | 1 | 138.0 | 82.9 | 1 | 180.9 | 108.7 | 1 | 223.7 | 134.4 |
| 2 | 10.3 | 6.2 | 2 | 53.1 | 31.9 | 2 | 96.0 | 57.7 | 2 | 138.9 | 83.4 | 2 | 181.7 | 109.2 | 2 | 224.6 | 134.9 |
| 3 | 11.1 | 6.7 | 3 | 54.0 | 32.4 | 3 | 96.9 | 58.2 | 3 | 139.7 | 84.0 | 3 | 182.6 | 109.7 | 3 | 225.4 | 135.5 |
| 4 | 12.0 | 7.2 | 4 | 54.9 | 33.0 | 4 | 97.7 | 58.7 | 4 | 140.6 | 84.5 | 4 | 183.4 | 110.2 | 4 | 226.3 | 136.0 |
| 5 | 12.9 | 7.7 | 5 | 55.7 | 33.5 | 5 | 98.6 | 59.2 | 5 | 141.4 | 85.0 | 5 | 184.3 | 110.7 | 5 | 227.1 | 136.5 |
| 6 | 13.7 | 8.2 | 6 | 56.6 | 34.0 | 6 | 99.4 | 59.7 | 6 | 142.3 | 85.5 | 6 | 185.1 | 111.2 | 6 | 228.0 | 137.0 |
| 7 | 14.6 | 8.8 | 7 | 57.4 | 34.5 | 7 | 100.3 | 60.3 | 7 | 143.1 | 86.0 | 7 | 186.0 | 111.8 | 7 | 228.9 | 137.5 |
| 8 | 15.4 | 9.3 | 8 | 58.3 | 35.0 | 8 | 101.1 | 60.8 | 8 | 144.0 | 86.5 | 8 | 186.9 | 112.3 | 8 | 229.7 | 138.0 |
| 9 | 16.3 | 9.8 | 9 | 59.1 | 35.5 | 9 | 102.0 | 61.3 | 9 | 144.9 | 87.0 | 9 | 187.7 | 112.8 | 9 | 230.6 | 138.5 |
| 20 | 17.1 | 10.3 | 70 | 60.0 | 36.1 | 120 | 102.9 | 61.8 | 170 | 145.7 | 87.6 | 220 | 188.6 | 113.3 | 270 | 231.4 | 139.1 |
| 1 | 18.0 | 10.8 | 1 | 60.9 | 36.6 | 1 | 103.7 | 62.3 | 1 | 146.6 | 88.1 | 1 | 189.4 | 113.8 | 1 | 232.3 | 139.6 |
| 2 | 18.9 | 11.3 | 2 | 61.7 | 37.1 | 2 | 104.6 | 62.8 | 2 | 147.4 | 88.6 | 2 | 190.3 | 114.3 | 2 | 233.1 | 140.1 |
| 3 | 19.7 | 11.8 | 3 | 62.6 | 37.6 | 3 | 105.4 | 63.3 | 3 | 148.3 | 89.1 | 3 | 191.1 | 114.9 | 3 | 234.0 | 140.6 |
| 4 | 20.6 | 12.4 | 4 | 63.4 | 38.1 | 4 | 106.3 | 63.9 | 4 | 149.1 | 89.6 | 4 | 192.0 | 115.4 | 4 | 234.9 | 141.1 |
| 5 | 21.4 | 12.9 | 5 | 64.3 | 38.6 | 5 | 107.1 | 64.4 | 5 | 150.0 | 90.1 | 5 | 192.9 | 115.9 | 5 | 235.7 | 141.6 |
| 6 | 22.3 | 13.4 | 6 | 65.1 | 39.1 | 6 | 108.0 | 64.9 | 6 | 150.9 | 90.6 | 6 | 193.7 | 116.4 | 6 | 236.6 | 142.2 |
| 7 | 23.1 | 13.9 | 7 | 66.0 | 39.7 | 7 | 108.9 | 65.4 | 7 | 151.7 | 91.2 | 7 | 194.6 | 116.9 | 7 | 237.4 | 142.7 |
| 8 | 24.0 | 14.4 | 8 | 66.9 | 40.2 | 8 | 109.7 | 65.9 | 8 | 152.6 | 91.7 | 8 | 195.4 | 117.4 | 8 | 238.3 | 143.2 |
| 9 | 24.9 | 14.9 | 9 | 67.7 | 40.7 | 9 | 110.6 | 66.4 | 9 | 153.4 | 92.2 | 9 | 196.3 | 117.9 | 9 | 239.1 | 143.7 |
| 30 | 25.7 | 15.5 | 80 | 68.6 | 41.2 | 130 | 111.4 | 67.0 | 180 | 154.3 | 92.7 | 230 | 197.1 | 118.5 | 280 | 240.0 | 144.2 |
| 1 | 26.6 | 16.0 | 1 | 69.4 | 41.7 | 1 | 112.3 | 67.5 | 1 | 155.1 | 93.2 | 1 | 198.0 | 119.0 | 1 | 240.9 | 144.7 |
| 2 | 27.4 | 16.5 | 2 | 70.3 | 42.2 | 2 | 113.1 | 68.0 | 2 | 156.0 | 93.7 | 2 | 198.9 | 119.5 | 2 | 241.7 | 145.2 |
| 3 | 28.3 | 17.0 | 3 | 71.1 | 42.7 | 3 | 114.0 | 68.5 | 3 | 156.9 | 94.3 | 3 | 199.7 | 120.0 | 3 | 242.6 | 145.8 |
| 4 | 29.1 | 17.5 | 4 | 72.0 | 43.3 | 4 | 114.9 | 69.0 | 4 | 157.7 | 94.8 | 4 | 200.6 | 120.5 | 4 | 243.4 | 146.3 |
| 5 | 30.0 | 18.0 | 5 | 72.9 | 43.8 | 5 | 115.7 | 69.5 | 5 | 158.6 | 95.3 | 5 | 201.4 | 121.0 | 5 | 244.3 | 146.8 |
| 6 | 30.9 | 18.5 | 6 | 73.7 | 44.3 | 6 | 116.6 | 70.0 | 6 | 159.4 | 95.8 | 6 | 202.3 | 121.5 | 6 | 245.1 | 147.3 |
| 7 | 31.7 | 19.1 | 7 | 74.6 | 44.8 | 7 | 117.4 | 70.6 | 7 | 160.3 | 96.3 | 7 | 203.1 | 122.1 | 7 | 246.0 | 147.8 |
| 8 | 32.6 | 19.6 | 8 | 75.4 | 45.3 | 8 | 118.3 | 71.1 | 8 | 161.1 | 96.8 | 8 | 204.0 | 122.6 | 8 | 246.9 | 148.3 |
| 9 | 33.4 | 20.1 | 9 | 76.3 | 45.8 | 9 | 119.1 | 71.6 | 9 | 162.0 | 97.3 | 9 | 204.9 | 123.1 | 9 | 247.7 | 148.8 |
| 40 | 34.3 | 20.6 | 90 | 77.1 | 46.4 | 140 | 120.0 | 72.1 | 190 | 162.9 | 97.9 | 240 | 205.7 | 123.6 | 290 | 248.6 | 149.4 |
| 1 | 35.1 | 21.1 | 1 | 78.0 | 46.9 | 1 | 120.9 | 72.6 | 1 | 163.7 | 98.4 | 1 | 206.6 | 124.1 | 1 | 249.4 | 149.9 |
| 2 | 36.0 | 21.6 | 2 | 78.9 | 47.4 | 2 | 121.7 | 73.1 | 2 | 164.6 | 98.9 | 2 | 207.4 | 124.6 | 2 | 250.3 | 150.4 |
| 3 | 36.9 | 22.1 | 3 | 79.7 | 47.9 | 3 | 122.6 | 73.7 | 3 | 165.4 | 99.4 | 3 | 208.3 | 125.2 | 3 | 251.2 | 150.9 |
| 4 | 37.7 | 22.7 | 4 | 80.6 | 48.4 | 4 | 123.4 | 74.2 | 4 | 166.3 | 99.9 | 4 | 209.1 | 125.7 | 4 | 252.0 | 151.4 |
| 5 | 38.6 | 23.2 | 5 | 81.4 | 48.9 | 5 | 124.3 | 74.7 | 5 | 167.1 | 100.4 | 5 | 210.0 | 126.2 | 5 | 252.9 | 151.9 |
| 6 | 39.4 | 23.7 | 6 | 82.3 | 49.4 | 6 | 125.1 | 75.2 | 6 | 168.0 | 100.9 | 6 | 210.9 | 126.7 | 6 | 253.7 | 152.5 |
| 7 | 40.3 | 24.2 | 7 | 83.1 | 50.0 | 7 | 126.0 | 75.7 | 7 | 168.9 | 101.5 | 7 | 211.7 | 127.2 | 7 | 254.6 | 153.0 |
| 8 | 41.1 | 24.7 | 8 | 84.0 | 50.5 | 8 | 126.9 | 76.2 | 8 | 169.7 | 102.0 | 8 | 212.6 | 127.7 | 8 | 255.4 | 153.5 |
| 9 | 42.0 | 25.2 | 9 | 84.9 | 51.0 | 9 | 127.7 | 76.7 | 9 | 170.6 | 102.5 | 9 | 213.4 | 128.2 | 9 | 256.3 | 154.0 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 301 315
269 239 225

R

089 059° 045
091 121 135

R ou φm

R

TABELA 1

R ou φ m

359 329° 315
181 211 225

TÁBUAS DE CARTEAÇÃO

001 031 045
129 149 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|
| D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap |
| 300 | 257.2 | 154.5 | 350 | 300.0 | 180.3 | 400 | 342.9 | 206.0 | 450 | 385.7 | 231.8 | 500 | 428.6 | 257.5 | 550 | 471.4 | 283.3 |
| 1 | 258.0 | 155.0 | 1 | 300.9 | 180.8 | 1 | 343.7 | 206.5 | 1 | 386.6 | 232.3 | 1 | 429.4 | 258.0 | 1 | 472.3 | 283.8 |
| 2 | 258.9 | 155.5 | 2 | 301.7 | 181.3 | 2 | 344.6 | 207.0 | 2 | 387.4 | 232.8 | 2 | 430.3 | 258.5 | 2 | 473.2 | 284.3 |
| 3 | 259.7 | 156.1 | 3 | 302.6 | 181.8 | 3 | 345.4 | 207.6 | 3 | 388.3 | 233.3 | 3 | 431.2 | 259.1 | 3 | 474.0 | 284.8 |
| 4 | 260.6 | 156.6 | 4 | 303.4 | 182.3 | 4 | 346.3 | 208.1 | 4 | 389.2 | 233.8 | 4 | 432.0 | 259.6 | 4 | 474.9 | 285.3 |
| 5 | 261.4 | 157.1 | 5 | 304.3 | 182.8 | 5 | 347.2 | 208.6 | 5 | 390.0 | 234.3 | 5 | 432.9 | 260.1 | 5 | 475.7 | 285.8 |
| 6 | 262.3 | 157.6 | 6 | 305.2 | 183.4 | 6 | 348.0 | 209.1 | 6 | 390.9 | 234.9 | 6 | 433.7 | 260.6 | 6 | 476.6 | 286.4 |
| 7 | 263.2 | 158.1 | 7 | 306.0 | 183.9 | 7 | 348.9 | 209.6 | 7 | 391.7 | 235.4 | 7 | 434.6 | 261.1 | 7 | 477.4 | 286.9 |
| 8 | 264.0 | 158.6 | 8 | 306.9 | 184.4 | 8 | 349.7 | 210.1 | 8 | 392.6 | 235.9 | 8 | 435.4 | 261.6 | 8 | 478.3 | 287.4 |
| 9 | 264.9 | 159.1 | 9 | 307.7 | 184.9 | 9 | 350.6 | 210.7 | 9 | 393.4 | 236.4 | 9 | 436.3 | 262.2 | 9 | 479.2 | 287.9 |
| 310 | 265.7 | 159.7 | 360 | 308.6 | 185.4 | 410 | 351.4 | 211.2 | 460 | 394.3 | 236.9 | 510 | 437.2 | 262.7 | 560 | 480.0 | 288.4 |
| 1 | 266.6 | 160.2 | 1 | 309.4 | 185.9 | 1 | 352.3 | 211.7 | 1 | 395.2 | 237.4 | 1 | 438.0 | 263.2 | 1 | 480.9 | 288.9 |
| 2 | 267.4 | 160.7 | 2 | 310.3 | 186.4 | 2 | 353.2 | 212.2 | 2 | 396.0 | 237.9 | 2 | 438.9 | 263.7 | 2 | 481.7 | 289.5 |
| 3 | 268.3 | 161.2 | 3 | 311.2 | 187.0 | 3 | 354.0 | 212.7 | 3 | 396.9 | 238.5 | 3 | 439.7 | 264.2 | 3 | 482.6 | 290.0 |
| 4 | 269.2 | 161.7 | 4 | 312.0 | 187.5 | 4 | 354.9 | 213.2 | 4 | 397.7 | 239.0 | 4 | 440.6 | 264.7 | 4 | 483.4 | 290.5 |
| 5 | 270.0 | 162.2 | 5 | 312.9 | 188.0 | 5 | 355.7 | 213.7 | 5 | 398.6 | 239.5 | 5 | 441.4 | 265.2 | 5 | 484.3 | 291.0 |
| 6 | 270.9 | 162.8 | 6 | 313.7 | 188.5 | 6 | 356.6 | 214.3 | 6 | 399.4 | 240.0 | 6 | 442.3 | 265.8 | 6 | 485.2 | 291.5 |
| 7 | 271.7 | 163.3 | 7 | 314.6 | 189.0 | 7 | 357.4 | 214.8 | 7 | 400.3 | 240.5 | 7 | 443.2 | 266.3 | 7 | 486.0 | 292.0 |
| 8 | 272.6 | 163.8 | 8 | 315.4 | 189.5 | 8 | 358.3 | 215.3 | 8 | 401.2 | 241.0 | 8 | 444.0 | 266.8 | 8 | 486.9 | 292.5 |
| 9 | 273.4 | 164.3 | 9 | 316.3 | 190.0 | 9 | 359.2 | 215.8 | 9 | 402.0 | 241.6 | 9 | 444.9 | 267.3 | 9 | 487.7 | 293.1 |
| 320 | 274.3 | 164.8 | 370 | 317.2 | 190.6 | 420 | 360.0 | 216.3 | 470 | 402.9 | 242.1 | 520 | 445.7 | 267.8 | 570 | 488.6 | 293.6 |
| 1 | 275.2 | 165.3 | 1 | 318.0 | 191.1 | 1 | 360.9 | 216.8 | 1 | 403.7 | 242.6 | 1 | 446.6 | 268.3 | 1 | 489.4 | 294.1 |
| 2 | 276.0 | 165.8 | 2 | 318.9 | 191.6 | 2 | 361.7 | 217.3 | 2 | 404.6 | 243.1 | 2 | 447.4 | 268.8 | 2 | 490.3 | 294.6 |
| 3 | 276.9 | 166.4 | 3 | 319.7 | 192.1 | 3 | 362.6 | 217.9 | 3 | 405.4 | 243.6 | 3 | 448.3 | 269.4 | 3 | 491.2 | 295.1 |
| 4 | 277.7 | 166.9 | 4 | 320.6 | 192.6 | 4 | 363.4 | 218.4 | 4 | 406.3 | 244.1 | 4 | 449.2 | 269.9 | 4 | 492.0 | 295.6 |
| 5 | 278.6 | 167.4 | 5 | 321.4 | 193.1 | 5 | 364.3 | 218.9 | 5 | 407.2 | 244.6 | 5 | 450.0 | 270.4 | 5 | 492.9 | 296.1 |
| 6 | 279.4 | 167.9 | 6 | 322.3 | 193.7 | 6 | 365.2 | 219.4 | 6 | 408.0 | 245.2 | 6 | 450.9 | 270.9 | 6 | 493.7 | 296.7 |
| 7 | 280.3 | 168.4 | 7 | 323.2 | 194.2 | 7 | 366.0 | 219.9 | 7 | 408.9 | 245.7 | 7 | 451.7 | 271.4 | 7 | 494.6 | 297.2 |
| 8 | 281.2 | 168.9 | 8 | 324.0 | 194.7 | 8 | 366.9 | 220.4 | 8 | 409.7 | 246.2 | 8 | 452.6 | 271.9 | 8 | 495.4 | 297.7 |
| 9 | 282.0 | 169.4 | 9 | 324.9 | 195.2 | 9 | 367.7 | 221.0 | 9 | 410.6 | 246.7 | 9 | 453.4 | 272.5 | 9 | 496.3 | 298.2 |
| 330 | 282.9 | 170.0 | 380 | 325.7 | 195.7 | 430 | 368.6 | 221.5 | 480 | 411.4 | 247.2 | 530 | 454.3 | 273.0 | 580 | 497.2 | 298.7 |
| 1 | 283.7 | 170.5 | 1 | 326.6 | 196.2 | 1 | 369.4 | 222.0 | 1 | 412.3 | 247.7 | 1 | 455.2 | 273.5 | 1 | 498.0 | 299.2 |
| 2 | 284.6 | 171.0 | 2 | 327.4 | 196.7 | 2 | 370.3 | 222.5 | 2 | 413.2 | 248.2 | 2 | 456.0 | 274.0 | 2 | 498.9 | 299.8 |
| 3 | 285.4 | 171.5 | 3 | 328.3 | 197.3 | 3 | 371.2 | 223.0 | 3 | 414.0 | 248.8 | 3 | 456.9 | 274.5 | 3 | 499.7 | 300.3 |
| 4 | 286.3 | 172.0 | 4 | 329.2 | 197.8 | 4 | 372.0 | 223.5 | 4 | 414.9 | 249.3 | 4 | 457.7 | 275.0 | 4 | 500.6 | 300.8 |
| 5 | 287.2 | 172.5 | 5 | 330.0 | 198.3 | 5 | 372.9 | 224.0 | 5 | 415.7 | 249.8 | 5 | 458.6 | 275.5 | 5 | 501.4 | 301.3 |
| 6 | 288.0 | 173.1 | 6 | 330.9 | 198.8 | 6 | 373.7 | 224.6 | 6 | 416.6 | 250.3 | 6 | 459.4 | 276.1 | 6 | 502.3 | 301.8 |
| 7 | 288.9 | 173.6 | 7 | 331.7 | 199.3 | 7 | 374.6 | 225.1 | 7 | 417.4 | 250.8 | 7 | 460.3 | 276.6 | 7 | 503.2 | 302.3 |
| 8 | 289.7 | 174.1 | 8 | 332.6 | 199.8 | 8 | 375.4 | 225.6 | 8 | 418.3 | 251.3 | 8 | 461.2 | 277.1 | 8 | 504.0 | 302.8 |
| 9 | 290.6 | 174.6 | 9 | 333.4 | 200.3 | 9 | 376.3 | 226.1 | 9 | 419.2 | 251.9 | 9 | 462.0 | 277.6 | 9 | 504.9 | 303.4 |
| 340 | 291.4 | 175.1 | 390 | 334.3 | 200.9 | 440 | 377.2 | 226.6 | 490 | 420.0 | 252.4 | 540 | 462.9 | 278.1 | 590 | 505.7 | 303.9 |
| 1 | 292.3 | 175.6 | 1 | 335.2 | 201.4 | 1 | 378.0 | 227.1 | 1 | 420.9 | 252.9 | 1 | 463.7 | 278.6 | 1 | 506.6 | 304.4 |
| 2 | 293.2 | 176.1 | 2 | 336.0 | 201.9 | 2 | 378.9 | 227.6 | 2 | 421.7 | 253.4 | 2 | 464.6 | 279.2 | 2 | 507.4 | 304.9 |
| 3 | 294.0 | 176.7 | 3 | 336.9 | 202.4 | 3 | 379.7 | 228.2 | 3 | 422.6 | 253.9 | 3 | 465.4 | 279.7 | 3 | 508.3 | 305.4 |
| 4 | 294.9 | 177.2 | 4 | 337.7 | 202.9 | 4 | 380.6 | 228.7 | 4 | 423.4 | 254.4 | 4 | 466.3 | 280.2 | 4 | 509.2 | 305.9 |
| 5 | 295.7 | 177.7 | 5 | 338.6 | 203.4 | 5 | 381.4 | 229.2 | 5 | 424.3 | 254.9 | 5 | 467.2 | 280.7 | 5 | 510.0 | 306.4 |
| 6 | 296.6 | 178.2 | 6 | 339.4 | 204.0 | 6 | 382.3 | 229.7 | 6 | 425.2 | 255.5 | 6 | 468.0 | 281.2 | 6 | 510.9 | 307.0 |
| 7 | 297.4 | 178.7 | 7 | 340.3 | 204.5 | 7 | 383.2 | 230.2 | 7 | 426.0 | 256.0 | 7 | 468.9 | 281.7 | 7 | 511.7 | 307.5 |
| 8 | 298.3 | 179.2 | 8 | 341.2 | 205.0 | 8 | 384.0 | 230.7 | 8 | 426.9 | 256.5 | 8 | 469.7 | 282.2 | 8 | 512.6 | 308.0 |
| 9 | 299.2 | 179.7 | 9 | 342.0 | 205.5 | 9 | 384.9 | 231.3 | 9 | 427.7 | 257.0 | 9 | 470.6 | 282.8 | 9 | 513.4 | 308.5 |
| D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 301 315
269 239 225

R

089 059° 045
091 121 135

R ou φ m

R

TABELA 1

R ou φm

359 328° 315
181 212 225

TÁBUAS DE CARTEAÇÃO

001 032 045
179 148 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 42.4 | 26.5 | 100 | 84.8 | 53.0 | 150 | 127.2 | 79.5 | 200 | 169.6 | 106.0 | 250 | 212.0 | 132.5 |
| 1 | 0.8 | 0.5 | 1 | 43.3 | 27.0 | 1 | 85.7 | 53.5 | 1 | 128.1 | 80.0 | 1 | 170.5 | 106.5 | 1 | 212.9 | 133.0 |
| 2 | 1.7 | 1.1 | 2 | 44.1 | 27.6 | 2 | 86.5 | 54.1 | 2 | 128.9 | 80.5 | 2 | 171.3 | 107.0 | 2 | 213.7 | 133.5 |
| 3 | 2.5 | 1.6 | 3 | 44.9 | 28.1 | 3 | 87.3 | 54.6 | 3 | 129.8 | 81.1 | 3 | 172.2 | 107.6 | 3 | 214.6 | 134.1 |
| 4 | 3.4 | 2.1 | 4 | 45.8 | 28.6 | 4 | 88.2 | 55.1 | 4 | 130.6 | 81.6 | 4 | 173.0 | 108.1 | 4 | 215.4 | 134.6 |
| 5 | 4.2 | 2.6 | 5 | 46.6 | 29.1 | 5 | 89.0 | 55.6 | 5 | 131.4 | 82.1 | 5 | 173.8 | 108.6 | 5 | 216.3 | 135.1 |
| 6 | 5.1 | 3.2 | 6 | 47.5 | 29.7 | 6 | 89.9 | 56.2 | 6 | 132.3 | 82.7 | 6 | 174.7 | 109.2 | 6 | 217.1 | 135.7 |
| 7 | 5.9 | 3.7 | 7 | 48.3 | 30.2 | 7 | 90.7 | 56.7 | 7 | 133.1 | 83.2 | 7 | 175.5 | 109.7 | 7 | 217.9 | 136.2 |
| 8 | 6.8 | 4.2 | 8 | 49.2 | 30.7 | 8 | 91.6 | 57.2 | 8 | 134.0 | 83.7 | 8 | 176.4 | 110.2 | 8 | 218.8 | 136.7 |
| 9 | 7.6 | 4.8 | 9 | 50.0 | 31.3 | 9 | 92.4 | 57.8 | 9 | 134.8 | 84.3 | 9 | 177.2 | 110.8 | 9 | 219.6 | 137.2 |
| 10 | 8.5 | 5.3 | 60 | 50.9 | 31.8 | 110 | 93.3 | 58.3 | 160 | 135.7 | 84.8 | 210 | 178.1 | 111.3 | 260 | 220.5 | 137.8 |
| 1 | 9.3 | 5.8 | 1 | 51.7 | 32.3 | 1 | 94.1 | 58.8 | 1 | 136.5 | 85.3 | 1 | 178.9 | 111.8 | 1 | 221.3 | 138.3 |
| 2 | 10.2 | 6.4 | 2 | 52.6 | 32.9 | 2 | 95.0 | 59.4 | 2 | 137.4 | 85.8 | 2 | 179.8 | 112.3 | 2 | 222.2 | 138.8 |
| 3 | 11.0 | 6.9 | 3 | 53.4 | 33.4 | 3 | 95.8 | 59.9 | 3 | 138.2 | 86.4 | 3 | 180.6 | 112.9 | 3 | 223.0 | 139.4 |
| 4 | 11.9 | 7.4 | 4 | 54.3 | 33.9 | 4 | 96.7 | 60.4 | 4 | 139.1 | 86.9 | 4 | 181.5 | 113.4 | 4 | 223.9 | 139.9 |
| 5 | 12.7 | 7.9 | 5 | 55.1 | 34.4 | 5 | 97.5 | 60.9 | 5 | 139.9 | 87.4 | 5 | 182.3 | 113.9 | 5 | 224.7 | 140.4 |
| 6 | 13.6 | 8.5 | 6 | 56.0 | 35.0 | 6 | 98.4 | 61.5 | 6 | 140.8 | 88.0 | 6 | 183.2 | 114.5 | 6 | 225.6 | 141.0 |
| 7 | 14.4 | 9.0 | 7 | 56.8 | 35.5 | 7 | 99.2 | 62.0 | 7 | 141.6 | 88.5 | 7 | 184.0 | 115.0 | 7 | 226.4 | 141.5 |
| 8 | 15.3 | 9.5 | 8 | 57.7 | 36.0 | 8 | 100.1 | 62.5 | 8 | 142.5 | 89.0 | 8 | 184.9 | 115.5 | 8 | 227.3 | 142.0 |
| 9 | 16.1 | 10.1 | 9 | 58.5 | 36.6 | 9 | 100.9 | 63.1 | 9 | 143.3 | 89.6 | 9 | 185.7 | 116.1 | 9 | 228.1 | 142.5 |
| 20 | 17.0 | 10.6 | 70 | 59.4 | 37.1 | 120 | 101.8 | 63.6 | 170 | 144.2 | 90.1 | 220 | 186.6 | 116.6 | 270 | 229.0 | 143.1 |
| 1 | 17.8 | 11.1 | 1 | 60.2 | 37.6 | 1 | 102.6 | 64.1 | 1 | 145.0 | 90.6 | 1 | 187.4 | 117.1 | 1 | 229.8 | 143.6 |
| 2 | 18.7 | 11.7 | 2 | 61.1 | 38.2 | 2 | 103.5 | 64.7 | 2 | 145.9 | 91.1 | 2 | 188.3 | 117.6 | 2 | 230.7 | 144.1 |
| 3 | 19.5 | 12.2 | 3 | 61.9 | 38.7 | 3 | 104.3 | 65.2 | 3 | 146.7 | 91.7 | 3 | 189.1 | 118.2 | 3 | 231.5 | 144.7 |
| 4 | 20.4 | 12.7 | 4 | 62.8 | 39.2 | 4 | 105.2 | 65.7 | 4 | 147.6 | 92.2 | 4 | 190.0 | 118.7 | 4 | 232.4 | 145.2 |
| 5 | 21.2 | 13.2 | 5 | 63.6 | 39.7 | 5 | 106.0 | 66.2 | 5 | 148.4 | 92.7 | 5 | 190.8 | 119.2 | 5 | 233.2 | 145.7 |
| 6 | 22.0 | 13.8 | 6 | 64.5 | 40.3 | 6 | 106.9 | 66.8 | 6 | 149.3 | 93.3 | 6 | 191.7 | 119.8 | 6 | 234.1 | 146.3 |
| 7 | 22.9 | 14.3 | 7 | 65.3 | 40.8 | 7 | 107.7 | 67.3 | 7 | 150.1 | 93.8 | 7 | 192.5 | 120.3 | 7 | 234.9 | 146.8 |
| 8 | 23.7 | 14.8 | 8 | 66.1 | 41.3 | 8 | 108.6 | 67.8 | 8 | 151.0 | 94.3 | 8 | 193.4 | 120.8 | 8 | 235.8 | 147.3 |
| 9 | 24.6 | 15.4 | 9 | 67.0 | 41.9 | 9 | 109.4 | 68.4 | 9 | 151.8 | 94.9 | 9 | 194.2 | 121.4 | 9 | 236.6 | 147.8 |
| 30 | 25.4 | 15.9 | 80 | 67.8 | 42.4 | 130 | 110.2 | 68.9 | 180 | 152.6 | 95.4 | 230 | 195.1 | 121.9 | 280 | 237.5 | 148.4 |
| 1 | 26.3 | 16.4 | 1 | 68.7 | 42.9 | 1 | 111.1 | 69.4 | 1 | 153.5 | 95.9 | 1 | 195.9 | 122.4 | 1 | 238.3 | 148.9 |
| 2 | 27.1 | 17.0 | 2 | 69.5 | 43.5 | 2 | 111.9 | 69.9 | 2 | 154.3 | 96.4 | 2 | 196.7 | 122.9 | 2 | 239.1 | 149.4 |
| 3 | 28.0 | 17.5 | 3 | 70.4 | 44.0 | 3 | 112.8 | 70.5 | 3 | 155.2 | 97.0 | 3 | 197.6 | 123.5 | 3 | 240.0 | 150.0 |
| 4 | 28.8 | 18.0 | 4 | 71.2 | 44.5 | 4 | 113.6 | 71.0 | 4 | 156.0 | 97.5 | 4 | 198.4 | 124.0 | 4 | 240.8 | 150.5 |
| 5 | 29.7 | 18.5 | 5 | 72.1 | 45.0 | 5 | 114.5 | 71.5 | 5 | 156.9 | 98.0 | 5 | 199.3 | 124.5 | 5 | 241.7 | 151.0 |
| 6 | 30.5 | 19.1 | 6 | 72.9 | 45.6 | 6 | 115.3 | 72.1 | 6 | 157.7 | 98.6 | 6 | 200.1 | 125.1 | 6 | 242.5 | 151.6 |
| 7 | 31.4 | 19.6 | 7 | 73.8 | 46.1 | 7 | 116.2 | 72.6 | 7 | 158.6 | 99.1 | 7 | 201.0 | 125.6 | 7 | 243.4 | 152.1 |
| 8 | 32.2 | 20.1 | 8 | 74.6 | 46.6 | 8 | 117.0 | 73.1 | 8 | 159.4 | 99.6 | 8 | 201.8 | 126.1 | 8 | 244.2 | 152.6 |
| 9 | 33.1 | 20.7 | 9 | 75.5 | 47.2 | 9 | 117.9 | 73.7 | 9 | 160.3 | 100.2 | 9 | 202.7 | 126.7 | 9 | 245.1 | 153.1 |
| 40 | 33.9 | 21.2 | 90 | 76.3 | 47.7 | 140 | 118.7 | 74.2 | 190 | 161.1 | 100.7 | 240 | 203.5 | 127.2 | 290 | 245.9 | 153.7 |
| 1 | 34.8 | 21.7 | 1 | 77.2 | 48.2 | 1 | 119.6 | 74.7 | 1 | 162.0 | 101.2 | 1 | 204.4 | 127.7 | 1 | 246.8 | 154.2 |
| 2 | 35.6 | 22.3 | 2 | 78.0 | 48.8 | 2 | 120.4 | 75.2 | 2 | 162.8 | 101.7 | 2 | 205.2 | 128.2 | 2 | 247.6 | 154.7 |
| 3 | 36.5 | 22.8 | 3 | 78.9 | 49.3 | 3 | 121.3 | 75.8 | 3 | 163.7 | 102.3 | 3 | 206.1 | 128.8 | 3 | 248.5 | 155.3 |
| 4 | 37.3 | 23.3 | 4 | 79.7 | 49.8 | 4 | 122.1 | 76.3 | 4 | 164.5 | 102.8 | 4 | 206.9 | 129.3 | 4 | 249.3 | 155.8 |
| 5 | 38.2 | 23.8 | 5 | 80.6 | 50.3 | 5 | 123.0 | 76.8 | 5 | 165.4 | 103.3 | 5 | 207.8 | 129.8 | 5 | 250.2 | 156.3 |
| 6 | 39.0 | 24.4 | 6 | 81.4 | 50.9 | 6 | 123.8 | 77.4 | 6 | 166.2 | 103.9 | 6 | 208.6 | 130.4 | 6 | 251.0 | 156.9 |
| 7 | 39.9 | 24.9 | 7 | 82.3 | 51.4 | 7 | 124.7 | 77.9 | 7 | 167.1 | 104.4 | 7 | 209.5 | 130.9 | 7 | 251.9 | 157.4 |
| 8 | 40.7 | 25.4 | 8 | 83.1 | 51.9 | 8 | 125.5 | 78.4 | 8 | 167.9 | 104.9 | 8 | 210.3 | 131.4 | 8 | 252.7 | 157.9 |
| 9 | 41.6 | 26.0 | 9 | 84.0 | 52.5 | 9 | 126.4 | 79.0 | 9 | 168.8 | 105.5 | 9 | 211.2 | 131.9 | 9 | 253.6 | 158.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 302 315
269 238 225

R

089 058° 045
091 122 135

R ou φm

R

TABELA 1

R ou φm

359 328° 315
181 212 225

TÁBUAS DE CARTEAÇÃO

001 032 045
179 148 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 254.4 | 159.0 | 350 | 296.8 | 185.5 | 400 | 339.2 | 212.0 | 450 | 381.6 | 238.5 | 500 | 424.0 | 265.0 | 550 | 466.4 | 291.5 |
| 1 | 255.3 | 159.5 | 1 | 297.7 | 186.0 | 1 | 340.1 | 212.5 | 1 | 382.5 | 239.0 | 1 | 424.9 | 265.5 | 1 | 467.3 | 292.0 |
| 2 | 256.1 | 160.0 | 2 | 298.5 | 186.5 | 2 | 340.9 | 213.0 | 2 | 383.3 | 239.5 | 2 | 425.7 | 266.0 | 2 | 468.1 | 292.5 |
| 3 | 257.0 | 160.6 | 3 | 299.4 | 187.1 | 3 | 341.8 | 213.6 | 3 | 384.2 | 240.1 | 3 | 426.6 | 266.5 | 3 | 469.0 | 293.0 |
| 4 | 257.8 | 161.1 | 4 | 300.2 | 187.6 | 4 | 342.6 | 214.1 | 4 | 385.0 | 240.6 | 4 | 427.4 | 267.1 | 4 | 469.8 | 293.6 |
| 5 | 258.7 | 161.6 | 5 | 301.1 | 188.1 | 5 | 343.5 | 214.6 | 5 | 385.9 | 241.1 | 5 | 428.3 | 267.6 | 5 | 470.7 | 294.1 |
| 6 | 259.5 | 162.2 | 6 | 301.9 | 188.7 | 6 | 344.3 | 215.1 | 6 | 386.7 | 241.6 | 6 | 429.1 | 268.1 | 6 | 471.5 | 294.6 |
| 7 | 260.4 | 162.7 | 7 | 302.8 | 189.2 | 7 | 345.2 | 215.7 | 7 | 387.6 | 242.2 | 7 | 430.0 | 268.7 | 7 | 472.4 | 295.2 |
| 8 | 261.2 | 163.2 | 8 | 303.6 | 189.7 | 8 | 346.0 | 216.2 | 8 | 388.4 | 242.7 | 8 | 430.8 | 269.2 | 8 | 473.2 | 295.7 |
| 9 | 262.0 | 163.7 | 9 | 304.4 | 190.2 | 9 | 346.9 | 216.7 | 9 | 389.3 | 243.2 | 9 | 431.7 | 269.7 | 9 | 474.1 | 296.2 |
| 310 | 262.9 | 164.3 | 360 | 305.3 | 190.8 | 410 | 347.7 | 217.3 | 460 | 390.1 | 243.8 | 510 | 432.5 | 270.3 | 560 | 474.9 | 296.8 |
| 1 | 263.7 | 164.8 | 1 | 306.1 | 191.3 | 1 | 348.5 | 217.8 | 1 | 390.9 | 244.3 | 1 | 433.4 | 270.8 | 1 | 475.8 | 297.3 |
| 2 | 264.6 | 165.3 | 2 | 307.0 | 191.8 | 2 | 349.4 | 218.3 | 2 | 391.8 | 244.8 | 2 | 434.2 | 271.3 | 2 | 476.6 | 297.8 |
| 3 | 265.4 | 165.9 | 3 | 307.8 | 192.4 | 3 | 350.2 | 218.9 | 3 | 392.6 | 245.4 | 3 | 435.0 | 271.8 | 3 | 477.5 | 298.3 |
| 4 | 266.3 | 166.4 | 4 | 308.7 | 192.9 | 4 | 351.1 | 219.4 | 4 | 393.5 | 245.9 | 4 | 435.9 | 272.4 | 4 | 478.3 | 298.9 |
| 5 | 267.1 | 166.9 | 5 | 309.5 | 193.4 | 5 | 351.9 | 219.9 | 5 | 394.3 | 246.4 | 5 | 436.7 | 272.9 | 5 | 479.1 | 299.4 |
| 6 | 268.0 | 167.5 | 6 | 310.4 | 194.0 | 6 | 352.8 | 220.4 | 6 | 395.2 | 246.9 | 6 | 437.6 | 273.4 | 6 | 480.0 | 299.9 |
| 7 | 268.8 | 168.0 | 7 | 311.2 | 194.5 | 7 | 353.6 | 221.0 | 7 | 396.0 | 247.5 | 7 | 438.4 | 274.0 | 7 | 480.8 | 300.5 |
| 8 | 269.7 | 168.5 | 8 | 312.1 | 195.0 | 8 | 354.5 | 221.5 | 8 | 396.9 | 248.0 | 8 | 439.3 | 274.5 | 8 | 481.7 | 301.0 |
| 9 | 270.5 | 169.0 | 9 | 312.9 | 195.5 | 9 | 355.3 | 222.0 | 9 | 397.7 | 248.5 | 9 | 440.1 | 275.0 | 9 | 482.5 | 301.5 |
| 320 | 271.4 | 169.6 | 370 | 313.8 | 196.1 | 420 | 356.2 | 222.6 | 470 | 398.6 | 249.1 | 520 | 441.0 | 275.6 | 570 | 483.4 | 302.1 |
| 1 | 272.2 | 170.1 | 1 | 314.6 | 196.6 | 1 | 357.0 | 223.1 | 1 | 399.4 | 249.6 | 1 | 441.8 | 276.1 | 1 | 484.2 | 302.6 |
| 2 | 273.1 | 170.6 | 2 | 315.5 | 197.1 | 2 | 357.9 | 223.6 | 2 | 400.3 | 250.1 | 2 | 442.7 | 276.6 | 2 | 485.1 | 303.1 |
| 3 | 273.9 | 171.2 | 3 | 316.3 | 197.7 | 3 | 358.7 | 224.2 | 3 | 401.1 | 250.7 | 3 | 443.5 | 277.1 | 3 | 485.9 | 303.6 |
| 4 | 274.8 | 171.7 | 4 | 317.2 | 198.2 | 4 | 359.6 | 224.7 | 4 | 402.0 | 251.2 | 4 | 444.4 | 277.7 | 4 | 486.8 | 304.2 |
| 5 | 275.6 | 172.2 | 5 | 318.0 | 198.7 | 5 | 360.4 | 225.2 | 5 | 402.8 | 251.7 | 5 | 445.2 | 278.2 | 5 | 487.6 | 304.7 |
| 6 | 276.5 | 172.8 | 6 | 318.9 | 199.2 | 6 | 361.3 | 225.7 | 6 | 403.7 | 252.2 | 6 | 446.1 | 278.7 | 6 | 488.5 | 305.2 |
| 7 | 277.3 | 173.3 | 7 | 319.7 | 199.8 | 7 | 362.1 | 226.3 | 7 | 404.5 | 252.8 | 7 | 446.9 | 279.3 | 7 | 489.3 | 305.8 |
| 8 | 278.2 | 173.8 | 8 | 320.6 | 200.3 | 8 | 363.0 | 226.8 | 8 | 405.4 | 253.3 | 8 | 447.8 | 279.8 | 8 | 490.2 | 306.3 |
| 9 | 279.0 | 174.3 | 9 | 321.4 | 200.8 | 9 | 363.8 | 227.3 | 9 | 406.2 | 253.8 | 9 | 448.6 | 280.3 | 9 | 491.0 | 306.8 |
| 330 | 279.9 | 174.9 | 380 | 322.3 | 201.4 | 430 | 364.7 | 227.9 | 480 | 407.1 | 254.4 | 530 | 449.5 | 280.9 | 580 | 491.9 | 307.4 |
| 1 | 280.7 | 175.4 | 1 | 323.1 | 201.9 | 1 | 365.5 | 228.4 | 1 | 407.9 | 254.9 | 1 | 450.3 | 281.4 | 1 | 492.7 | 307.9 |
| 2 | 281.6 | 175.9 | 2 | 324.0 | 202.4 | 2 | 366.4 | 228.9 | 2 | 408.8 | 255.4 | 2 | 451.2 | 281.9 | 2 | 493.6 | 308.4 |
| 3 | 282.4 | 176.5 | 3 | 324.8 | 203.0 | 3 | 367.2 | 229.5 | 3 | 409.6 | 256.0 | 3 | 452.0 | 282.4 | 3 | 494.4 | 308.9 |
| 4 | 283.2 | 177.0 | 4 | 325.7 | 203.5 | 4 | 368.1 | 230.0 | 4 | 410.5 | 256.5 | 4 | 452.9 | 283.0 | 4 | 495.3 | 309.5 |
| 5 | 284.1 | 177.5 | 5 | 326.5 | 204.0 | 5 | 368.9 | 230.5 | 5 | 411.3 | 257.0 | 5 | 453.7 | 283.5 | 5 | 496.1 | 310.0 |
| 6 | 284.9 | 178.1 | 6 | 327.3 | 204.5 | 6 | 369.7 | 231.0 | 6 | 412.2 | 257.5 | 6 | 454.6 | 284.0 | 6 | 497.0 | 310.5 |
| 7 | 285.8 | 178.6 | 7 | 328.2 | 205.1 | 7 | 370.6 | 231.6 | 7 | 413.0 | 258.1 | 7 | 455.4 | 284.6 | 7 | 497.8 | 311.1 |
| 8 | 286.6 | 179.1 | 8 | 329.0 | 205.6 | 8 | 371.4 | 232.1 | 8 | 413.8 | 258.6 | 8 | 456.2 | 285.1 | 8 | 498.7 | 311.6 |
| 9 | 287.5 | 179.6 | 9 | 329.9 | 206.1 | 9 | 372.3 | 232.6 | 9 | 414.7 | 259.1 | 9 | 457.1 | 285.6 | 9 | 499.5 | 312.1 |
| 340 | 288.3 | 180.2 | 390 | 330.7 | 206.7 | 440 | 373.1 | 233.2 | 490 | 415.5 | 259.7 | 540 | 457.9 | 286.2 | 590 | 500.3 | 312.7 |
| 1 | 289.2 | 180.7 | 1 | 331.6 | 207.2 | 1 | 374.0 | 233.7 | 1 | 416.4 | 260.2 | 1 | 458.8 | 286.7 | 1 | 501.2 | 313.2 |
| 2 | 290.0 | 181.2 | 2 | 332.4 | 207.7 | 2 | 374.8 | 234.2 | 2 | 417.2 | 260.7 | 2 | 459.6 | 287.2 | 2 | 502.0 | 313.7 |
| 3 | 290.9 | 181.8 | 3 | 333.3 | 208.3 | 3 | 375.7 | 234.8 | 3 | 418.1 | 261.3 | 3 | 460.5 | 287.7 | 3 | 502.9 | 314.2 |
| 4 | 291.7 | 182.3 | 4 | 334.1 | 208.8 | 4 | 376.5 | 235.3 | 4 | 418.9 | 261.8 | 4 | 461.3 | 288.3 | 4 | 503.7 | 314.8 |
| 5 | 292.6 | 182.8 | 5 | 335.0 | 209.3 | 5 | 377.4 | 235.8 | 5 | 419.8 | 262.3 | 5 | 462.2 | 288.8 | 5 | 504.6 | 315.3 |
| 6 | 293.4 | 183.4 | 6 | 335.8 | 209.8 | 6 | 378.2 | 236.3 | 6 | 420.6 | 262.8 | 6 | 463.0 | 289.3 | 6 | 505.4 | 315.8 |
| 7 | 294.3 | 183.9 | 7 | 336.7 | 210.4 | 7 | 379.1 | 236.9 | 7 | 421.5 | 263.4 | 7 | 463.9 | 289.9 | 7 | 506.3 | 316.4 |
| 8 | 295.1 | 184.4 | 8 | 337.5 | 210.9 | 8 | 379.9 | 237.4 | 8 | 422.3 | 263.9 | 8 | 464.7 | 290.4 | 8 | 507.1 | 316.9 |
| 9 | 296.0 | 184.9 | 9 | 338.4 | 211.4 | 9 | 380.8 | 237.9 | 9 | 423.2 | 264.4 | 9 | 465.6 | 290.9 | 9 | 508.0 | 317.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |
| | | ap | | | ap | | | ap | | | ap | | | ap | | | ap |

271 302 315
269 238 225

R

089 058° 045
091 122 135

R ou φm

R

TABELA 1

R ou φm

359 327° 315
181 213 225

TÁBUAS DE CARTEAÇÃO

001 033 045
179 147 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 41.9 | 27.2 | 100 | 83.9 | 54.5 | 150 | 125.8 | 81.7 | 200 | 167.7 | 108.9 | 250 | 209.7 | 136.2 |
| 1 | 0.8 | 0.5 | 1 | 42.8 | 27.8 | 1 | 84.7 | 55.0 | 1 | 126.6 | 82.2 | 1 | 168.6 | 109.5 | 1 | 210.5 | 136.7 |
| 2 | 1.7 | 1.1 | 2 | 43.6 | 28.3 | 2 | 85.5 | 55.6 | 2 | 127.5 | 82.8 | 2 | 169.4 | 110.0 | 2 | 211.3 | 137.2 |
| 3 | 2.5 | 1.6 | 3 | 44.4 | 28.9 | 3 | 86.4 | 56.1 | 3 | 128.3 | 83.3 | 3 | 170.3 | 110.6 | 3 | 212.2 | 137.8 |
| 4 | 3.4 | 2.2 | 4 | 45.3 | 29.4 | 4 | 87.2 | 56.6 | 4 | 129.2 | 83.9 | 4 | 171.1 | 111.1 | 4 | 213.0 | 138.3 |
| 5 | 4.2 | 2.7 | 5 | 46.1 | 30.0 | 5 | 88.1 | 57.2 | 5 | 130.0 | 84.4 | 5 | 171.9 | 111.7 | 5 | 213.9 | 138.9 |
| 6 | 5.0 | 3.3 | 6 | 47.0 | 30.5 | 6 | 88.9 | 57.7 | 6 | 130.8 | 85.0 | 6 | 172.8 | 112.2 | 6 | 214.7 | 139.4 |
| 7 | 5.9 | 3.8 | 7 | 47.8 | 31.0 | 7 | 89.7 | 58.3 | 7 | 131.7 | 85.5 | 7 | 173.6 | 112.7 | 7 | 215.5 | 140.0 |
| 8 | 6.7 | 4.4 | 8 | 48.6 | 31.6 | 8 | 90.6 | 58.8 | 8 | 132.5 | 86.1 | 8 | 174.4 | 113.3 | 8 | 216.4 | 140.5 |
| 9 | 7.5 | 4.9 | 9 | 49.5 | 32.1 | 9 | 91.4 | 59.4 | 9 | 133.3 | 86.6 | 9 | 175.3 | 113.8 | 9 | 217.2 | 141.1 |
| 10 | 8.4 | 5.4 | 60 | 50.3 | 32.7 | 110 | 92.3 | 59.9 | 160 | 134.2 | 87.1 | 210 | 176.1 | 114.4 | 260 | 218.1 | 141.6 |
| 1 | 9.2 | 6.0 | 1 | 51.2 | 33.2 | 1 | 93.1 | 60.5 | 1 | 135.0 | 87.7 | 1 | 177.0 | 114.9 | 1 | 218.9 | 142.2 |
| 2 | 10.1 | 6.5 | 2 | 52.0 | 33.8 | 2 | 93.9 | 61.0 | 2 | 135.9 | 88.2 | 2 | 177.8 | 115.5 | 2 | 219.7 | 142.7 |
| 3 | 10.9 | 7.1 | 3 | 52.8 | 34.3 | 3 | 94.8 | 61.5 | 3 | 136.7 | 88.8 | 3 | 178.6 | 116.0 | 3 | 220.6 | 143.2 |
| 4 | 11.7 | 7.6 | 4 | 53.7 | 34.9 | 4 | 95.6 | 62.1 | 4 | 137.5 | 89.3 | 4 | 179.5 | 116.6 | 4 | 221.4 | 143.8 |
| 5 | 12.6 | 8.2 | 5 | 54.5 | 35.4 | 5 | 96.4 | 62.6 | 5 | 138.4 | 89.9 | 5 | 180.3 | 117.1 | 5 | 222.2 | 144.3 |
| 6 | 13.4 | 8.7 | 6 | 55.4 | 35.9 | 6 | 97.3 | 63.2 | 6 | 139.2 | 90.4 | 6 | 181.2 | 117.6 | 6 | 223.1 | 144.9 |
| 7 | 14.3 | 9.3 | 7 | 56.2 | 36.5 | 7 | 98.1 | 63.7 | 7 | 140.1 | 91.0 | 7 | 182.0 | 118.2 | 7 | 223.9 | 145.4 |
| 8 | 15.1 | 9.8 | 8 | 57.0 | 37.0 | 8 | 99.0 | 64.3 | 8 | 140.9 | 91.5 | 8 | 182.8 | 118.7 | 8 | 224.8 | 146.0 |
| 9 | 15.9 | 10.3 | 9 | 57.9 | 37.6 | 9 | 99.8 | 64.8 | 9 | 141.7 | 92.0 | 9 | 183.7 | 119.3 | 9 | 225.6 | 146.5 |
| 20 | 16.8 | 10.9 | 70 | 58.7 | 38.1 | 120 | 100.6 | 65.4 | 170 | 142.6 | 92.6 | 220 | 184.5 | 119.8 | 270 | 226.4 | 147.1 |
| 1 | 17.6 | 11.4 | 1 | 59.5 | 38.7 | 1 | 101.5 | 65.9 | 1 | 143.4 | 93.1 | 1 | 185.3 | 120.4 | 1 | 227.3 | 147.6 |
| 2 | 18.5 | 12.0 | 2 | 60.4 | 39.2 | 2 | 102.3 | 66.4 | 2 | 144.3 | 93.7 | 2 | 186.2 | 120.9 | 2 | 228.1 | 148.1 |
| 3 | 19.3 | 12.5 | 3 | 61.2 | 39.8 | 3 | 103.2 | 67.0 | 3 | 145.1 | 94.2 | 3 | 187.0 | 121.5 | 3 | 229.0 | 148.7 |
| 4 | 20.1 | 13.1 | 4 | 62.1 | 40.3 | 4 | 104.0 | 67.5 | 4 | 145.9 | 94.8 | 4 | 187.9 | 122.0 | 4 | 229.8 | 149.2 |
| 5 | 21.0 | 13.6 | 5 | 62.9 | 40.8 | 5 | 104.8 | 68.1 | 5 | 146.8 | 95.3 | 5 | 188.7 | 122.5 | 5 | 230.6 | 149.8 |
| 6 | 21.8 | 14.2 | 6 | 63.7 | 41.4 | 6 | 105.7 | 68.6 | 6 | 147.6 | 95.9 | 6 | 189.5 | 123.1 | 6 | 231.5 | 150.3 |
| 7 | 22.6 | 14.7 | 7 | 64.6 | 41.9 | 7 | 106.5 | 69.2 | 7 | 148.4 | 96.4 | 7 | 190.4 | 123.6 | 7 | 232.3 | 150.9 |
| 8 | 23.5 | 15.2 | 8 | 65.4 | 42.5 | 8 | 107.3 | 69.7 | 8 | 149.3 | 96.9 | 8 | 191.2 | 124.2 | 8 | 233.2 | 151.4 |
| 9 | 24.3 | 15.8 | 9 | 66.3 | 43.0 | 9 | 108.2 | 70.3 | 9 | 150.1 | 97.5 | 9 | 192.1 | 124.7 | 9 | 234.0 | 152.0 |
| 30 | 25.2 | 16.3 | 80 | 67.1 | 43.6 | 130 | 109.0 | 70.8 | 180 | 151.0 | 98.0 | 230 | 192.9 | 125.3 | 280 | 234.8 | 152.5 |
| 1 | 26.0 | 16.9 | 1 | 67.9 | 44.1 | 1 | 109.9 | 71.3 | 1 | 151.8 | 98.6 | 1 | 193.7 | 125.8 | 1 | 235.7 | 153.0 |
| 2 | 26.8 | 17.4 | 2 | 68.8 | 44.7 | 2 | 110.7 | 71.9 | 2 | 152.6 | 99.1 | 2 | 194.6 | 126.4 | 2 | 236.5 | 153.6 |
| 3 | 27.7 | 18.0 | 3 | 69.6 | 45.2 | 3 | 111.5 | 72.4 | 3 | 153.5 | 99.7 | 3 | 195.4 | 126.9 | 3 | 237.3 | 154.1 |
| 4 | 28.5 | 18.5 | 4 | 70.4 | 45.7 | 4 | 112.4 | 73.0 | 4 | 154.3 | 100.2 | 4 | 196.2 | 127.4 | 4 | 238.2 | 154.7 |
| 5 | 29.4 | 19.1 | 5 | 71.3 | 46.3 | 5 | 113.2 | 73.5 | 5 | 155.2 | 100.8 | 5 | 197.1 | 128.0 | 5 | 239.0 | 155.2 |
| 6 | 30.2 | 19.6 | 6 | 72.1 | 46.8 | 6 | 114.1 | 74.1 | 6 | 156.0 | 101.3 | 6 | 197.9 | 128.5 | 6 | 239.9 | 155.8 |
| 7 | 31.0 | 20.2 | 7 | 73.0 | 47.4 | 7 | 114.9 | 74.6 | 7 | 156.8 | 101.8 | 7 | 198.8 | 129.1 | 7 | 240.7 | 156.3 |
| 8 | 31.9 | 20.7 | 8 | 73.8 | 47.9 | 8 | 115.7 | 75.2 | 8 | 157.7 | 102.4 | 8 | 199.6 | 129.6 | 8 | 241.5 | 156.9 |
| 9 | 32.7 | 21.2 | 9 | 74.6 | 48.5 | 9 | 116.6 | 75.7 | 9 | 158.5 | 102.9 | 9 | 200.4 | 130.2 | 9 | 242.4 | 157.4 |
| 40 | 33.5 | 21.8 | 90 | 75.5 | 49.0 | 140 | 117.4 | 76.2 | 190 | 159.3 | 103.5 | 240 | 201.3 | 130.7 | 290 | 243.2 | 157.9 |
| 1 | 34.4 | 22.3 | 1 | 76.3 | 49.6 | 1 | 118.3 | 76.8 | 1 | 160.2 | 104.0 | 1 | 202.1 | 131.3 | 1 | 244.1 | 158.5 |
| 2 | 35.2 | 22.9 | 2 | 77.2 | 50.1 | 2 | 119.1 | 77.3 | 2 | 161.0 | 104.6 | 2 | 203.0 | 131.8 | 2 | 244.9 | 159.0 |
| 3 | 36.1 | 23.4 | 3 | 78.0 | 50.7 | 3 | 119.9 | 77.9 | 3 | 161.9 | 105.1 | 3 | 203.8 | 132.3 | 3 | 245.7 | 159.6 |
| 4 | 36.9 | 24.0 | 4 | 78.8 | 51.2 | 4 | 120.8 | 78.4 | 4 | 162.7 | 105.7 | 4 | 204.6 | 132.9 | 4 | 246.6 | 160.1 |
| 5 | 37.7 | 24.5 | 5 | 79.7 | 51.7 | 5 | 121.6 | 79.0 | 5 | 163.5 | 106.2 | 5 | 205.5 | 133.4 | 5 | 247.4 | 160.7 |
| 6 | 38.6 | 25.1 | 6 | 80.5 | 52.3 | 6 | 122.4 | 79.5 | 6 | 164.4 | 106.7 | 6 | 206.3 | 134.0 | 6 | 248.2 | 161.2 |
| 7 | 39.4 | 25.6 | 7 | 81.4 | 52.8 | 7 | 123.3 | 80.1 | 7 | 165.2 | 107.3 | 7 | 207.2 | 134.5 | 7 | 249.1 | 161.8 |
| 8 | 40.3 | 26.1 | 8 | 82.2 | 53.4 | 8 | 124.1 | 80.6 | 8 | 166.1 | 107.8 | 8 | 208.0 | 135.1 | 8 | 249.9 | 162.3 |
| 9 | 41.1 | 26.7 | 9 | 83.0 | 53.9 | 9 | 125.0 | 81.2 | 9 | 166.9 | 108.4 | 9 | 208.8 | 135.6 | 9 | 250.8 | 162.8 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 303 315
269 237 225

R

089 057° 045
091 123 135

R ou φm

R

TABELA 1

R ou φm

359 327° 315
181 213 225

TÁBUAS DE CARTEAÇÃO

001 033 045
179 147 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 251.6 | 163.4 | 350 | 293.5 | 190.6 | 400 | 335.5 | 217.9 | 450 | 377.4 | 245.1 | 500 | 419.3 | 272.3 | 550 | 461.3 | 299.6 |
| 1 | 252.4 | 163.9 | 1 | 294.4 | 191.2 | 1 | 336.3 | 218.4 | 1 | 378.2 | 245.6 | 1 | 420.2 | 272.9 | 1 | 462.1 | 300.1 |
| 2 | 253.3 | 164.5 | 2 | 295.2 | 191.7 | 2 | 337.1 | 218.9 | 2 | 379.1 | 246.2 | 2 | 421.0 | 273.4 | 2 | 462.9 | 300.6 |
| 3 | 254.1 | 165.0 | 3 | 296.1 | 192.3 | 3 | 338.0 | 219.5 | 3 | 379.9 | 246.7 | 3 | 421.9 | 274.0 | 3 | 463.8 | 301.2 |
| 4 | 255.0 | 165.6 | 4 | 296.9 | 192.8 | 4 | 338.8 | 220.0 | 4 | 380.8 | 247.3 | 4 | 422.7 | 274.5 | 4 | 464.6 | 301.7 |
| 5 | 255.8 | 166.1 | 5 | 297.7 | 193.3 | 5 | 339.7 | 220.6 | 5 | 381.6 | 247.8 | 5 | 423.5 | 275.0 | 5 | 465.5 | 302.3 |
| 6 | 256.6 | 166.7 | 6 | 298.6 | 193.9 | 6 | 340.5 | 221.1 | 6 | 382.4 | 248.4 | 6 | 424.4 | 275.6 | 6 | 466.3 | 302.8 |
| 7 | 257.5 | 167.2 | 7 | 299.4 | 194.4 | 7 | 341.3 | 221.7 | 7 | 383.3 | 248.9 | 7 | 425.2 | 276.1 | 7 | 467.1 | 303.4 |
| 8 | 258.3 | 167.7 | 8 | 300.2 | 195.0 | 8 | 342.2 | 222.2 | 8 | 384.1 | 249.4 | 8 | 426.0 | 276.7 | 8 | 468.0 | 303.9 |
| 9 | 259.1 | 168.3 | 9 | 301.1 | 195.5 | 9 | 343.0 | 222.8 | 9 | 384.9 | 250.0 | 9 | 426.9 | 277.2 | 9 | 468.8 | 304.5 |
| 310 | 260.0 | 168.8 | 360 | 301.9 | 196.1 | 410 | 343.9 | 223.3 | 460 | 385.8 | 250.5 | 510 | 427.7 | 277.8 | 560 | 469.7 | 305.0 |
| 1 | 260.8 | 169.4 | 1 | 302.8 | 196.6 | 1 | 344.7 | 223.8 | 1 | 386.6 | 251.1 | 1 | 428.6 | 278.3 | 1 | 470.5 | 305.5 |
| 2 | 261.7 | 169.9 | 2 | 303.6 | 197.2 | 2 | 345.5 | 224.4 | 2 | 387.5 | 251.6 | 2 | 429.4 | 278.9 | 2 | 471.3 | 306.1 |
| 3 | 262.5 | 170.5 | 3 | 304.4 | 197.7 | 3 | 346.4 | 224.9 | 3 | 388.3 | 252.2 | 3 | 430.2 | 279.4 | 3 | 472.2 | 306.6 |
| 4 | 263.3 | 171.0 | 4 | 305.3 | 198.2 | 4 | 347.2 | 225.5 | 4 | 389.1 | 252.7 | 4 | 431.1 | 279.9 | 4 | 473.0 | 307.2 |
| 5 | 264.2 | 171.6 | 5 | 306.1 | 198.8 | 5 | 348.0 | 226.0 | 5 | 390.0 | 253.3 | 5 | 431.9 | 280.5 | 5 | 473.8 | 307.7 |
| 6 | 265.0 | 172.1 | 6 | 307.0 | 199.3 | 6 | 348.9 | 226.6 | 6 | 390.8 | 253.8 | 6 | 432.8 | 281.0 | 6 | 474.7 | 308.3 |
| 7 | 265.9 | 172.7 | 7 | 307.8 | 199.9 | 7 | 349.7 | 227.1 | 7 | 391.7 | 254.3 | 7 | 433.6 | 281.6 | 7 | 475.5 | 308.8 |
| 8 | 266.7 | 173.2 | 8 | 308.6 | 200.4 | 8 | 350.6 | 227.7 | 8 | 392.5 | 254.9 | 8 | 434.4 | 282.1 | 8 | 476.4 | 309.4 |
| 9 | 267.5 | 173.7 | 9 | 309.5 | 201.0 | 9 | 351.4 | 228.2 | 9 | 393.3 | 255.4 | 9 | 435.3 | 282.7 | 9 | 477.2 | 309.9 |
| 320 | 268.4 | 174.3 | 370 | 310.3 | 201.5 | 420 | 352.2 | 228.7 | 470 | 394.2 | 256.0 | 520 | 436.1 | 283.2 | 570 | 478.0 | 310.4 |
| 1 | 269.2 | 174.8 | 1 | 311.1 | 202.1 | 1 | 353.1 | 229.3 | 1 | 395.0 | 256.5 | 1 | 436.9 | 283.8 | 1 | 478.9 | 311.0 |
| 2 | 270.1 | 175.4 | 2 | 312.0 | 202.6 | 2 | 353.9 | 229.8 | 2 | 395.9 | 257.1 | 2 | 437.8 | 284.3 | 2 | 479.7 | 311.5 |
| 3 | 270.9 | 175.9 | 3 | 312.8 | 203.2 | 3 | 354.8 | 230.4 | 3 | 396.7 | 257.6 | 3 | 438.6 | 284.8 | 3 | 480.6 | 312.1 |
| 4 | 271.7 | 176.5 | 4 | 313.7 | 203.7 | 4 | 355.6 | 230.9 | 4 | 397.5 | 258.2 | 4 | 439.5 | 285.4 | 4 | 481.4 | 312.6 |
| 5 | 272.6 | 177.0 | 5 | 314.5 | 204.2 | 5 | 356.4 | 231.5 | 5 | 398.4 | 258.7 | 5 | 440.3 | 285.9 | 5 | 482.2 | 313.2 |
| 6 | 273.4 | 177.6 | 6 | 315.3 | 204.8 | 6 | 357.3 | 232.0 | 6 | 399.2 | 259.2 | 6 | 441.1 | 286.5 | 6 | 483.1 | 313.7 |
| 7 | 274.2 | 178.1 | 7 | 316.2 | 205.3 | 7 | 358.1 | 232.6 | 7 | 400.0 | 259.8 | 7 | 442.0 | 287.0 | 7 | 483.9 | 314.3 |
| 8 | 275.1 | 178.6 | 8 | 317.0 | 205.9 | 8 | 359.0 | 233.1 | 8 | 400.9 | 260.3 | 8 | 442.8 | 287.6 | 8 | 484.8 | 314.8 |
| 9 | 275.9 | 179.2 | 9 | 317.9 | 206.4 | 9 | 359.8 | 233.7 | 9 | 401.7 | 260.9 | 9 | 443.7 | 288.1 | 9 | 485.6 | 315.3 |
| 330 | 276.8 | 179.7 | 380 | 318.7 | 207.0 | 430 | 360.6 | 234.2 | 480 | 402.6 | 261.4 | 530 | 444.5 | 288.7 | 580 | 486.4 | 315.9 |
| 1 | 277.6 | 180.3 | 1 | 319.5 | 207.5 | 1 | 361.5 | 234.7 | 1 | 403.4 | 262.0 | 1 | 445.3 | 289.2 | 1 | 487.3 | 316.4 |
| 2 | 278.4 | 180.8 | 2 | 320.4 | 208.1 | 2 | 362.3 | 235.3 | 2 | 404.2 | 262.5 | 2 | 446.2 | 289.7 | 2 | 488.1 | 317.0 |
| 3 | 279.3 | 181.4 | 3 | 321.2 | 208.6 | 3 | 363.1 | 235.8 | 3 | 405.1 | 263.1 | 3 | 447.0 | 290.3 | 3 | 488.9 | 317.5 |
| 4 | 280.1 | 181.9 | 4 | 322.0 | 209.1 | 4 | 364.0 | 236.4 | 4 | 405.9 | 263.6 | 4 | 447.9 | 290.8 | 4 | 489.8 | 318.1 |
| 5 | 281.0 | 182.5 | 5 | 322.9 | 209.7 | 5 | 364.8 | 236.9 | 5 | 406.8 | 264.1 | 5 | 448.7 | 291.4 | 5 | 490.6 | 318.6 |
| 6 | 281.8 | 183.0 | 6 | 323.7 | 210.2 | 6 | 365.7 | 237.5 | 6 | 407.6 | 264.7 | 6 | 449.5 | 291.9 | 6 | 491.5 | 319.2 |
| 7 | 282.6 | 183.5 | 7 | 324.6 | 210.8 | 7 | 366.5 | 238.0 | 7 | 408.4 | 265.2 | 7 | 450.4 | 292.5 | 7 | 492.3 | 319.7 |
| 8 | 283.5 | 184.1 | 8 | 325.4 | 211.3 | 8 | 367.3 | 238.6 | 8 | 409.3 | 265.8 | 8 | 451.2 | 293.0 | 8 | 493.1 | 320.2 |
| 9 | 284.3 | 184.6 | 9 | 326.2 | 211.9 | 9 | 368.2 | 239.1 | 9 | 410.1 | 266.3 | 9 | 452.0 | 293.6 | 9 | 494.0 | 320.8 |
| 340 | 285.1 | 185.2 | 390 | 327.1 | 212.4 | 440 | 369.0 | 239.6 | 490 | 410.9 | 266.9 | 540 | 452.9 | 294.1 | 590 | 494.8 | 321.3 |
| 1 | 286.0 | 185.7 | 1 | 327.9 | 213.0 | 1 | 369.9 | 240.2 | 1 | 411.8 | 267.4 | 1 | 453.7 | 294.6 | 1 | 495.7 | 321.9 |
| 2 | 286.8 | 186.3 | 2 | 328.8 | 213.5 | 2 | 370.7 | 240.7 | 2 | 412.6 | 268.0 | 2 | 454.6 | 295.2 | 2 | 496.5 | 322.4 |
| 3 | 287.7 | 186.8 | 3 | 329.6 | 214.0 | 3 | 371.5 | 241.3 | 3 | 413.5 | 268.5 | 3 | 455.4 | 295.7 | 3 | 497.3 | 323.0 |
| 4 | 288.5 | 187.4 | 4 | 330.4 | 214.6 | 4 | 372.4 | 241.8 | 4 | 414.3 | 269.1 | 4 | 456.2 | 296.3 | 4 | 498.2 | 323.5 |
| 5 | 289.3 | 187.9 | 5 | 331.3 | 215.1 | 5 | 373.2 | 242.4 | 5 | 415.1 | 269.6 | 5 | 457.1 | 296.8 | 5 | 499.0 | 324.1 |
| 6 | 290.2 | 188.4 | 6 | 332.1 | 215.7 | 6 | 374.0 | 242.9 | 6 | 416.0 | 270.1 | 6 | 457.9 | 297.4 | 6 | 499.8 | 324.6 |
| 7 | 291.0 | 189.0 | 7 | 333.0 | 216.2 | 7 | 374.9 | 243.5 | 7 | 416.8 | 270.7 | 7 | 458.8 | 297.9 | 7 | 500.7 | 325.1 |
| 8 | 291.9 | 189.5 | 8 | 333.8 | 216.8 | 8 | 375.7 | 244.0 | 8 | 417.7 | 271.2 | 8 | 459.6 | 298.5 | 8 | 501.5 | 325.7 |
| 9 | 292.7 | 190.1 | 9 | 334.6 | 217.3 | 9 | 376.6 | 244.5 | 9 | 418.5 | 271.8 | 9 | 460.4 | 299.0 | 9 | 502.4 | 326.2 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 303 315
269 237 225

R

089 057° 045
091 123 135

R ou φm

R

TABELA 1

R ou ϕ m

359 326° 315
181 214 225

TÁBUAS DE CARTEAÇÃO

001 034 045
179 146 135

| ΔL | ap | $\Delta \phi$ | ap | ΔL | ap | $\Delta \phi$ | ap | ΔL | ap | $\Delta \phi$ | ap | ΔL | ap | $\Delta \phi$ | ap | ΔL | ap | $\Delta \phi$ | ap | |
|------------|---------------|---------------|------------|---------------|---------------|---------------|---------------|---------------|------------|---------------|---------------|------------|---------------|---------------|------------|---------------|---------------|---------------|---------------|---------------|
| D | $\Delta \phi$ | ap | D | $\Delta \phi$ | ap | D | $\Delta \phi$ | ap | D | $\Delta \phi$ | ap | D | $\Delta \phi$ | ap | D | $\Delta \phi$ | ap | D | $\Delta \phi$ | ap |
| 0 | 0.0 | 0.0 | 50 | 41.5 | 28.0 | 100 | 82.9 | 55.9 | 150 | 124.4 | 83.9 | 200 | 165.8 | 111.8 | 250 | 207.3 | 139.8 | | | |
| 1 | 0.8 | 0.6 | 1 | 42.3 | 28.5 | 1 | 83.7 | 56.5 | 1 | 125.2 | 84.4 | 1 | 166.6 | 112.4 | 1 | 208.1 | 140.4 | | | |
| 2 | 1.7 | 1.1 | 2 | 43.1 | 29.1 | 2 | 84.6 | 57.0 | 2 | 126.0 | 85.0 | 2 | 167.5 | 113.0 | 2 | 208.9 | 140.9 | | | |
| 3 | 2.5 | 1.7 | 3 | 43.9 | 29.6 | 3 | 85.4 | 57.6 | 3 | 126.8 | 85.6 | 3 | 168.3 | 113.5 | 3 | 209.7 | 141.5 | | | |
| 4 | 3.3 | 2.2 | 4 | 44.8 | 30.2 | 4 | 86.2 | 58.2 | 4 | 127.7 | 86.1 | 4 | 169.1 | 114.1 | 4 | 210.6 | 142.0 | | | |
| 5 | 4.1 | 2.8 | 5 | 45.6 | 30.8 | 5 | 87.0 | 58.7 | 5 | 128.5 | 86.7 | 5 | 170.0 | 114.6 | 5 | 211.4 | 142.6 | | | |
| 6 | 5.0 | 3.4 | 6 | 46.4 | 31.3 | 6 | 87.9 | 59.3 | 6 | 129.3 | 87.2 | 6 | 170.8 | 115.2 | 6 | 212.2 | 143.2 | | | |
| 7 | 5.8 | 3.9 | 7 | 47.3 | 31.9 | 7 | 88.7 | 59.8 | 7 | 130.2 | 87.8 | 7 | 171.6 | 115.8 | 7 | 213.1 | 143.7 | | | |
| 8 | 6.6 | 4.5 | 8 | 48.1 | 32.4 | 8 | 89.5 | 60.4 | 8 | 131.0 | 88.4 | 8 | 172.4 | 116.3 | 8 | 213.9 | 144.3 | | | |
| 9 | 7.5 | 5.0 | 9 | 48.9 | 33.0 | 9 | 90.4 | 61.0 | 9 | 131.8 | 88.9 | 9 | 173.3 | 116.9 | 9 | 214.7 | 144.8 | | | |
| 10 | 8.3 | 5.6 | 60 | 49.7 | 33.6 | 110 | 91.2 | 61.5 | 160 | 132.6 | 89.5 | 210 | 174.1 | 117.4 | 260 | 215.5 | 145.4 | | | |
| 1 | 9.1 | 6.2 | 1 | 50.6 | 34.1 | 1 | 92.0 | 62.1 | 1 | 133.5 | 90.0 | 1 | 174.9 | 118.0 | 1 | 216.4 | 145.9 | | | |
| 2 | 9.9 | 6.7 | 2 | 51.4 | 34.7 | 2 | 92.9 | 62.6 | 2 | 134.3 | 90.6 | 2 | 175.8 | 118.5 | 2 | 217.2 | 146.5 | | | |
| 3 | 10.8 | 7.3 | 3 | 52.2 | 35.2 | 3 | 93.7 | 63.2 | 3 | 135.1 | 91.1 | 3 | 176.6 | 119.1 | 3 | 218.0 | 147.1 | | | |
| 4 | 11.6 | 7.8 | 4 | 53.1 | 35.8 | 4 | 94.5 | 63.7 | 4 | 136.0 | 91.7 | 4 | 177.4 | 119.7 | 4 | 218.9 | 147.6 | | | |
| 5 | 12.4 | 8.4 | 5 | 53.9 | 36.3 | 5 | 95.3 | 64.3 | 5 | 136.8 | 92.3 | 5 | 178.2 | 120.2 | 5 | 219.7 | 148.2 | | | |
| 6 | 13.3 | 8.9 | 6 | 54.7 | 36.9 | 6 | 96.2 | 64.9 | 6 | 137.6 | 92.8 | 6 | 179.1 | 120.8 | 6 | 220.5 | 148.7 | | | |
| 7 | 14.1 | 9.5 | 7 | 55.5 | 37.5 | 7 | 97.0 | 65.4 | 7 | 138.4 | 93.4 | 7 | 179.9 | 121.3 | 7 | 221.4 | 149.3 | | | |
| 8 | 14.9 | 10.1 | 8 | 56.4 | 38.0 | 8 | 97.8 | 66.0 | 8 | 139.3 | 93.9 | 8 | 180.7 | 121.9 | 8 | 222.2 | 149.9 | | | |
| 9 | 15.8 | 10.6 | 9 | 57.2 | 38.6 | 9 | 98.7 | 66.5 | 9 | 140.1 | 94.5 | 9 | 181.6 | 122.5 | 9 | 223.0 | 150.4 | | | |
| 20 | 16.6 | 11.2 | 70 | 58.0 | 39.1 | 120 | 99.5 | 67.1 | 170 | 140.9 | 95.1 | 220 | 182.4 | 123.0 | 270 | 223.8 | 151.0 | | | |
| 1 | 17.4 | 11.7 | 1 | 58.9 | 39.7 | 1 | 100.3 | 67.7 | 1 | 141.8 | 95.6 | 1 | 183.2 | 123.6 | 1 | 224.7 | 151.5 | | | |
| 2 | 18.2 | 12.3 | 2 | 59.7 | 40.3 | 2 | 101.1 | 68.2 | 2 | 142.6 | 96.2 | 2 | 184.0 | 124.1 | 2 | 225.5 | 152.1 | | | |
| 3 | 19.1 | 12.9 | 3 | 60.5 | 40.8 | 3 | 102.0 | 68.8 | 3 | 143.4 | 96.7 | 3 | 184.9 | 124.7 | 3 | 226.3 | 152.7 | | | |
| 4 | 19.9 | 13.4 | 4 | 61.3 | 41.4 | 4 | 102.8 | 69.3 | 4 | 144.3 | 97.3 | 4 | 185.7 | 125.3 | 4 | 227.2 | 153.2 | | | |
| 5 | 20.7 | 14.0 | 5 | 62.2 | 41.9 | 5 | 103.6 | 69.9 | 5 | 145.1 | 97.9 | 5 | 186.5 | 125.8 | 5 | 228.0 | 153.8 | | | |
| 6 | 21.6 | 14.5 | 6 | 63.0 | 42.5 | 6 | 104.5 | 70.5 | 6 | 145.9 | 98.4 | 6 | 187.4 | 126.4 | 6 | 228.8 | 154.3 | | | |
| 7 | 22.4 | 15.1 | 7 | 63.8 | 43.1 | 7 | 105.3 | 71.0 | 7 | 146.7 | 99.0 | 7 | 188.2 | 126.9 | 7 | 229.6 | 154.9 | | | |
| 8 | 23.2 | 15.7 | 8 | 64.7 | 43.6 | 8 | 106.1 | 71.6 | 8 | 147.6 | 99.5 | 8 | 189.0 | 127.5 | 8 | 230.5 | 155.5 | | | |
| 9 | 24.0 | 16.2 | 9 | 65.5 | 44.2 | 9 | 106.9 | 72.1 | 9 | 148.4 | 100.1 | 9 | 189.8 | 128.1 | 9 | 231.3 | 156.0 | | | |
| 30 | 24.9 | 16.8 | 80 | 66.3 | 44.7 | 130 | 107.8 | 72.7 | 180 | 149.2 | 100.7 | 230 | 190.7 | 128.6 | 280 | 232.1 | 156.6 | | | |
| 1 | 25.7 | 17.3 | 1 | 67.2 | 45.3 | 1 | 108.6 | 73.3 | 1 | 150.1 | 101.2 | 1 | 191.5 | 129.2 | 1 | 233.0 | 157.1 | | | |
| 2 | 26.5 | 17.9 | 2 | 68.0 | 45.9 | 2 | 109.4 | 73.8 | 2 | 150.9 | 101.8 | 2 | 192.3 | 129.7 | 2 | 233.8 | 157.7 | | | |
| 3 | 27.4 | 18.5 | 3 | 68.8 | 46.4 | 3 | 110.3 | 74.4 | 3 | 151.7 | 102.3 | 3 | 193.2 | 130.3 | 3 | 234.6 | 158.3 | | | |
| 4 | 28.2 | 19.0 | 4 | 69.6 | 47.0 | 4 | 111.1 | 74.9 | 4 | 152.5 | 102.9 | 4 | 194.0 | 130.9 | 4 | 235.4 | 158.8 | | | |
| 5 | 29.0 | 19.6 | 5 | 70.5 | 47.5 | 5 | 111.9 | 75.5 | 5 | 153.4 | 103.5 | 5 | 194.8 | 131.4 | 5 | 236.3 | 159.4 | | | |
| 6 | 29.8 | 20.1 | 6 | 71.3 | 48.1 | 6 | 112.7 | 76.1 | 6 | 154.2 | 104.0 | 6 | 195.7 | 132.0 | 6 | 237.1 | 159.9 | | | |
| 7 | 30.7 | 20.7 | 7 | 72.1 | 48.6 | 7 | 113.6 | 76.6 | 7 | 155.0 | 104.6 | 7 | 196.5 | 132.5 | 7 | 237.9 | 160.5 | | | |
| 8 | 31.5 | 21.2 | 8 | 73.0 | 49.2 | 8 | 114.4 | 77.2 | 8 | 155.9 | 105.1 | 8 | 197.3 | 133.1 | 8 | 238.8 | 161.0 | | | |
| 9 | 32.3 | 21.8 | 9 | 73.8 | 49.8 | 9 | 115.2 | 77.7 | 9 | 156.7 | 105.7 | 9 | 198.1 | 133.6 | 9 | 239.6 | 161.6 | | | |
| 40 | 33.2 | 22.4 | 90 | 74.6 | 50.3 | 140 | 116.1 | 78.3 | 190 | 157.5 | 106.2 | 240 | 199.0 | 134.2 | 290 | 240.4 | 162.2 | | | |
| 1 | 34.0 | 22.9 | 1 | 75.4 | 50.9 | 1 | 116.9 | 78.8 | 1 | 158.3 | 106.8 | 1 | 199.8 | 134.8 | 1 | 241.2 | 162.7 | | | |
| 2 | 34.8 | 23.5 | 2 | 76.3 | 51.4 | 2 | 117.7 | 79.4 | 2 | 159.2 | 107.4 | 2 | 200.6 | 135.3 | 2 | 242.1 | 163.3 | | | |
| 3 | 35.6 | 24.0 | 3 | 77.1 | 52.0 | 3 | 118.6 | 80.0 | 3 | 160.0 | 107.9 | 3 | 201.5 | 135.9 | 3 | 242.9 | 163.8 | | | |
| 4 | 36.5 | 24.6 | 4 | 77.9 | 52.6 | 4 | 119.4 | 80.5 | 4 | 160.8 | 108.5 | 4 | 202.3 | 136.4 | 4 | 243.7 | 164.4 | | | |
| 5 | 37.3 | 25.2 | 5 | 78.8 | 53.1 | 5 | 120.2 | 81.1 | 5 | 161.7 | 109.0 | 5 | 203.1 | 137.0 | 5 | 244.6 | 165.0 | | | |
| 6 | 38.1 | 25.7 | 6 | 79.6 | 53.7 | 6 | 121.0 | 81.6 | 6 | 162.5 | 109.6 | 6 | 203.9 | 137.6 | 6 | 245.4 | 165.5 | | | |
| 7 | 39.0 | 26.3 | 7 | 80.4 | 54.2 | 7 | 121.9 | 82.2 | 7 | 163.3 | 110.2 | 7 | 204.8 | 138.1 | 7 | 246.2 | 166.1 | | | |
| 8 | 39.8 | 26.8 | 8 | 81.2 | 54.8 | 8 | 122.7 | 82.8 | 8 | 164.1 | 110.7 | 8 | 205.6 | 138.7 | 8 | 247.1 | 166.6 | | | |
| 9 | 40.6 | 27.4 | 9 | 82.1 | 55.4 | 9 | 123.5 | 83.3 | 9 | 165.0 | 111.3 | 9 | 206.4 | 139.2 | 9 | 247.9 | 167.2 | | | |
| D | ap | $\Delta \phi$ | D | ap | $\Delta \phi$ | D | ap | $\Delta \phi$ | D | ap | $\Delta \phi$ | D | ap | $\Delta \phi$ | D | ap | $\Delta \phi$ | D | ap | $\Delta \phi$ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 304 315
269 236 225

R

089 056° 045
091 124 135

R ou ϕ m

R

TABELA 1

R ou ϕ m

359 326° 315
181 214 225

TÁBUAS DE CARTEAÇÃO

001 034 045
179 146 135

| ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap |
|------------|---------------|---------------|------------|---------------|---------------|------------|---------------|---------------|------------|---------------|---------------|------------|---------------|---------------|------------|---------------|---------------|
| D | $\Delta \phi$ | ap | D | $\Delta \phi$ | ap | D | $\Delta \phi$ | ap | D | $\Delta \phi$ | ap | D | $\Delta \phi$ | ap | D | $\Delta \phi$ | ap |
| 300 | 248.7 | 167.8 | 350 | 290.2 | 195.7 | 400 | 331.6 | 223.7 | 450 | 373.1 | 251.6 | 500 | 414.5 | 279.6 | 550 | 456.0 | 307.6 |
| 1 | 249.5 | 168.3 | 1 | 291.0 | 196.3 | 1 | 332.4 | 224.2 | 1 | 373.9 | 252.2 | 1 | 415.3 | 280.2 | 1 | 456.8 | 308.1 |
| 2 | 250.4 | 168.9 | 2 | 291.8 | 196.8 | 2 | 333.3 | 224.8 | 2 | 374.7 | 252.8 | 2 | 416.2 | 280.7 | 2 | 457.6 | 308.7 |
| 3 | 251.2 | 169.4 | 3 | 292.7 | 197.4 | 3 | 334.1 | 225.4 | 3 | 375.6 | 253.3 | 3 | 417.0 | 281.3 | 3 | 458.5 | 309.2 |
| 4 | 252.0 | 170.0 | 4 | 293.5 | 198.0 | 4 | 334.9 | 225.9 | 4 | 376.4 | 253.9 | 4 | 417.8 | 281.8 | 4 | 459.3 | 309.8 |
| 5 | 252.9 | 170.6 | 5 | 294.3 | 198.5 | 5 | 335.8 | 226.5 | 5 | 377.2 | 254.4 | 5 | 418.7 | 282.4 | 5 | 460.1 | 310.4 |
| 6 | 253.7 | 171.1 | 6 | 295.1 | 199.1 | 6 | 336.6 | 227.0 | 6 | 378.0 | 255.0 | 6 | 419.5 | 283.0 | 6 | 460.9 | 310.9 |
| 7 | 254.5 | 171.7 | 7 | 296.0 | 199.6 | 7 | 337.4 | 227.6 | 7 | 378.9 | 255.6 | 7 | 420.3 | 283.5 | 7 | 461.8 | 311.5 |
| 8 | 255.3 | 172.2 | 8 | 296.8 | 200.2 | 8 | 338.2 | 228.2 | 8 | 379.7 | 256.1 | 8 | 421.2 | 284.1 | 8 | 462.6 | 312.0 |
| 9 | 256.2 | 172.8 | 9 | 297.6 | 200.8 | 9 | 339.1 | 228.7 | 9 | 380.5 | 256.7 | 9 | 422.0 | 284.6 | 9 | 463.4 | 312.6 |
| 310 | 257.0 | 173.3 | 360 | 298.5 | 201.3 | 410 | 339.9 | 229.3 | 460 | 381.4 | 257.2 | 510 | 422.8 | 285.2 | 560 | 464.3 | 313.1 |
| 1 | 257.8 | 173.9 | 1 | 299.3 | 201.9 | 1 | 340.7 | 229.8 | 1 | 382.2 | 257.8 | 1 | 423.6 | 285.7 | 1 | 465.1 | 313.7 |
| 2 | 258.7 | 174.5 | 2 | 300.1 | 202.4 | 2 | 341.6 | 230.4 | 2 | 383.0 | 258.3 | 2 | 424.5 | 286.3 | 2 | 465.9 | 314.3 |
| 3 | 259.5 | 175.0 | 3 | 300.9 | 203.0 | 3 | 342.4 | 230.9 | 3 | 383.8 | 258.9 | 3 | 425.3 | 286.9 | 3 | 466.7 | 314.8 |
| 4 | 260.3 | 175.6 | 4 | 301.8 | 203.5 | 4 | 343.2 | 231.5 | 4 | 384.7 | 259.5 | 4 | 426.1 | 287.4 | 4 | 467.6 | 315.4 |
| 5 | 261.1 | 176.1 | 5 | 302.6 | 204.1 | 5 | 344.1 | 232.1 | 5 | 385.5 | 260.0 | 5 | 427.0 | 288.0 | 5 | 468.4 | 315.9 |
| 6 | 262.0 | 176.7 | 6 | 303.4 | 204.7 | 6 | 344.9 | 232.6 | 6 | 386.3 | 260.6 | 6 | 427.8 | 288.5 | 6 | 469.2 | 316.5 |
| 7 | 262.8 | 177.3 | 7 | 304.3 | 205.2 | 7 | 345.7 | 233.2 | 7 | 387.2 | 261.1 | 7 | 428.6 | 289.1 | 7 | 470.1 | 317.1 |
| 8 | 263.6 | 177.8 | 8 | 305.1 | 205.8 | 8 | 346.5 | 233.7 | 8 | 388.0 | 261.7 | 8 | 429.4 | 289.7 | 8 | 470.9 | 317.6 |
| 9 | 264.5 | 178.4 | 9 | 305.9 | 206.3 | 9 | 347.4 | 234.3 | 9 | 388.8 | 262.3 | 9 | 430.3 | 290.2 | 9 | 471.7 | 318.2 |
| 320 | 265.3 | 178.9 | 370 | 306.7 | 206.9 | 420 | 348.2 | 234.9 | 470 | 389.6 | 262.8 | 520 | 431.1 | 290.8 | 570 | 472.6 | 318.7 |
| 1 | 266.1 | 179.5 | 1 | 307.6 | 207.5 | 1 | 349.0 | 235.4 | 1 | 390.5 | 263.4 | 1 | 431.9 | 291.3 | 1 | 473.4 | 319.3 |
| 2 | 266.9 | 180.1 | 2 | 308.4 | 208.0 | 2 | 349.9 | 236.0 | 2 | 391.3 | 263.9 | 2 | 432.8 | 291.9 | 2 | 474.2 | 319.9 |
| 3 | 267.8 | 180.6 | 3 | 309.2 | 208.6 | 3 | 350.7 | 236.5 | 3 | 392.1 | 264.5 | 3 | 433.6 | 292.5 | 3 | 475.0 | 320.4 |
| 4 | 268.6 | 181.2 | 4 | 310.1 | 209.1 | 4 | 351.5 | 237.1 | 4 | 393.0 | 265.1 | 4 | 434.4 | 293.0 | 4 | 475.9 | 321.0 |
| 5 | 269.4 | 181.7 | 5 | 310.9 | 209.7 | 5 | 352.3 | 237.7 | 5 | 393.8 | 265.6 | 5 | 435.2 | 293.6 | 5 | 476.7 | 321.5 |
| 6 | 270.3 | 182.3 | 6 | 311.7 | 210.3 | 6 | 353.2 | 238.2 | 6 | 394.6 | 266.2 | 6 | 436.1 | 294.1 | 6 | 477.5 | 322.1 |
| 7 | 271.1 | 182.9 | 7 | 312.5 | 210.8 | 7 | 354.0 | 238.8 | 7 | 395.5 | 266.7 | 7 | 436.9 | 294.7 | 7 | 478.4 | 322.7 |
| 8 | 271.9 | 183.4 | 8 | 313.4 | 211.4 | 8 | 354.8 | 239.3 | 8 | 396.3 | 267.3 | 8 | 437.7 | 295.3 | 8 | 479.2 | 323.2 |
| 9 | 272.8 | 184.0 | 9 | 314.2 | 211.9 | 9 | 355.7 | 239.9 | 9 | 397.1 | 267.9 | 9 | 438.6 | 295.8 | 9 | 480.0 | 323.8 |
| 330 | 273.6 | 184.5 | 380 | 315.0 | 212.5 | 430 | 356.5 | 240.5 | 480 | 397.9 | 268.4 | 530 | 439.4 | 296.4 | 580 | 480.8 | 324.3 |
| 1 | 274.4 | 185.1 | 1 | 315.9 | 213.1 | 1 | 357.3 | 241.0 | 1 | 398.8 | 269.0 | 1 | 440.2 | 296.9 | 1 | 481.7 | 324.9 |
| 2 | 275.2 | 185.7 | 2 | 316.7 | 213.6 | 2 | 358.1 | 241.6 | 2 | 399.6 | 269.5 | 2 | 441.0 | 297.5 | 2 | 482.5 | 325.5 |
| 3 | 276.1 | 186.2 | 3 | 317.5 | 214.2 | 3 | 359.0 | 242.1 | 3 | 400.4 | 270.1 | 3 | 441.9 | 298.0 | 3 | 483.3 | 326.0 |
| 4 | 276.9 | 186.8 | 4 | 318.4 | 214.7 | 4 | 359.8 | 242.7 | 4 | 401.3 | 270.6 | 4 | 442.7 | 298.6 | 4 | 484.2 | 326.6 |
| 5 | 277.7 | 187.3 | 5 | 319.2 | 215.3 | 5 | 360.6 | 243.2 | 5 | 402.1 | 271.2 | 5 | 443.5 | 299.2 | 5 | 485.0 | 327.1 |
| 6 | 278.6 | 187.9 | 6 | 320.0 | 215.8 | 6 | 361.5 | 243.8 | 6 | 402.9 | 271.8 | 6 | 444.4 | 299.7 | 6 | 485.8 | 327.7 |
| 7 | 279.4 | 188.4 | 7 | 320.8 | 216.4 | 7 | 362.3 | 244.4 | 7 | 403.7 | 272.3 | 7 | 445.2 | 300.3 | 7 | 486.6 | 328.2 |
| 8 | 280.2 | 189.0 | 8 | 321.7 | 217.0 | 8 | 363.1 | 244.9 | 8 | 404.6 | 272.9 | 8 | 446.0 | 300.8 | 8 | 487.5 | 328.8 |
| 9 | 281.0 | 189.6 | 9 | 322.5 | 217.5 | 9 | 363.9 | 245.5 | 9 | 405.4 | 273.4 | 9 | 446.9 | 301.4 | 9 | 488.3 | 329.4 |
| 340 | 281.9 | 190.1 | 390 | 323.3 | 218.1 | 440 | 364.8 | 246.0 | 490 | 406.2 | 274.0 | 540 | 447.7 | 302.0 | 590 | 489.1 | 329.9 |
| 1 | 282.7 | 190.7 | 1 | 324.2 | 218.6 | 1 | 365.6 | 246.6 | 1 | 407.1 | 274.6 | 1 | 448.5 | 302.5 | 1 | 490.0 | 330.5 |
| 2 | 283.5 | 191.2 | 2 | 325.0 | 219.2 | 2 | 366.4 | 247.2 | 2 | 407.9 | 275.1 | 2 | 449.3 | 303.1 | 2 | 490.8 | 331.0 |
| 3 | 284.4 | 191.8 | 3 | 325.8 | 219.8 | 3 | 367.3 | 247.7 | 3 | 408.7 | 275.7 | 3 | 450.2 | 303.6 | 3 | 491.6 | 331.6 |
| 4 | 285.2 | 192.4 | 4 | 326.6 | 220.3 | 4 | 368.1 | 248.3 | 4 | 409.5 | 276.2 | 4 | 451.0 | 304.2 | 4 | 492.4 | 332.2 |
| 5 | 286.0 | 192.9 | 5 | 327.5 | 220.9 | 5 | 368.9 | 248.8 | 5 | 410.4 | 276.8 | 5 | 451.8 | 304.8 | 5 | 493.3 | 332.7 |
| 6 | 286.8 | 193.5 | 6 | 328.3 | 221.4 | 6 | 369.8 | 249.4 | 6 | 411.2 | 277.4 | 6 | 452.7 | 305.3 | 6 | 494.1 | 333.3 |
| 7 | 287.7 | 194.0 | 7 | 329.1 | 222.0 | 7 | 370.6 | 250.0 | 7 | 412.0 | 277.9 | 7 | 453.5 | 305.9 | 7 | 494.9 | 333.8 |
| 8 | 288.5 | 194.6 | 8 | 330.0 | 222.6 | 8 | 371.4 | 250.5 | 8 | 412.9 | 278.5 | 8 | 454.3 | 306.4 | 8 | 495.8 | 334.4 |
| 9 | 289.3 | 195.2 | 9 | 330.8 | 223.1 | 9 | 372.2 | 251.1 | 9 | 413.7 | 279.0 | 9 | 455.1 | 307.0 | 9 | 496.6 | 335.0 |
| D | ap | $\Delta \phi$ | D | ap | $\Delta \phi$ | D | ap | $\Delta \phi$ | D | ap | $\Delta \phi$ | D | ap | $\Delta \phi$ | D | ap | $\Delta \phi$ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 304 315
269 236 225

R

089 056° 045
091 124 135

R ou ϕ m

R

TABELA 1

R ou φm

359 325° 315
181 215 225

TÁBUAS DE CARTEAÇÃO

001 035 045
179 145 136

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 41.0 | 28.7 | 100 | 81.9 | 57.4 | 150 | 122.9 | 86.0 | 200 | 163.8 | 114.7 | 250 | 204.8 | 143.4 |
| 1 | 0.8 | 0.6 | 1 | 41.8 | 29.3 | 1 | 82.7 | 57.9 | 1 | 123.7 | 86.6 | 1 | 164.6 | 115.3 | 1 | 205.6 | 144.0 |
| 2 | 1.6 | 1.1 | 2 | 42.6 | 29.8 | 2 | 83.6 | 58.5 | 2 | 124.5 | 87.2 | 2 | 165.5 | 115.9 | 2 | 206.4 | 144.5 |
| 3 | 2.5 | 1.7 | 3 | 43.4 | 30.4 | 3 | 84.4 | 59.1 | 3 | 125.3 | 87.8 | 3 | 166.3 | 116.4 | 3 | 207.2 | 145.1 |
| 4 | 3.3 | 2.3 | 4 | 44.2 | 31.0 | 4 | 85.2 | 59.7 | 4 | 126.1 | 88.3 | 4 | 167.1 | 117.0 | 4 | 208.1 | 145.7 |
| 5 | 4.1 | 2.9 | 5 | 45.1 | 31.5 | 5 | 86.0 | 60.2 | 5 | 127.0 | 88.9 | 5 | 167.9 | 117.6 | 5 | 208.9 | 146.3 |
| 6 | 4.9 | 3.4 | 6 | 45.9 | 32.1 | 6 | 86.8 | 60.8 | 6 | 127.8 | 89.5 | 6 | 168.7 | 118.2 | 6 | 209.7 | 146.8 |
| 7 | 5.7 | 4.0 | 7 | 46.7 | 32.7 | 7 | 87.6 | 61.4 | 7 | 128.6 | 90.1 | 7 | 169.6 | 118.7 | 7 | 210.5 | 147.4 |
| 8 | 6.6 | 4.6 | 8 | 47.5 | 33.3 | 8 | 88.5 | 61.9 | 8 | 129.4 | 90.6 | 8 | 170.4 | 119.3 | 8 | 211.3 | 148.0 |
| 9 | 7.4 | 5.2 | 9 | 48.3 | 33.8 | 9 | 89.3 | 62.5 | 9 | 130.2 | 91.2 | 9 | 171.2 | 119.9 | 9 | 212.2 | 148.6 |
| 10 | 8.2 | 5.7 | 60 | 49.1 | 34.4 | 110 | 90.1 | 63.1 | 160 | 131.1 | 91.8 | 210 | 172.0 | 120.5 | 260 | 213.0 | 149.1 |
| 1 | 9.0 | 6.3 | 1 | 50.0 | 35.0 | 1 | 90.9 | 63.7 | 1 | 131.9 | 92.3 | 1 | 172.8 | 121.0 | 1 | 213.8 | 149.7 |
| 2 | 9.8 | 6.9 | 2 | 50.8 | 35.6 | 2 | 91.7 | 64.2 | 2 | 132.7 | 92.9 | 2 | 173.7 | 121.6 | 2 | 214.6 | 150.3 |
| 3 | 10.6 | 7.5 | 3 | 51.6 | 36.1 | 3 | 92.6 | 64.8 | 3 | 133.5 | 93.5 | 3 | 174.5 | 122.2 | 3 | 215.4 | 150.9 |
| 4 | 11.5 | 8.0 | 4 | 52.4 | 36.7 | 4 | 93.4 | 65.4 | 4 | 134.3 | 94.1 | 4 | 175.3 | 122.7 | 4 | 216.3 | 151.4 |
| 5 | 12.3 | 8.6 | 5 | 53.2 | 37.3 | 5 | 94.2 | 66.0 | 5 | 135.2 | 94.6 | 5 | 176.1 | 123.3 | 5 | 217.1 | 152.0 |
| 6 | 13.1 | 9.2 | 6 | 54.1 | 37.9 | 6 | 95.0 | 66.5 | 6 | 136.0 | 95.2 | 6 | 176.9 | 123.9 | 6 | 217.9 | 152.6 |
| 7 | 13.9 | 9.8 | 7 | 54.9 | 38.4 | 7 | 95.8 | 67.1 | 7 | 136.8 | 95.8 | 7 | 177.8 | 124.5 | 7 | 218.7 | 153.1 |
| 8 | 14.7 | 10.3 | 8 | 55.7 | 39.0 | 8 | 96.7 | 67.7 | 8 | 137.6 | 96.4 | 8 | 178.6 | 125.0 | 8 | 219.5 | 153.7 |
| 9 | 15.6 | 10.9 | 9 | 56.5 | 39.6 | 9 | 97.5 | 68.3 | 9 | 138.4 | 96.9 | 9 | 179.4 | 125.6 | 9 | 220.4 | 154.3 |
| 20 | 16.4 | 11.5 | 70 | 57.3 | 40.2 | 120 | 98.3 | 68.8 | 170 | 139.3 | 97.5 | 220 | 180.2 | 126.2 | 270 | 221.2 | 154.9 |
| 1 | 17.2 | 12.0 | 1 | 58.2 | 40.7 | 1 | 99.1 | 69.4 | 1 | 140.1 | 98.1 | 1 | 181.0 | 126.8 | 1 | 222.0 | 155.4 |
| 2 | 18.0 | 12.6 | 2 | 59.0 | 41.3 | 2 | 99.9 | 70.0 | 2 | 140.9 | 98.7 | 2 | 181.9 | 127.3 | 2 | 222.8 | 156.0 |
| 3 | 18.8 | 13.2 | 3 | 59.8 | 41.9 | 3 | 100.8 | 70.5 | 3 | 141.7 | 99.2 | 3 | 182.7 | 127.9 | 3 | 223.6 | 156.6 |
| 4 | 19.7 | 13.8 | 4 | 60.6 | 42.4 | 4 | 101.6 | 71.1 | 4 | 142.5 | 99.8 | 4 | 183.5 | 128.5 | 4 | 224.4 | 157.2 |
| 5 | 20.5 | 14.3 | 5 | 61.4 | 43.0 | 5 | 102.4 | 71.7 | 5 | 143.4 | 100.4 | 5 | 184.3 | 129.1 | 5 | 225.3 | 157.7 |
| 6 | 21.3 | 14.9 | 6 | 62.3 | 43.6 | 6 | 103.2 | 72.3 | 6 | 144.2 | 100.9 | 6 | 185.1 | 129.6 | 6 | 226.1 | 158.3 |
| 7 | 22.1 | 15.5 | 7 | 63.1 | 44.2 | 7 | 104.0 | 72.8 | 7 | 145.0 | 101.5 | 7 | 185.9 | 130.2 | 7 | 226.9 | 158.9 |
| 8 | 22.9 | 16.1 | 8 | 63.9 | 44.7 | 8 | 104.9 | 73.4 | 8 | 145.8 | 102.1 | 8 | 186.8 | 130.8 | 8 | 227.7 | 159.5 |
| 9 | 23.8 | 16.6 | 9 | 64.7 | 45.3 | 9 | 105.7 | 74.0 | 9 | 146.6 | 102.7 | 9 | 187.6 | 131.3 | 9 | 228.5 | 160.0 |
| 30 | 24.6 | 17.2 | 80 | 65.5 | 45.9 | 130 | 106.5 | 74.6 | 180 | 147.4 | 103.2 | 230 | 188.4 | 131.9 | 280 | 229.4 | 160.6 |
| 1 | 25.4 | 17.8 | 1 | 66.4 | 46.5 | 1 | 107.3 | 75.1 | 1 | 148.3 | 103.8 | 1 | 189.2 | 132.5 | 1 | 230.2 | 161.2 |
| 2 | 26.2 | 18.4 | 2 | 67.2 | 47.0 | 2 | 108.1 | 75.7 | 2 | 149.1 | 104.4 | 2 | 190.0 | 133.1 | 2 | 231.0 | 161.7 |
| 3 | 27.0 | 18.9 | 3 | 68.0 | 47.6 | 3 | 108.9 | 76.3 | 3 | 149.9 | 105.0 | 3 | 190.9 | 133.6 | 3 | 231.8 | 162.3 |
| 4 | 27.9 | 19.5 | 4 | 68.8 | 48.2 | 4 | 109.8 | 76.9 | 4 | 150.7 | 105.5 | 4 | 191.7 | 134.2 | 4 | 232.6 | 162.9 |
| 5 | 28.7 | 20.1 | 5 | 69.6 | 48.8 | 5 | 110.6 | 77.4 | 5 | 151.5 | 106.1 | 5 | 192.5 | 134.8 | 5 | 233.5 | 163.5 |
| 6 | 29.5 | 20.6 | 6 | 70.4 | 49.3 | 6 | 111.4 | 78.0 | 6 | 152.4 | 106.7 | 6 | 193.3 | 135.4 | 6 | 234.3 | 164.0 |
| 7 | 30.3 | 21.2 | 7 | 71.3 | 49.9 | 7 | 112.2 | 78.6 | 7 | 153.2 | 107.3 | 7 | 194.1 | 135.9 | 7 | 235.1 | 164.6 |
| 8 | 31.1 | 21.8 | 8 | 72.1 | 50.5 | 8 | 113.0 | 79.2 | 8 | 154.0 | 107.8 | 8 | 195.0 | 136.5 | 8 | 235.9 | 165.2 |
| 9 | 31.9 | 22.4 | 9 | 72.9 | 51.0 | 9 | 113.9 | 79.7 | 9 | 154.8 | 108.4 | 9 | 195.8 | 137.1 | 9 | 236.7 | 165.8 |
| 40 | 32.8 | 22.9 | 90 | 73.7 | 51.6 | 140 | 114.7 | 80.3 | 190 | 155.6 | 109.0 | 240 | 196.6 | 137.7 | 290 | 237.6 | 166.3 |
| 1 | 33.6 | 23.5 | 1 | 74.5 | 52.2 | 1 | 115.5 | 80.9 | 1 | 156.5 | 109.6 | 1 | 197.4 | 138.2 | 1 | 238.4 | 166.9 |
| 2 | 34.4 | 24.1 | 2 | 75.4 | 52.8 | 2 | 116.3 | 81.4 | 2 | 157.3 | 110.1 | 2 | 198.2 | 138.8 | 2 | 239.2 | 167.5 |
| 3 | 35.2 | 24.7 | 3 | 76.2 | 53.3 | 3 | 117.1 | 82.0 | 3 | 158.1 | 110.7 | 3 | 199.1 | 139.4 | 3 | 240.0 | 168.1 |
| 4 | 36.0 | 25.2 | 4 | 77.0 | 53.9 | 4 | 118.0 | 82.6 | 4 | 158.9 | 111.3 | 4 | 199.9 | 140.0 | 4 | 240.8 | 168.6 |
| 5 | 36.9 | 25.8 | 5 | 77.8 | 54.5 | 5 | 118.8 | 83.2 | 5 | 159.7 | 111.8 | 5 | 200.7 | 140.5 | 5 | 241.6 | 169.2 |
| 6 | 37.7 | 26.4 | 6 | 78.6 | 55.1 | 6 | 119.6 | 83.7 | 6 | 160.6 | 112.4 | 6 | 201.5 | 141.1 | 6 | 242.5 | 169.8 |
| 7 | 38.5 | 27.0 | 7 | 79.5 | 55.6 | 7 | 120.4 | 84.3 | 7 | 161.4 | 113.0 | 7 | 202.3 | 141.7 | 7 | 243.3 | 170.4 |
| 8 | 39.3 | 27.5 | 8 | 80.3 | 56.2 | 8 | 121.2 | 84.9 | 8 | 162.2 | 113.6 | 8 | 203.1 | 142.2 | 8 | 244.1 | 170.9 |
| 9 | 40.1 | 28.1 | 9 | 81.1 | 56.8 | 9 | 122.1 | 85.5 | 9 | 163.0 | 114.1 | 9 | 204.0 | 142.8 | 9 | 244.9 | 171.5 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 305 316
269 235 225

R

089 055° 045
091 125 135

R ou φm

R

TABELA 1

R ou φm

359 325° 315
181 215 225

TÁBUAS DE CARTEAÇÃO

001 035 045
179 145 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 245.7 | 172.1 | 350 | 286.7 | 200.8 | 400 | 327.7 | 229.4 | 450 | 368.6 | 258.1 | 500 | 409.6 | 286.8 | 550 | 450.5 | 315.5 |
| 1 | 246.6 | 172.6 | 1 | 287.5 | 201.3 | 1 | 328.5 | 230.0 | 1 | 369.4 | 258.7 | 1 | 410.4 | 287.4 | 1 | 451.4 | 316.0 |
| 2 | 247.4 | 173.2 | 2 | 288.3 | 201.9 | 2 | 329.3 | 230.6 | 2 | 370.3 | 259.3 | 2 | 411.2 | 287.9 | 2 | 452.2 | 316.6 |
| 3 | 248.2 | 173.8 | 3 | 289.2 | 202.5 | 3 | 330.1 | 231.2 | 3 | 371.1 | 259.8 | 3 | 412.0 | 288.5 | 3 | 453.0 | 317.2 |
| 4 | 249.0 | 174.4 | 4 | 290.0 | 203.0 | 4 | 330.9 | 231.7 | 4 | 371.9 | 260.4 | 4 | 412.9 | 289.1 | 4 | 453.8 | 317.8 |
| 5 | 249.8 | 174.9 | 5 | 290.8 | 203.6 | 5 | 331.8 | 232.3 | 5 | 372.7 | 261.0 | 5 | 413.7 | 289.7 | 5 | 454.6 | 318.3 |
| 6 | 250.7 | 175.5 | 6 | 291.6 | 204.2 | 6 | 332.6 | 232.9 | 6 | 373.5 | 261.6 | 6 | 414.5 | 290.2 | 6 | 455.4 | 318.9 |
| 7 | 251.5 | 176.1 | 7 | 292.4 | 204.8 | 7 | 333.4 | 233.4 | 7 | 374.4 | 262.1 | 7 | 415.3 | 290.8 | 7 | 456.3 | 319.5 |
| 8 | 252.3 | 176.7 | 8 | 293.3 | 205.3 | 8 | 334.2 | 234.0 | 8 | 375.2 | 262.7 | 8 | 416.1 | 291.4 | 8 | 457.1 | 320.1 |
| 9 | 253.1 | 177.2 | 9 | 294.1 | 205.9 | 9 | 335.0 | 234.6 | 9 | 376.0 | 263.3 | 9 | 416.9 | 292.0 | 9 | 457.9 | 320.6 |
| 310 | 253.9 | 177.8 | 360 | 294.9 | 206.5 | 410 | 335.9 | 235.2 | 460 | 376.8 | 263.8 | 510 | 417.8 | 292.5 | 560 | 458.7 | 321.2 |
| 1 | 254.8 | 178.4 | 1 | 295.7 | 207.1 | 1 | 336.7 | 235.7 | 1 | 377.6 | 264.4 | 1 | 418.6 | 293.1 | 1 | 459.5 | 321.8 |
| 2 | 255.6 | 179.0 | 2 | 296.5 | 207.6 | 2 | 337.5 | 236.3 | 2 | 378.4 | 265.0 | 2 | 419.4 | 293.7 | 2 | 460.4 | 322.3 |
| 3 | 256.4 | 179.5 | 3 | 297.4 | 208.2 | 3 | 338.3 | 236.9 | 3 | 379.3 | 265.6 | 3 | 420.2 | 294.2 | 3 | 461.2 | 322.9 |
| 4 | 257.2 | 180.1 | 4 | 298.2 | 208.8 | 4 | 339.1 | 237.5 | 4 | 380.1 | 266.1 | 4 | 421.0 | 294.8 | 4 | 462.0 | 323.5 |
| 5 | 258.0 | 180.7 | 5 | 299.0 | 209.4 | 5 | 339.9 | 238.0 | 5 | 380.9 | 266.7 | 5 | 421.9 | 295.4 | 5 | 462.8 | 324.1 |
| 6 | 258.9 | 181.3 | 6 | 299.8 | 209.9 | 6 | 340.8 | 238.6 | 6 | 381.7 | 267.3 | 6 | 422.7 | 296.0 | 6 | 463.6 | 324.6 |
| 7 | 259.7 | 181.8 | 7 | 300.6 | 210.5 | 7 | 341.6 | 239.2 | 7 | 382.5 | 267.9 | 7 | 423.5 | 296.5 | 7 | 464.5 | 325.2 |
| 8 | 260.5 | 182.4 | 8 | 301.4 | 211.1 | 8 | 342.4 | 239.8 | 8 | 383.4 | 268.4 | 8 | 424.3 | 297.1 | 8 | 465.3 | 325.8 |
| 9 | 261.3 | 183.0 | 9 | 302.3 | 211.6 | 9 | 343.2 | 240.3 | 9 | 384.2 | 269.0 | 9 | 425.1 | 297.7 | 9 | 466.1 | 326.4 |
| 320 | 262.1 | 183.5 | 370 | 303.1 | 212.2 | 420 | 344.0 | 240.9 | 470 | 385.0 | 269.6 | 520 | 426.0 | 298.3 | 570 | 466.9 | 326.9 |
| 1 | 262.9 | 184.1 | 1 | 303.9 | 212.8 | 1 | 344.9 | 241.5 | 1 | 385.8 | 270.2 | 1 | 426.8 | 298.8 | 1 | 467.7 | 327.5 |
| 2 | 263.8 | 184.7 | 2 | 304.7 | 213.4 | 2 | 345.7 | 242.0 | 2 | 386.6 | 270.7 | 2 | 427.6 | 299.4 | 2 | 468.6 | 328.1 |
| 3 | 264.6 | 185.3 | 3 | 305.5 | 213.9 | 3 | 346.5 | 242.6 | 3 | 387.5 | 271.3 | 3 | 428.4 | 300.0 | 3 | 469.4 | 328.7 |
| 4 | 265.4 | 185.8 | 4 | 306.4 | 214.5 | 4 | 347.3 | 243.2 | 4 | 388.3 | 271.9 | 4 | 429.2 | 300.6 | 4 | 470.2 | 329.2 |
| 5 | 266.2 | 186.4 | 5 | 307.2 | 215.1 | 5 | 348.1 | 243.8 | 5 | 389.1 | 272.4 | 5 | 430.1 | 301.1 | 5 | 471.0 | 329.8 |
| 6 | 267.0 | 187.0 | 6 | 308.0 | 215.7 | 6 | 349.0 | 244.3 | 6 | 389.9 | 273.0 | 6 | 430.9 | 301.7 | 6 | 471.8 | 330.4 |
| 7 | 267.9 | 187.6 | 7 | 308.8 | 216.2 | 7 | 349.8 | 244.9 | 7 | 390.7 | 273.6 | 7 | 431.7 | 302.3 | 7 | 472.7 | 331.0 |
| 8 | 268.7 | 188.1 | 8 | 309.6 | 216.8 | 8 | 350.6 | 245.5 | 8 | 391.6 | 274.2 | 8 | 432.5 | 302.8 | 8 | 473.5 | 331.5 |
| 9 | 269.5 | 188.7 | 9 | 310.5 | 217.4 | 9 | 351.4 | 246.1 | 9 | 392.4 | 274.7 | 9 | 433.3 | 303.4 | 9 | 474.3 | 332.1 |
| 330 | 270.3 | 189.3 | 380 | 311.3 | 218.0 | 430 | 352.2 | 246.6 | 480 | 393.2 | 275.3 | 530 | 434.2 | 304.0 | 580 | 475.1 | 332.7 |
| 1 | 271.1 | 189.9 | 1 | 312.1 | 218.5 | 1 | 353.1 | 247.2 | 1 | 394.0 | 275.9 | 1 | 435.0 | 304.6 | 1 | 475.9 | 333.2 |
| 2 | 272.0 | 190.4 | 2 | 312.9 | 219.1 | 2 | 353.9 | 247.8 | 2 | 394.8 | 276.5 | 2 | 435.8 | 305.1 | 2 | 476.7 | 333.8 |
| 3 | 272.8 | 191.0 | 3 | 313.7 | 219.7 | 3 | 354.7 | 248.4 | 3 | 395.7 | 277.0 | 3 | 436.6 | 305.7 | 3 | 477.6 | 334.4 |
| 4 | 273.6 | 191.6 | 4 | 314.6 | 220.3 | 4 | 355.5 | 248.9 | 4 | 396.5 | 277.6 | 4 | 437.4 | 306.3 | 4 | 478.4 | 335.0 |
| 5 | 274.4 | 192.1 | 5 | 315.4 | 220.8 | 5 | 356.3 | 249.5 | 5 | 397.3 | 278.2 | 5 | 438.2 | 306.9 | 5 | 479.2 | 335.5 |
| 6 | 275.2 | 192.7 | 6 | 316.2 | 221.4 | 6 | 357.2 | 250.1 | 6 | 398.1 | 278.8 | 6 | 439.1 | 307.4 | 6 | 480.0 | 336.1 |
| 7 | 276.1 | 193.3 | 7 | 317.0 | 222.0 | 7 | 358.0 | 250.7 | 7 | 398.9 | 279.3 | 7 | 439.9 | 308.0 | 7 | 480.8 | 336.7 |
| 8 | 276.9 | 193.9 | 8 | 317.8 | 222.5 | 8 | 358.8 | 251.2 | 8 | 399.7 | 279.9 | 8 | 440.7 | 308.6 | 8 | 481.7 | 337.3 |
| 9 | 277.7 | 194.4 | 9 | 318.7 | 223.1 | 9 | 359.6 | 251.8 | 9 | 400.6 | 280.5 | 9 | 441.5 | 309.2 | 9 | 482.5 | 337.8 |
| 340 | 278.5 | 195.0 | 390 | 319.5 | 223.7 | 440 | 360.4 | 252.4 | 490 | 401.4 | 281.1 | 540 | 442.3 | 309.7 | 590 | 483.3 | 338.4 |
| 1 | 279.3 | 195.6 | 1 | 320.3 | 224.3 | 1 | 361.2 | 252.9 | 1 | 402.2 | 281.6 | 1 | 443.2 | 310.3 | 1 | 484.1 | 339.0 |
| 2 | 280.1 | 196.2 | 2 | 321.1 | 224.8 | 2 | 362.1 | 253.5 | 2 | 403.0 | 282.2 | 2 | 444.0 | 310.9 | 2 | 484.9 | 339.6 |
| 3 | 281.0 | 196.7 | 3 | 321.9 | 225.4 | 3 | 362.9 | 254.1 | 3 | 403.8 | 282.8 | 3 | 444.8 | 311.5 | 3 | 485.8 | 340.1 |
| 4 | 281.8 | 197.3 | 4 | 322.7 | 226.0 | 4 | 363.7 | 254.7 | 4 | 404.7 | 283.3 | 4 | 445.6 | 312.0 | 4 | 486.6 | 340.7 |
| 5 | 282.6 | 197.9 | 5 | 323.6 | 226.6 | 5 | 364.5 | 255.2 | 5 | 405.5 | 283.9 | 5 | 446.4 | 312.6 | 5 | 487.4 | 341.3 |
| 6 | 283.4 | 198.5 | 6 | 324.4 | 227.1 | 6 | 365.3 | 255.8 | 6 | 406.3 | 284.5 | 6 | 447.3 | 313.2 | 6 | 488.2 | 341.9 |
| 7 | 284.2 | 199.0 | 7 | 325.2 | 227.7 | 7 | 366.2 | 256.4 | 7 | 407.1 | 285.1 | 7 | 448.1 | 313.7 | 7 | 489.0 | 342.4 |
| 8 | 285.1 | 199.6 | 8 | 326.0 | 228.3 | 8 | 367.0 | 257.0 | 8 | 407.9 | 285.6 | 8 | 448.9 | 314.3 | 8 | 489.9 | 343.0 |
| 9 | 285.9 | 200.2 | 9 | 326.8 | 228.9 | 9 | 367.8 | 257.5 | 9 | 408.8 | 286.2 | 9 | 449.7 | 314.9 | 9 | 490.7 | 343.6 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 305 315
269 235 225

R

089 055° 045
091 125 135

R ou φm

R

TABELA 1

R ou φm

359 324° 315
181 216 226

TÁBUAS DE CARTEAÇÃO

001 036 045
179 144 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 40.5 | 29.4 | 100 | 80.9 | 58.8 | 150 | 121.4 | 88.2 | 200 | 161.8 | 117.6 | 250 | 202.3 | 146.9 |
| 1 | 0.8 | 0.6 | 1 | 41.3 | 30.0 | 1 | 81.7 | 59.4 | 1 | 122.2 | 88.8 | 1 | 162.6 | 118.1 | 1 | 203.1 | 147.5 |
| 2 | 1.6 | 1.2 | 2 | 42.1 | 30.6 | 2 | 82.5 | 60.0 | 2 | 123.0 | 89.3 | 2 | 163.4 | 118.7 | 2 | 203.9 | 148.1 |
| 3 | 2.4 | 1.8 | 3 | 42.9 | 31.2 | 3 | 83.3 | 60.5 | 3 | 123.8 | 89.9 | 3 | 164.2 | 119.3 | 3 | 204.7 | 148.7 |
| 4 | 3.2 | 2.4 | 4 | 43.7 | 31.7 | 4 | 84.1 | 61.1 | 4 | 124.6 | 90.5 | 4 | 165.0 | 119.9 | 4 | 205.5 | 149.3 |
| 5 | 4.0 | 2.9 | 5 | 44.5 | 32.3 | 5 | 84.9 | 61.7 | 5 | 125.4 | 91.1 | 5 | 165.8 | 120.5 | 5 | 206.3 | 149.9 |
| 6 | 4.9 | 3.5 | 6 | 45.3 | 32.9 | 6 | 85.8 | 62.3 | 6 | 126.2 | 91.7 | 6 | 166.7 | 121.1 | 6 | 207.1 | 150.5 |
| 7 | 5.7 | 4.1 | 7 | 46.1 | 33.5 | 7 | 86.6 | 62.9 | 7 | 127.0 | 92.3 | 7 | 167.5 | 121.7 | 7 | 207.9 | 151.1 |
| 8 | 6.5 | 4.7 | 8 | 46.9 | 34.1 | 8 | 87.4 | 63.5 | 8 | 127.8 | 92.9 | 8 | 168.3 | 122.3 | 8 | 208.7 | 151.6 |
| 9 | 7.3 | 5.3 | 9 | 47.7 | 34.7 | 9 | 88.2 | 64.1 | 9 | 128.6 | 93.5 | 9 | 169.1 | 122.8 | 9 | 209.5 | 152.2 |
| 10 | 8.1 | 5.9 | 60 | 48.5 | 35.3 | 110 | 89.0 | 64.7 | 160 | 129.4 | 94.0 | 210 | 169.9 | 123.4 | 260 | 210.3 | 152.8 |
| 1 | 8.9 | 6.5 | 1 | 49.4 | 35.9 | 1 | 89.8 | 65.2 | 1 | 130.3 | 94.6 | 1 | 170.7 | 124.0 | 1 | 211.2 | 153.4 |
| 2 | 9.7 | 7.1 | 2 | 50.2 | 36.4 | 2 | 90.6 | 65.8 | 2 | 131.1 | 95.2 | 2 | 171.5 | 124.6 | 2 | 212.0 | 154.0 |
| 3 | 10.5 | 7.6 | 3 | 51.0 | 37.0 | 3 | 91.4 | 66.4 | 3 | 131.9 | 95.8 | 3 | 172.3 | 125.2 | 3 | 212.8 | 154.6 |
| 4 | 11.3 | 8.2 | 4 | 51.8 | 37.6 | 4 | 92.2 | 67.0 | 4 | 132.7 | 96.4 | 4 | 173.1 | 125.8 | 4 | 213.6 | 155.2 |
| 5 | 12.1 | 8.8 | 5 | 52.6 | 38.2 | 5 | 93.0 | 67.6 | 5 | 133.5 | 97.0 | 5 | 173.9 | 126.4 | 5 | 214.4 | 155.8 |
| 6 | 12.9 | 9.4 | 6 | 53.4 | 38.8 | 6 | 93.8 | 68.2 | 6 | 134.3 | 97.6 | 6 | 174.7 | 127.0 | 6 | 215.2 | 156.4 |
| 7 | 13.8 | 10.0 | 7 | 54.2 | 39.4 | 7 | 94.7 | 68.8 | 7 | 135.1 | 98.2 | 7 | 175.6 | 127.5 | 7 | 216.0 | 156.9 |
| 8 | 14.6 | 10.6 | 8 | 55.0 | 40.0 | 8 | 95.5 | 69.4 | 8 | 135.9 | 98.7 | 8 | 176.4 | 128.1 | 8 | 216.8 | 157.5 |
| 9 | 15.4 | 11.2 | 9 | 55.8 | 40.6 | 9 | 96.3 | 69.9 | 9 | 136.7 | 99.3 | 9 | 177.2 | 128.7 | 9 | 217.6 | 158.1 |
| 20 | 16.2 | 11.8 | 70 | 56.6 | 41.1 | 120 | 97.1 | 70.5 | 170 | 137.5 | 99.9 | 220 | 178.0 | 129.3 | 270 | 218.4 | 158.7 |
| 1 | 17.0 | 12.3 | 1 | 57.4 | 41.7 | 1 | 97.9 | 71.1 | 1 | 138.3 | 100.5 | 1 | 178.8 | 129.9 | 1 | 219.2 | 159.3 |
| 2 | 17.8 | 12.9 | 2 | 58.2 | 42.3 | 2 | 98.7 | 71.7 | 2 | 139.2 | 101.1 | 2 | 179.6 | 130.5 | 2 | 220.1 | 159.9 |
| 3 | 18.6 | 13.5 | 3 | 59.1 | 42.9 | 3 | 99.5 | 72.3 | 3 | 140.0 | 101.7 | 3 | 180.4 | 131.1 | 3 | 220.9 | 160.5 |
| 4 | 19.4 | 14.1 | 4 | 59.9 | 43.5 | 4 | 100.3 | 72.9 | 4 | 140.8 | 102.3 | 4 | 181.2 | 131.7 | 4 | 221.7 | 161.1 |
| 5 | 20.2 | 14.7 | 5 | 60.7 | 44.1 | 5 | 101.1 | 73.5 | 5 | 141.6 | 102.9 | 5 | 182.0 | 132.3 | 5 | 222.5 | 161.6 |
| 6 | 21.0 | 15.3 | 6 | 61.5 | 44.7 | 6 | 101.9 | 74.1 | 6 | 142.4 | 103.5 | 6 | 182.8 | 132.8 | 6 | 223.3 | 162.2 |
| 7 | 21.8 | 15.9 | 7 | 62.3 | 45.3 | 7 | 102.7 | 74.6 | 7 | 143.2 | 104.0 | 7 | 183.6 | 133.4 | 7 | 224.1 | 162.8 |
| 8 | 22.7 | 16.5 | 8 | 63.1 | 45.8 | 8 | 103.6 | 75.2 | 8 | 144.0 | 104.6 | 8 | 184.5 | 134.0 | 8 | 224.9 | 163.4 |
| 9 | 23.5 | 17.0 | 9 | 63.9 | 46.4 | 9 | 104.4 | 75.8 | 9 | 144.8 | 105.2 | 9 | 185.3 | 134.6 | 9 | 225.7 | 164.0 |
| 30 | 24.3 | 17.6 | 80 | 64.7 | 47.0 | 130 | 105.2 | 76.4 | 180 | 145.6 | 105.8 | 230 | 186.1 | 135.2 | 280 | 226.5 | 164.6 |
| 1 | 25.1 | 18.2 | 1 | 65.5 | 47.6 | 1 | 106.0 | 77.0 | 1 | 146.4 | 106.4 | 1 | 186.9 | 135.8 | 1 | 227.3 | 165.2 |
| 2 | 25.9 | 18.8 | 2 | 66.3 | 48.2 | 2 | 106.8 | 77.6 | 2 | 147.2 | 107.0 | 2 | 187.7 | 136.4 | 2 | 228.1 | 165.8 |
| 3 | 26.7 | 19.4 | 3 | 67.1 | 48.8 | 3 | 107.6 | 78.2 | 3 | 148.1 | 107.6 | 3 | 188.5 | 137.0 | 3 | 229.0 | 166.3 |
| 4 | 27.5 | 20.0 | 4 | 68.0 | 49.4 | 4 | 108.4 | 78.8 | 4 | 148.9 | 108.2 | 4 | 189.3 | 137.5 | 4 | 229.8 | 166.9 |
| 5 | 28.3 | 20.6 | 5 | 68.8 | 50.0 | 5 | 109.2 | 79.4 | 5 | 149.7 | 108.7 | 5 | 190.1 | 138.1 | 5 | 230.6 | 167.5 |
| 6 | 29.1 | 21.2 | 6 | 69.6 | 50.5 | 6 | 110.0 | 79.9 | 6 | 150.5 | 109.3 | 6 | 190.9 | 138.7 | 6 | 231.4 | 168.1 |
| 7 | 29.9 | 21.7 | 7 | 70.4 | 51.1 | 7 | 110.8 | 80.5 | 7 | 151.3 | 109.9 | 7 | 191.7 | 139.3 | 7 | 232.2 | 168.7 |
| 8 | 30.7 | 22.3 | 8 | 71.2 | 51.7 | 8 | 111.6 | 81.1 | 8 | 152.1 | 110.5 | 8 | 192.5 | 139.9 | 8 | 233.0 | 169.3 |
| 9 | 31.6 | 22.9 | 9 | 72.0 | 52.3 | 9 | 112.5 | 81.7 | 9 | 152.9 | 111.1 | 9 | 193.4 | 140.5 | 9 | 233.8 | 169.9 |
| 40 | 32.4 | 23.5 | 90 | 72.8 | 52.9 | 140 | 113.3 | 82.3 | 190 | 153.7 | 111.7 | 240 | 194.2 | 141.1 | 290 | 234.6 | 170.5 |
| 1 | 33.2 | 24.1 | 1 | 73.6 | 53.5 | 1 | 114.1 | 82.9 | 1 | 154.5 | 112.3 | 1 | 195.0 | 141.7 | 1 | 235.4 | 171.0 |
| 2 | 34.0 | 24.7 | 2 | 74.4 | 54.1 | 2 | 114.9 | 83.5 | 2 | 155.3 | 112.9 | 2 | 195.8 | 142.2 | 2 | 236.2 | 171.6 |
| 3 | 34.8 | 25.3 | 3 | 75.2 | 54.7 | 3 | 115.7 | 84.1 | 3 | 156.1 | 113.4 | 3 | 196.6 | 142.8 | 3 | 237.0 | 172.2 |
| 4 | 35.6 | 25.9 | 4 | 76.0 | 55.3 | 4 | 116.5 | 84.6 | 4 | 156.9 | 114.0 | 4 | 197.4 | 143.4 | 4 | 237.9 | 172.8 |
| 5 | 36.4 | 26.5 | 5 | 76.9 | 55.8 | 5 | 117.3 | 85.2 | 5 | 157.8 | 114.6 | 5 | 198.2 | 144.0 | 5 | 238.7 | 173.4 |
| 6 | 37.2 | 27.0 | 6 | 77.7 | 56.4 | 6 | 118.1 | 85.8 | 6 | 158.6 | 115.2 | 6 | 199.0 | 144.6 | 6 | 239.5 | 174.0 |
| 7 | 38.0 | 27.6 | 7 | 78.5 | 57.0 | 7 | 118.9 | 86.4 | 7 | 159.4 | 115.8 | 7 | 199.8 | 145.2 | 7 | 240.3 | 174.6 |
| 8 | 38.8 | 28.2 | 8 | 79.3 | 57.6 | 8 | 119.7 | 87.0 | 8 | 160.2 | 116.4 | 8 | 200.6 | 145.8 | 8 | 241.1 | 175.2 |
| 9 | 39.6 | 28.8 | 9 | 80.1 | 58.2 | 9 | 120.5 | 87.6 | 9 | 161.0 | 117.0 | 9 | 201.4 | 146.4 | 9 | 241.9 | 175.7 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 306 315
269 234 225

R

089 054° 045
091 126 135

R ou φm

R

TABELA 1

R ou φm

358 324° 315

181 216 225

TÁBUAS DE CARTEAÇÃO

001 036 045

179 144 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 242.7 | 176.3 | 350 | 283.2 | 205.7 | 400 | 323.6 | 235.1 | 450 | 364.1 | 264.5 | 500 | 404.5 | 293.9 | 550 | 445.0 | 323.3 |
| 1 | 243.5 | 176.9 | 1 | 284.0 | 206.3 | 1 | 324.4 | 235.7 | 1 | 364.9 | 265.1 | 1 | 405.3 | 294.5 | 1 | 445.8 | 323.9 |
| 2 | 244.3 | 177.5 | 2 | 284.8 | 206.9 | 2 | 325.2 | 236.3 | 2 | 365.7 | 265.7 | 2 | 406.1 | 295.1 | 2 | 446.6 | 324.5 |
| 3 | 245.1 | 178.1 | 3 | 285.6 | 207.5 | 3 | 326.0 | 236.9 | 3 | 366.5 | 266.3 | 3 | 406.9 | 295.7 | 3 | 447.4 | 325.0 |
| 4 | 245.9 | 178.7 | 4 | 286.4 | 208.1 | 4 | 326.8 | 237.5 | 4 | 367.3 | 266.9 | 4 | 407.7 | 296.2 | 4 | 448.2 | 325.6 |
| 5 | 246.8 | 179.3 | 5 | 287.2 | 208.7 | 5 | 327.7 | 238.1 | 5 | 368.1 | 267.4 | 5 | 408.6 | 296.8 | 5 | 449.0 | 326.2 |
| 6 | 247.6 | 179.9 | 6 | 288.0 | 209.3 | 6 | 328.5 | 238.6 | 6 | 368.9 | 268.0 | 6 | 409.4 | 297.4 | 6 | 449.8 | 326.8 |
| 7 | 248.4 | 180.5 | 7 | 288.8 | 209.8 | 7 | 329.3 | 239.2 | 7 | 369.7 | 268.6 | 7 | 410.2 | 298.0 | 7 | 450.6 | 327.4 |
| 8 | 249.2 | 181.0 | 8 | 289.6 | 210.4 | 8 | 330.1 | 239.8 | 8 | 370.5 | 269.2 | 8 | 411.0 | 298.6 | 8 | 451.4 | 328.0 |
| 9 | 250.0 | 181.6 | 9 | 290.4 | 211.0 | 9 | 330.9 | 240.4 | 9 | 371.3 | 269.8 | 9 | 411.8 | 299.2 | 9 | 452.2 | 328.6 |
| 310 | 250.8 | 182.2 | 360 | 291.2 | 211.6 | 410 | 331.7 | 241.0 | 460 | 372.1 | 270.4 | 510 | 412.6 | 299.8 | 560 | 453.0 | 329.2 |
| 1 | 251.6 | 182.8 | 1 | 292.1 | 212.2 | 1 | 332.5 | 241.6 | 1 | 373.0 | 271.0 | 1 | 413.4 | 300.4 | 1 | 453.9 | 329.7 |
| 2 | 252.4 | 183.4 | 2 | 292.9 | 212.8 | 2 | 333.3 | 242.2 | 2 | 373.8 | 271.6 | 2 | 414.2 | 300.9 | 2 | 454.7 | 330.3 |
| 3 | 253.2 | 184.0 | 3 | 293.7 | 213.4 | 3 | 334.1 | 242.8 | 3 | 374.6 | 272.1 | 3 | 415.0 | 301.5 | 3 | 455.5 | 330.9 |
| 4 | 254.0 | 184.6 | 4 | 294.5 | 214.0 | 4 | 334.9 | 243.3 | 4 | 375.4 | 272.7 | 4 | 415.8 | 302.1 | 4 | 456.3 | 331.5 |
| 5 | 254.8 | 185.2 | 5 | 295.3 | 214.5 | 5 | 335.7 | 243.9 | 5 | 376.2 | 273.3 | 5 | 416.6 | 302.7 | 5 | 457.1 | 332.1 |
| 6 | 255.6 | 185.7 | 6 | 296.1 | 215.1 | 6 | 336.6 | 244.5 | 6 | 377.0 | 273.9 | 6 | 417.5 | 303.3 | 6 | 457.9 | 332.7 |
| 7 | 256.5 | 186.3 | 7 | 296.9 | 215.7 | 7 | 337.4 | 245.1 | 7 | 377.8 | 274.5 | 7 | 418.3 | 303.9 | 7 | 458.7 | 333.3 |
| 8 | 257.3 | 186.9 | 8 | 297.7 | 216.3 | 8 | 338.2 | 245.7 | 8 | 378.6 | 275.1 | 8 | 419.1 | 304.5 | 8 | 459.5 | 333.9 |
| 9 | 258.1 | 187.5 | 9 | 298.5 | 216.9 | 9 | 339.0 | 246.3 | 9 | 379.4 | 275.7 | 9 | 419.9 | 305.1 | 9 | 460.3 | 334.4 |
| 320 | 258.9 | 188.1 | 370 | 299.3 | 217.5 | 420 | 339.8 | 246.9 | 470 | 380.2 | 276.3 | 520 | 420.7 | 305.6 | 570 | 461.1 | 335.0 |
| 1 | 259.7 | 188.7 | 1 | 300.1 | 218.1 | 1 | 340.6 | 247.5 | 1 | 381.0 | 276.8 | 1 | 421.5 | 306.2 | 1 | 461.9 | 335.6 |
| 2 | 260.5 | 189.3 | 2 | 301.0 | 218.7 | 2 | 341.4 | 248.0 | 2 | 381.9 | 277.4 | 2 | 422.3 | 306.8 | 2 | 462.8 | 336.2 |
| 3 | 261.3 | 189.9 | 3 | 301.8 | 219.2 | 3 | 342.2 | 248.6 | 3 | 382.7 | 278.0 | 3 | 423.1 | 307.4 | 3 | 463.6 | 336.8 |
| 4 | 262.1 | 190.4 | 4 | 302.6 | 219.8 | 4 | 343.0 | 249.2 | 4 | 383.5 | 278.6 | 4 | 423.9 | 308.0 | 4 | 464.4 | 337.4 |
| 5 | 262.9 | 191.0 | 5 | 303.4 | 220.4 | 5 | 343.8 | 249.8 | 5 | 384.3 | 279.2 | 5 | 424.7 | 308.6 | 5 | 465.2 | 338.0 |
| 6 | 263.7 | 191.6 | 6 | 304.2 | 221.0 | 6 | 344.6 | 250.4 | 6 | 385.1 | 279.8 | 6 | 425.5 | 309.2 | 6 | 466.0 | 338.6 |
| 7 | 264.5 | 192.2 | 7 | 305.0 | 221.6 | 7 | 345.5 | 251.0 | 7 | 385.9 | 280.4 | 7 | 426.4 | 309.8 | 7 | 466.8 | 339.2 |
| 8 | 265.4 | 192.8 | 8 | 305.8 | 222.2 | 8 | 346.3 | 251.6 | 8 | 386.7 | 281.0 | 8 | 427.2 | 310.4 | 8 | 467.6 | 339.7 |
| 9 | 266.2 | 193.4 | 9 | 306.6 | 222.8 | 9 | 347.1 | 252.2 | 9 | 387.5 | 281.5 | 9 | 428.0 | 310.9 | 9 | 468.4 | 340.3 |
| 330 | 267.0 | 194.0 | 380 | 307.4 | 223.4 | 430 | 347.9 | 252.7 | 480 | 388.3 | 282.1 | 530 | 428.8 | 311.5 | 580 | 469.2 | 340.9 |
| 1 | 267.8 | 194.6 | 1 | 308.2 | 223.9 | 1 | 348.7 | 253.3 | 1 | 389.1 | 282.7 | 1 | 429.6 | 312.1 | 1 | 470.0 | 341.5 |
| 2 | 268.6 | 195.1 | 2 | 309.0 | 224.5 | 2 | 349.5 | 253.9 | 2 | 389.9 | 283.3 | 2 | 430.4 | 312.7 | 2 | 470.8 | 342.1 |
| 3 | 269.4 | 195.7 | 3 | 309.9 | 225.1 | 3 | 350.3 | 254.5 | 3 | 390.8 | 283.9 | 3 | 431.2 | 313.3 | 3 | 471.7 | 342.7 |
| 4 | 270.2 | 196.3 | 4 | 310.7 | 225.7 | 4 | 351.1 | 255.1 | 4 | 391.6 | 284.5 | 4 | 432.0 | 313.9 | 4 | 472.5 | 343.3 |
| 5 | 271.0 | 196.9 | 5 | 311.5 | 226.3 | 5 | 351.9 | 255.7 | 5 | 392.4 | 285.1 | 5 | 432.8 | 314.5 | 5 | 473.3 | 343.9 |
| 6 | 271.8 | 197.5 | 6 | 312.3 | 226.9 | 6 | 352.7 | 256.3 | 6 | 393.2 | 285.7 | 6 | 433.6 | 315.1 | 6 | 474.1 | 344.4 |
| 7 | 272.6 | 198.1 | 7 | 313.1 | 227.5 | 7 | 353.5 | 256.9 | 7 | 394.0 | 286.3 | 7 | 434.4 | 315.6 | 7 | 474.9 | 345.0 |
| 8 | 273.4 | 198.7 | 8 | 313.9 | 228.1 | 8 | 354.3 | 257.4 | 8 | 394.8 | 286.8 | 8 | 435.3 | 316.2 | 8 | 475.7 | 345.6 |
| 9 | 274.3 | 199.3 | 9 | 314.7 | 228.6 | 9 | 355.2 | 258.0 | 9 | 395.6 | 287.4 | 9 | 436.1 | 316.8 | 9 | 476.5 | 346.2 |
| 340 | 275.1 | 199.8 | 390 | 315.5 | 229.2 | 440 | 356.0 | 258.6 | 490 | 396.4 | 288.0 | 540 | 436.9 | 317.4 | 590 | 477.3 | 346.8 |
| 1 | 275.9 | 200.4 | 1 | 316.3 | 229.8 | 1 | 356.8 | 259.2 | 1 | 397.2 | 288.6 | 1 | 437.7 | 318.0 | 1 | 478.1 | 347.4 |
| 2 | 276.7 | 201.0 | 2 | 317.1 | 230.4 | 2 | 357.6 | 259.8 | 2 | 398.0 | 289.2 | 2 | 438.5 | 318.6 | 2 | 478.9 | 348.0 |
| 3 | 277.5 | 201.6 | 3 | 317.9 | 231.0 | 3 | 358.4 | 260.4 | 3 | 398.8 | 289.8 | 3 | 439.3 | 319.2 | 3 | 479.7 | 348.6 |
| 4 | 278.3 | 202.2 | 4 | 318.8 | 231.6 | 4 | 359.2 | 261.0 | 4 | 399.7 | 290.4 | 4 | 440.1 | 319.8 | 4 | 480.6 | 349.1 |
| 5 | 279.1 | 202.8 | 5 | 319.6 | 232.2 | 5 | 360.0 | 261.6 | 5 | 400.5 | 291.0 | 5 | 440.9 | 320.3 | 5 | 481.4 | 349.7 |
| 6 | 279.9 | 203.4 | 6 | 320.4 | 232.8 | 6 | 360.8 | 262.2 | 6 | 401.3 | 291.5 | 6 | 441.7 | 320.9 | 6 | 482.2 | 350.3 |
| 7 | 280.7 | 204.0 | 7 | 321.2 | 233.4 | 7 | 361.6 | 262.7 | 7 | 402.1 | 292.1 | 7 | 442.5 | 321.5 | 7 | 483.0 | 350.9 |
| 8 | 281.5 | 204.5 | 8 | 322.0 | 233.9 | 8 | 362.4 | 263.3 | 8 | 402.9 | 292.7 | 8 | 443.3 | 322.1 | 8 | 483.8 | 351.5 |
| 9 | 282.3 | 205.1 | 9 | 322.8 | 234.5 | 9 | 363.2 | 263.9 | 9 | 403.7 | 293.3 | 9 | 444.2 | 322.7 | 9 | 484.6 | 352.1 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 306 315

269 234 225

089 054° 045

091 126 135

R

R ou φm

R
359 323° 315
181 217 225

TABELA 1
TÁBUAS DE CARTEAÇÃO

R ou φm
001 037 045
179 143 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 39.9 | 30.1 | 100 | 79.9 | 60.2 | 150 | 119.8 | 90.3 | 200 | 159.7 | 120.4 | 250 | 199.7 | 150.5 |
| 1 | 0.8 | 0.6 | 1 | 40.7 | 30.7 | 1 | 80.7 | 60.8 | 1 | 120.6 | 90.9 | 1 | 160.5 | 121.0 | 1 | 200.5 | 151.1 |
| 2 | 1.6 | 1.2 | 2 | 41.5 | 31.3 | 2 | 81.5 | 61.4 | 2 | 121.4 | 91.5 | 2 | 161.3 | 121.6 | 2 | 201.3 | 151.7 |
| 3 | 2.4 | 1.8 | 3 | 42.3 | 31.9 | 3 | 82.3 | 62.0 | 3 | 122.2 | 92.1 | 3 | 162.1 | 122.2 | 3 | 202.1 | 152.3 |
| 4 | 3.2 | 2.4 | 4 | 43.1 | 32.5 | 4 | 83.1 | 62.6 | 4 | 123.0 | 92.7 | 4 | 162.9 | 122.8 | 4 | 202.9 | 152.9 |
| 5 | 4.0 | 3.0 | 5 | 43.9 | 33.1 | 5 | 83.9 | 63.2 | 5 | 123.8 | 93.3 | 5 | 163.7 | 123.4 | 5 | 203.7 | 153.5 |
| 6 | 4.8 | 3.6 | 6 | 44.7 | 33.7 | 6 | 84.7 | 63.8 | 6 | 124.6 | 93.9 | 6 | 164.5 | 124.0 | 6 | 204.5 | 154.1 |
| 7 | 5.6 | 4.2 | 7 | 45.5 | 34.3 | 7 | 85.5 | 64.4 | 7 | 125.4 | 94.5 | 7 | 165.3 | 124.6 | 7 | 205.2 | 154.7 |
| 8 | 6.4 | 4.8 | 8 | 46.3 | 34.9 | 8 | 86.3 | 65.0 | 8 | 126.2 | 95.1 | 8 | 166.1 | 125.2 | 8 | 206.0 | 155.3 |
| 9 | 7.2 | 5.4 | 9 | 47.1 | 35.5 | 9 | 87.1 | 65.6 | 9 | 127.0 | 95.7 | 9 | 166.9 | 125.8 | 9 | 206.8 | 155.9 |
| 10 | 8.0 | 6.0 | 60 | 47.9 | 36.1 | 110 | 87.8 | 66.2 | 160 | 127.8 | 96.3 | 210 | 167.7 | 126.4 | 260 | 207.6 | 156.5 |
| 1 | 8.8 | 6.6 | 1 | 48.7 | 36.7 | 1 | 88.6 | 66.8 | 1 | 128.6 | 96.9 | 1 | 168.5 | 127.0 | 1 | 208.4 | 157.1 |
| 2 | 9.6 | 7.2 | 2 | 49.5 | 37.3 | 2 | 89.4 | 67.4 | 2 | 129.4 | 97.5 | 2 | 169.3 | 127.6 | 2 | 209.2 | 157.7 |
| 3 | 10.4 | 7.8 | 3 | 50.3 | 37.9 | 3 | 90.2 | 68.0 | 3 | 130.2 | 98.1 | 3 | 170.1 | 128.2 | 3 | 210.0 | 158.3 |
| 4 | 11.2 | 8.4 | 4 | 51.1 | 38.5 | 4 | 91.0 | 68.6 | 4 | 131.0 | 98.7 | 4 | 170.9 | 128.8 | 4 | 210.8 | 158.9 |
| 5 | 12.0 | 9.0 | 5 | 51.9 | 39.1 | 5 | 91.8 | 69.2 | 5 | 131.8 | 99.3 | 5 | 171.7 | 129.4 | 5 | 211.6 | 159.5 |
| 6 | 12.8 | 9.6 | 6 | 52.7 | 39.7 | 6 | 92.6 | 69.8 | 6 | 132.6 | 99.9 | 6 | 172.5 | 130.0 | 6 | 212.4 | 160.1 |
| 7 | 13.6 | 10.2 | 7 | 53.5 | 40.3 | 7 | 93.4 | 70.4 | 7 | 133.4 | 100.5 | 7 | 173.3 | 130.6 | 7 | 213.2 | 160.7 |
| 8 | 14.4 | 10.8 | 8 | 54.3 | 40.9 | 8 | 94.2 | 71.0 | 8 | 134.2 | 101.1 | 8 | 174.1 | 131.2 | 8 | 214.0 | 161.3 |
| 9 | 15.2 | 11.4 | 9 | 55.1 | 41.5 | 9 | 95.0 | 71.6 | 9 | 135.0 | 101.7 | 9 | 174.9 | 131.8 | 9 | 214.8 | 161.9 |
| 20 | 16.0 | 12.0 | 70 | 55.9 | 42.1 | 120 | 95.8 | 72.2 | 170 | 135.8 | 102.3 | 220 | 175.7 | 132.4 | 270 | 215.6 | 162.5 |
| 1 | 16.8 | 12.6 | 1 | 56.7 | 42.7 | 1 | 96.6 | 72.8 | 1 | 136.6 | 102.9 | 1 | 176.5 | 133.0 | 1 | 216.4 | 163.1 |
| 2 | 17.6 | 13.2 | 2 | 57.5 | 43.3 | 2 | 97.4 | 73.4 | 2 | 137.4 | 103.5 | 2 | 177.3 | 133.6 | 2 | 217.2 | 163.7 |
| 3 | 18.4 | 13.8 | 3 | 58.3 | 43.9 | 3 | 98.2 | 74.0 | 3 | 138.2 | 104.1 | 3 | 178.1 | 134.2 | 3 | 218.0 | 164.3 |
| 4 | 19.2 | 14.4 | 4 | 59.1 | 44.5 | 4 | 99.0 | 74.6 | 4 | 139.0 | 104.7 | 4 | 178.9 | 134.8 | 4 | 218.8 | 164.9 |
| 5 | 20.0 | 15.0 | 5 | 59.9 | 45.1 | 5 | 99.8 | 75.2 | 5 | 139.8 | 105.3 | 5 | 179.7 | 135.4 | 5 | 219.6 | 165.5 |
| 6 | 20.8 | 15.6 | 6 | 60.7 | 45.7 | 6 | 100.6 | 75.8 | 6 | 140.6 | 105.9 | 6 | 180.5 | 136.0 | 6 | 220.4 | 166.1 |
| 7 | 21.6 | 16.2 | 7 | 61.5 | 46.3 | 7 | 101.4 | 76.4 | 7 | 141.4 | 106.5 | 7 | 181.3 | 136.6 | 7 | 221.2 | 166.7 |
| 8 | 22.4 | 16.9 | 8 | 62.3 | 46.9 | 8 | 102.2 | 77.0 | 8 | 142.2 | 107.1 | 8 | 182.1 | 137.2 | 8 | 222.0 | 167.3 |
| 9 | 23.2 | 17.5 | 9 | 63.1 | 47.5 | 9 | 103.0 | 77.6 | 9 | 143.0 | 107.7 | 9 | 182.9 | 137.8 | 9 | 222.8 | 167.9 |
| 30 | 24.0 | 18.1 | 80 | 63.9 | 48.1 | 130 | 103.8 | 78.2 | 180 | 143.8 | 108.3 | 230 | 183.7 | 138.4 | 280 | 223.6 | 168.5 |
| 1 | 24.8 | 18.7 | 1 | 64.7 | 48.7 | 1 | 104.6 | 78.8 | 1 | 144.6 | 108.9 | 1 | 184.5 | 139.0 | 1 | 224.4 | 169.1 |
| 2 | 25.6 | 19.3 | 2 | 65.5 | 49.3 | 2 | 105.4 | 79.4 | 2 | 145.4 | 109.5 | 2 | 185.3 | 139.6 | 2 | 225.2 | 169.7 |
| 3 | 26.4 | 19.9 | 3 | 66.3 | 50.0 | 3 | 106.2 | 80.0 | 3 | 146.2 | 110.1 | 3 | 186.1 | 140.2 | 3 | 226.0 | 170.3 |
| 4 | 27.2 | 20.5 | 4 | 67.1 | 50.6 | 4 | 107.0 | 80.6 | 4 | 146.9 | 110.7 | 4 | 186.9 | 140.8 | 4 | 226.8 | 170.9 |
| 5 | 28.0 | 21.1 | 5 | 67.9 | 51.2 | 5 | 107.8 | 81.2 | 5 | 147.7 | 111.3 | 5 | 187.7 | 141.4 | 5 | 227.6 | 171.5 |
| 6 | 28.8 | 21.7 | 6 | 68.7 | 51.8 | 6 | 108.6 | 81.8 | 6 | 148.5 | 111.9 | 6 | 188.5 | 142.0 | 6 | 228.4 | 172.1 |
| 7 | 29.5 | 22.3 | 7 | 69.5 | 52.4 | 7 | 109.4 | 82.4 | 7 | 149.3 | 112.5 | 7 | 189.3 | 142.6 | 7 | 229.2 | 172.7 |
| 8 | 30.3 | 22.9 | 8 | 70.3 | 53.0 | 8 | 110.2 | 83.1 | 8 | 150.1 | 113.1 | 8 | 190.1 | 143.2 | 8 | 230.0 | 173.3 |
| 9 | 31.1 | 23.5 | 9 | 71.1 | 53.6 | 9 | 111.0 | 83.7 | 9 | 150.9 | 113.7 | 9 | 190.9 | 143.8 | 9 | 230.8 | 173.9 |
| 40 | 31.9 | 24.1 | 90 | 71.9 | 54.2 | 140 | 111.8 | 84.3 | 190 | 151.7 | 114.3 | 240 | 191.7 | 144.4 | 290 | 231.6 | 174.5 |
| 1 | 32.7 | 24.7 | 1 | 72.7 | 54.8 | 1 | 112.6 | 84.9 | 1 | 152.5 | 114.9 | 1 | 192.5 | 145.0 | 1 | 232.4 | 175.1 |
| 2 | 33.5 | 25.3 | 2 | 73.5 | 55.4 | 2 | 113.4 | 85.5 | 2 | 153.3 | 115.5 | 2 | 193.3 | 145.6 | 2 | 233.2 | 175.7 |
| 3 | 34.3 | 25.9 | 3 | 74.3 | 56.0 | 3 | 114.2 | 86.1 | 3 | 154.1 | 116.2 | 3 | 194.1 | 146.2 | 3 | 234.0 | 176.3 |
| 4 | 35.1 | 26.5 | 4 | 75.1 | 56.6 | 4 | 115.0 | 86.7 | 4 | 154.9 | 116.8 | 4 | 194.9 | 146.8 | 4 | 234.8 | 176.9 |
| 5 | 35.9 | 27.1 | 5 | 75.9 | 57.2 | 5 | 115.8 | 87.3 | 5 | 155.7 | 117.4 | 5 | 195.7 | 147.4 | 5 | 235.6 | 177.5 |
| 6 | 36.7 | 27.7 | 6 | 76.7 | 57.8 | 6 | 116.6 | 87.9 | 6 | 156.5 | 118.0 | 6 | 196.5 | 148.0 | 6 | 236.4 | 178.1 |
| 7 | 37.5 | 28.3 | 7 | 77.5 | 58.4 | 7 | 117.4 | 88.5 | 7 | 157.3 | 118.6 | 7 | 197.3 | 148.6 | 7 | 237.2 | 178.7 |
| 8 | 38.3 | 28.9 | 8 | 78.3 | 59.0 | 8 | 118.2 | 89.1 | 8 | 158.1 | 119.2 | 8 | 198.1 | 149.3 | 8 | 238.0 | 179.3 |
| 9 | 39.1 | 29.5 | 9 | 79.1 | 59.6 | 9 | 119.0 | 89.7 | 9 | 158.9 | 119.8 | 9 | 198.9 | 149.9 | 9 | 238.8 | 179.9 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 307 315
289 233 225
R

089 053° 045
091 127 135
R ou φm

R

TABELA 1

R ou φm

359 323° 315
181 217 225

TÁBUAS DE CARTEAÇÃO

001 037 045
179 143 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 239.6 | 180.5 | 350 | 279.5 | 210.6 | 400 | 319.5 | 240.7 | 450 | 359.4 | 270.8 | 500 | 399.3 | 300.9 | 550 | 439.2 | 331.0 |
| 1 | 240.4 | 181.1 | 1 | 280.3 | 211.2 | 1 | 320.3 | 241.3 | 1 | 360.2 | 271.4 | 1 | 400.1 | 301.5 | 1 | 440.0 | 331.6 |
| 2 | 241.2 | 181.7 | 2 | 281.1 | 211.8 | 2 | 321.1 | 241.9 | 2 | 361.0 | 272.0 | 2 | 400.9 | 302.1 | 2 | 440.8 | 332.2 |
| 3 | 242.0 | 182.3 | 3 | 281.9 | 212.4 | 3 | 321.9 | 242.5 | 3 | 361.8 | 272.6 | 3 | 401.7 | 302.7 | 3 | 441.6 | 332.8 |
| 4 | 242.8 | 183.0 | 4 | 282.7 | 213.0 | 4 | 322.6 | 243.1 | 4 | 362.6 | 273.2 | 4 | 402.5 | 303.3 | 4 | 442.4 | 333.4 |
| 5 | 243.6 | 183.6 | 5 | 283.5 | 213.6 | 5 | 323.4 | 243.7 | 5 | 363.4 | 273.8 | 5 | 403.3 | 303.9 | 5 | 443.2 | 334.0 |
| 6 | 244.4 | 184.2 | 6 | 284.3 | 214.2 | 6 | 324.2 | 244.3 | 6 | 364.2 | 274.4 | 6 | 404.1 | 304.5 | 6 | 444.0 | 334.6 |
| 7 | 245.2 | 184.8 | 7 | 285.1 | 214.8 | 7 | 325.0 | 244.9 | 7 | 365.0 | 275.0 | 7 | 404.9 | 305.1 | 7 | 444.8 | 335.2 |
| 8 | 246.0 | 185.4 | 8 | 285.9 | 215.4 | 8 | 325.8 | 245.5 | 8 | 365.8 | 275.6 | 8 | 405.7 | 305.7 | 8 | 445.6 | 335.8 |
| 9 | 246.8 | 186.0 | 9 | 286.7 | 216.1 | 9 | 326.6 | 246.1 | 9 | 366.6 | 276.2 | 9 | 406.5 | 306.3 | 9 | 446.4 | 336.4 |
| 310 | 247.6 | 186.6 | 360 | 287.5 | 216.7 | 410 | 327.4 | 246.7 | 460 | 367.4 | 276.8 | 510 | 407.3 | 306.9 | 560 | 447.2 | 337.0 |
| 1 | 248.4 | 187.2 | 1 | 288.3 | 217.3 | 1 | 328.2 | 247.3 | 1 | 368.2 | 277.4 | 1 | 408.1 | 307.5 | 1 | 448.0 | 337.6 |
| 2 | 249.2 | 187.8 | 2 | 289.1 | 217.9 | 2 | 329.0 | 247.9 | 2 | 369.0 | 278.0 | 2 | 408.9 | 308.1 | 2 | 448.8 | 338.2 |
| 3 | 250.0 | 188.4 | 3 | 289.9 | 218.5 | 3 | 329.8 | 248.5 | 3 | 369.8 | 278.6 | 3 | 409.7 | 308.7 | 3 | 449.6 | 338.8 |
| 4 | 250.8 | 189.0 | 4 | 290.7 | 219.1 | 4 | 330.6 | 249.2 | 4 | 370.6 | 279.2 | 4 | 410.5 | 309.3 | 4 | 450.4 | 339.4 |
| 5 | 251.6 | 189.6 | 5 | 291.5 | 219.7 | 5 | 331.4 | 249.8 | 5 | 371.4 | 279.8 | 5 | 411.3 | 309.9 | 5 | 451.2 | 340.0 |
| 6 | 252.4 | 190.2 | 6 | 292.3 | 220.3 | 6 | 332.2 | 250.4 | 6 | 372.2 | 280.4 | 6 | 412.1 | 310.5 | 6 | 452.0 | 340.6 |
| 7 | 253.2 | 190.8 | 7 | 293.1 | 220.9 | 7 | 333.0 | 251.0 | 7 | 373.0 | 281.0 | 7 | 412.9 | 311.1 | 7 | 452.8 | 341.2 |
| 8 | 254.0 | 191.4 | 8 | 293.9 | 221.5 | 8 | 333.8 | 251.6 | 8 | 373.8 | 281.6 | 8 | 413.7 | 311.7 | 8 | 453.6 | 341.8 |
| 9 | 254.8 | 192.0 | 9 | 294.7 | 222.1 | 9 | 334.6 | 252.2 | 9 | 374.6 | 282.3 | 9 | 414.5 | 312.3 | 9 | 454.4 | 342.4 |
| 320 | 255.6 | 192.6 | 370 | 295.5 | 222.7 | 420 | 335.4 | 252.8 | 470 | 375.4 | 282.9 | 520 | 415.3 | 312.9 | 570 | 455.2 | 343.0 |
| 1 | 256.4 | 193.2 | 1 | 296.3 | 223.3 | 1 | 336.2 | 253.4 | 1 | 376.2 | 283.5 | 1 | 416.1 | 313.5 | 1 | 456.0 | 343.6 |
| 2 | 257.2 | 193.8 | 2 | 297.1 | 223.9 | 2 | 337.0 | 254.0 | 2 | 377.0 | 284.1 | 2 | 416.9 | 314.1 | 2 | 456.8 | 344.2 |
| 3 | 258.0 | 194.4 | 3 | 297.9 | 224.5 | 3 | 337.8 | 254.6 | 3 | 377.8 | 284.7 | 3 | 417.7 | 314.7 | 3 | 457.6 | 344.8 |
| 4 | 258.8 | 195.0 | 4 | 298.7 | 225.1 | 4 | 338.6 | 255.2 | 4 | 378.6 | 285.3 | 4 | 418.5 | 315.4 | 4 | 458.4 | 345.4 |
| 5 | 259.6 | 195.6 | 5 | 299.5 | 225.7 | 5 | 339.4 | 255.8 | 5 | 379.4 | 285.9 | 5 | 419.3 | 316.0 | 5 | 459.2 | 346.0 |
| 6 | 260.4 | 196.2 | 6 | 300.3 | 226.3 | 6 | 340.2 | 256.4 | 6 | 380.2 | 286.5 | 6 | 420.1 | 316.6 | 6 | 460.0 | 346.6 |
| 7 | 261.2 | 196.8 | 7 | 301.1 | 226.9 | 7 | 341.0 | 257.0 | 7 | 380.9 | 287.1 | 7 | 420.9 | 317.2 | 7 | 460.8 | 347.2 |
| 8 | 262.0 | 197.4 | 8 | 301.9 | 227.5 | 8 | 341.8 | 257.6 | 8 | 381.7 | 287.7 | 8 | 421.7 | 317.8 | 8 | 461.6 | 347.8 |
| 9 | 262.8 | 198.0 | 9 | 302.7 | 228.1 | 9 | 342.6 | 258.2 | 9 | 382.5 | 288.3 | 9 | 422.5 | 318.4 | 9 | 462.4 | 348.5 |
| 330 | 263.6 | 198.6 | 380 | 303.5 | 228.7 | 430 | 343.4 | 258.8 | 480 | 383.3 | 288.9 | 530 | 423.3 | 319.0 | 580 | 463.2 | 349.1 |
| 1 | 264.3 | 199.2 | 1 | 304.3 | 229.3 | 1 | 344.2 | 259.4 | 1 | 384.1 | 289.5 | 1 | 424.1 | 319.6 | 1 | 464.0 | 349.7 |
| 2 | 265.1 | 199.8 | 2 | 305.1 | 229.9 | 2 | 345.0 | 260.0 | 2 | 384.9 | 290.1 | 2 | 424.9 | 320.2 | 2 | 464.8 | 350.3 |
| 3 | 265.9 | 200.4 | 3 | 305.9 | 230.5 | 3 | 345.8 | 260.6 | 3 | 385.7 | 290.7 | 3 | 425.7 | 320.8 | 3 | 465.6 | 350.9 |
| 4 | 266.7 | 201.0 | 4 | 306.7 | 231.1 | 4 | 346.6 | 261.2 | 4 | 386.5 | 291.3 | 4 | 426.5 | 321.4 | 4 | 466.4 | 351.5 |
| 5 | 267.5 | 201.6 | 5 | 307.5 | 231.7 | 5 | 347.4 | 261.8 | 5 | 387.3 | 291.9 | 5 | 427.3 | 322.0 | 5 | 467.2 | 352.1 |
| 6 | 268.3 | 202.2 | 6 | 308.3 | 232.3 | 6 | 348.2 | 262.4 | 6 | 388.1 | 292.5 | 6 | 428.1 | 322.6 | 6 | 468.0 | 352.7 |
| 7 | 269.1 | 202.8 | 7 | 309.1 | 232.9 | 7 | 349.0 | 263.0 | 7 | 388.9 | 293.1 | 7 | 428.9 | 323.2 | 7 | 468.8 | 353.3 |
| 8 | 269.9 | 203.4 | 8 | 309.9 | 233.5 | 8 | 349.8 | 263.6 | 8 | 389.7 | 293.7 | 8 | 429.7 | 323.8 | 8 | 469.6 | 353.9 |
| 9 | 270.7 | 204.0 | 9 | 310.7 | 234.1 | 9 | 350.6 | 264.2 | 9 | 390.5 | 294.3 | 9 | 430.5 | 324.4 | 9 | 470.4 | 354.5 |
| 340 | 271.5 | 204.6 | 390 | 311.5 | 234.7 | 440 | 351.4 | 264.8 | 490 | 391.3 | 294.9 | 540 | 431.3 | 325.0 | 590 | 471.2 | 355.1 |
| 1 | 272.3 | 205.2 | 1 | 312.3 | 235.3 | 1 | 352.2 | 265.4 | 1 | 392.1 | 295.5 | 1 | 432.1 | 325.6 | 1 | 472.0 | 355.7 |
| 2 | 273.1 | 205.8 | 2 | 313.1 | 235.9 | 2 | 353.0 | 266.0 | 2 | 392.9 | 296.1 | 2 | 432.9 | 326.2 | 2 | 472.8 | 356.3 |
| 3 | 273.9 | 206.4 | 3 | 313.9 | 236.5 | 3 | 353.8 | 266.6 | 3 | 393.7 | 296.7 | 3 | 433.7 | 326.8 | 3 | 473.6 | 356.9 |
| 4 | 274.7 | 207.0 | 4 | 314.7 | 237.1 | 4 | 354.6 | 267.2 | 4 | 394.5 | 297.3 | 4 | 434.5 | 327.4 | 4 | 474.4 | 357.5 |
| 5 | 275.5 | 207.6 | 5 | 315.5 | 237.7 | 5 | 355.4 | 267.8 | 5 | 395.3 | 297.9 | 5 | 435.3 | 328.0 | 5 | 475.2 | 358.1 |
| 6 | 276.3 | 208.2 | 6 | 316.3 | 238.3 | 6 | 356.2 | 268.4 | 6 | 396.1 | 298.5 | 6 | 436.1 | 328.6 | 6 | 476.0 | 358.7 |
| 7 | 277.1 | 208.8 | 7 | 317.1 | 238.9 | 7 | 357.0 | 269.0 | 7 | 396.9 | 299.1 | 7 | 436.9 | 329.2 | 7 | 476.8 | 359.3 |
| 8 | 277.9 | 209.4 | 8 | 317.9 | 239.5 | 8 | 357.8 | 269.6 | 8 | 397.7 | 299.7 | 8 | 437.7 | 329.8 | 8 | 477.6 | 359.9 |
| 9 | 278.7 | 210.0 | 9 | 318.7 | 240.1 | 9 | 358.6 | 270.2 | 9 | 398.5 | 300.3 | 9 | 438.5 | 330.4 | 9 | 478.4 | 360.5 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 307 315
269 233 225

R

089 053° 045
091 127 135

R ou φm

R

TABELA 1

R ou φm

359 322° 315
181 218 225

TÁBUAS DE CARTEAÇÃO

001 038 045
179 142 135

| ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap |
|----|------|------|----|------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 39.4 | 30.8 | 100 | 78.8 | 61.6 | 150 | 118.2 | 92.3 | 200 | 157.6 | 123.1 | 250 | 197.0 | 153.9 |
| 1 | 0.8 | 0.6 | 1 | 40.2 | 31.4 | 1 | 79.6 | 62.2 | 1 | 119.0 | 93.0 | 1 | 158.4 | 123.7 | 1 | 197.8 | 154.5 |
| 2 | 1.6 | 1.2 | 2 | 41.0 | 32.0 | 2 | 80.4 | 62.8 | 2 | 119.8 | 93.6 | 2 | 159.2 | 124.4 | 2 | 198.6 | 155.1 |
| 3 | 2.4 | 1.8 | 3 | 41.8 | 32.6 | 3 | 81.2 | 63.4 | 3 | 120.6 | 94.2 | 3 | 160.0 | 125.0 | 3 | 199.4 | 155.8 |
| 4 | 3.2 | 2.5 | 4 | 42.6 | 33.2 | 4 | 82.0 | 64.0 | 4 | 121.4 | 94.8 | 4 | 160.8 | 125.6 | 4 | 200.2 | 156.4 |
| 5 | 3.9 | 3.1 | 5 | 43.3 | 33.9 | 5 | 82.7 | 64.6 | 5 | 122.1 | 95.4 | 5 | 161.5 | 126.2 | 5 | 200.9 | 157.0 |
| 6 | 4.7 | 3.7 | 6 | 44.1 | 34.5 | 6 | 83.5 | 65.3 | 6 | 122.9 | 96.0 | 6 | 162.3 | 126.8 | 6 | 201.7 | 157.6 |
| 7 | 5.5 | 4.3 | 7 | 44.9 | 35.1 | 7 | 84.3 | 65.9 | 7 | 123.7 | 96.7 | 7 | 163.1 | 127.4 | 7 | 202.5 | 158.2 |
| 8 | 6.3 | 4.9 | 8 | 45.7 | 35.7 | 8 | 85.1 | 66.5 | 8 | 124.5 | 97.3 | 8 | 163.9 | 128.1 | 8 | 203.3 | 158.8 |
| 9 | 7.1 | 5.5 | 9 | 46.5 | 36.3 | 9 | 85.9 | 67.1 | 9 | 125.3 | 97.9 | 9 | 164.7 | 128.7 | 9 | 204.1 | 159.5 |
| 10 | 7.9 | 6.2 | 60 | 47.3 | 36.9 | 110 | 86.7 | 67.7 | 160 | 126.1 | 98.5 | 210 | 165.5 | 129.3 | 260 | 204.9 | 160.1 |
| 1 | 8.7 | 6.8 | 1 | 48.1 | 37.6 | 1 | 87.5 | 68.3 | 1 | 126.9 | 99.1 | 1 | 166.3 | 129.9 | 1 | 205.7 | 160.7 |
| 2 | 9.5 | 7.4 | 2 | 48.9 | 38.2 | 2 | 88.3 | 69.0 | 2 | 127.7 | 99.7 | 2 | 167.1 | 130.5 | 2 | 206.5 | 161.3 |
| 3 | 10.2 | 8.0 | 3 | 49.6 | 38.8 | 3 | 89.0 | 69.6 | 3 | 128.4 | 100.4 | 3 | 167.8 | 131.1 | 3 | 207.2 | 161.9 |
| 4 | 11.0 | 8.6 | 4 | 50.4 | 39.4 | 4 | 89.8 | 70.2 | 4 | 129.2 | 101.0 | 4 | 168.6 | 131.8 | 4 | 208.0 | 162.5 |
| 5 | 11.8 | 9.2 | 5 | 51.2 | 40.0 | 5 | 90.6 | 70.8 | 5 | 130.0 | 101.6 | 5 | 169.4 | 132.4 | 5 | 208.8 | 163.2 |
| 6 | 12.6 | 9.9 | 6 | 52.0 | 40.6 | 6 | 91.4 | 71.4 | 6 | 130.8 | 102.2 | 6 | 170.2 | 133.0 | 6 | 209.6 | 163.8 |
| 7 | 13.4 | 10.5 | 7 | 52.8 | 41.2 | 7 | 92.2 | 72.0 | 7 | 131.6 | 102.8 | 7 | 171.0 | 133.6 | 7 | 210.4 | 164.4 |
| 8 | 14.2 | 11.1 | 8 | 53.6 | 41.9 | 8 | 93.0 | 72.6 | 8 | 132.4 | 103.4 | 8 | 171.8 | 134.2 | 8 | 211.2 | 165.0 |
| 9 | 15.0 | 11.7 | 9 | 54.4 | 42.5 | 9 | 93.8 | 73.3 | 9 | 133.2 | 104.0 | 9 | 172.6 | 134.8 | 9 | 212.0 | 165.6 |
| 20 | 15.8 | 12.3 | 70 | 55.2 | 43.1 | 120 | 94.6 | 73.9 | 170 | 134.0 | 104.7 | 220 | 173.4 | 135.4 | 270 | 212.8 | 166.2 |
| 1 | 16.5 | 12.9 | 1 | 55.9 | 43.7 | 1 | 95.3 | 74.5 | 1 | 134.7 | 105.3 | 1 | 174.2 | 136.1 | 1 | 213.6 | 166.8 |
| 2 | 17.3 | 13.5 | 2 | 56.7 | 44.3 | 2 | 96.1 | 75.1 | 2 | 135.5 | 105.9 | 2 | 174.9 | 136.7 | 2 | 214.3 | 167.5 |
| 3 | 18.1 | 14.2 | 3 | 57.5 | 44.9 | 3 | 96.9 | 75.7 | 3 | 136.3 | 106.5 | 3 | 175.7 | 137.3 | 3 | 215.1 | 168.1 |
| 4 | 18.9 | 14.8 | 4 | 58.3 | 45.6 | 4 | 97.7 | 76.3 | 4 | 137.1 | 107.1 | 4 | 176.5 | 137.9 | 4 | 215.9 | 168.7 |
| 5 | 19.7 | 15.4 | 5 | 59.1 | 46.2 | 5 | 98.5 | 77.0 | 5 | 137.9 | 107.7 | 5 | 177.3 | 138.5 | 5 | 216.7 | 169.3 |
| 6 | 20.5 | 16.0 | 6 | 59.9 | 46.8 | 6 | 99.3 | 77.6 | 6 | 138.7 | 108.4 | 6 | 178.1 | 139.1 | 6 | 217.5 | 169.9 |
| 7 | 21.3 | 16.6 | 7 | 60.7 | 47.4 | 7 | 100.1 | 78.2 | 7 | 139.5 | 109.0 | 7 | 178.9 | 139.8 | 7 | 218.3 | 170.5 |
| 8 | 22.1 | 17.2 | 8 | 61.5 | 48.0 | 8 | 100.9 | 78.8 | 8 | 140.3 | 109.6 | 8 | 179.7 | 140.4 | 8 | 219.1 | 171.2 |
| 9 | 22.9 | 17.9 | 9 | 62.3 | 48.6 | 9 | 101.7 | 79.4 | 9 | 141.1 | 110.2 | 9 | 180.5 | 141.0 | 9 | 219.9 | 171.8 |
| 30 | 23.6 | 18.5 | 80 | 63.0 | 49.3 | 130 | 102.4 | 80.0 | 180 | 141.8 | 110.8 | 230 | 181.2 | 141.6 | 280 | 220.6 | 172.4 |
| 1 | 24.4 | 19.1 | 1 | 63.8 | 49.9 | 1 | 103.2 | 80.7 | 1 | 142.6 | 111.4 | 1 | 182.0 | 142.2 | 1 | 221.4 | 173.0 |
| 2 | 25.2 | 19.7 | 2 | 64.6 | 50.5 | 2 | 104.0 | 81.3 | 2 | 143.4 | 112.1 | 2 | 182.8 | 142.8 | 2 | 222.2 | 173.6 |
| 3 | 26.0 | 20.3 | 3 | 65.4 | 51.1 | 3 | 104.8 | 81.9 | 3 | 144.2 | 112.7 | 3 | 183.6 | 143.4 | 3 | 223.0 | 174.2 |
| 4 | 26.8 | 20.9 | 4 | 66.2 | 51.7 | 4 | 105.6 | 82.5 | 4 | 145.0 | 113.3 | 4 | 184.4 | 144.1 | 4 | 223.8 | 174.8 |
| 5 | 27.6 | 21.5 | 5 | 67.0 | 52.3 | 5 | 106.4 | 83.1 | 5 | 145.8 | 113.9 | 5 | 185.2 | 144.7 | 5 | 224.6 | 175.5 |
| 6 | 28.4 | 22.2 | 6 | 67.8 | 52.9 | 6 | 107.2 | 83.7 | 6 | 146.6 | 114.5 | 6 | 186.0 | 145.3 | 6 | 225.4 | 176.1 |
| 7 | 29.2 | 22.8 | 7 | 68.6 | 53.6 | 7 | 108.0 | 84.3 | 7 | 147.4 | 115.1 | 7 | 186.8 | 145.9 | 7 | 226.2 | 176.7 |
| 8 | 29.9 | 23.4 | 8 | 69.3 | 54.2 | 8 | 108.7 | 85.0 | 8 | 148.1 | 115.7 | 8 | 187.5 | 146.5 | 8 | 226.9 | 177.3 |
| 9 | 30.7 | 24.0 | 9 | 70.1 | 54.8 | 9 | 109.5 | 85.6 | 9 | 148.9 | 116.4 | 9 | 188.3 | 147.1 | 9 | 227.7 | 177.9 |
| 40 | 31.5 | 24.6 | 90 | 70.9 | 55.4 | 140 | 110.3 | 86.2 | 190 | 149.7 | 117.0 | 240 | 189.1 | 147.8 | 290 | 228.5 | 178.5 |
| 1 | 32.3 | 25.2 | 1 | 71.7 | 56.0 | 1 | 111.1 | 86.8 | 1 | 150.5 | 117.6 | 1 | 189.9 | 148.4 | 1 | 229.3 | 179.2 |
| 2 | 33.1 | 25.9 | 2 | 72.5 | 56.6 | 2 | 111.9 | 87.4 | 2 | 151.3 | 118.2 | 2 | 190.7 | 149.0 | 2 | 230.1 | 179.8 |
| 3 | 33.9 | 26.5 | 3 | 73.3 | 57.3 | 3 | 112.7 | 88.0 | 3 | 152.1 | 118.8 | 3 | 191.5 | 149.6 | 3 | 230.9 | 180.4 |
| 4 | 34.7 | 27.1 | 4 | 74.1 | 57.9 | 4 | 113.5 | 88.7 | 4 | 152.9 | 119.4 | 4 | 192.3 | 150.2 | 4 | 231.7 | 181.0 |
| 5 | 35.5 | 27.7 | 5 | 74.9 | 58.5 | 5 | 114.3 | 89.3 | 5 | 153.7 | 120.1 | 5 | 193.1 | 150.8 | 5 | 232.5 | 181.6 |
| 6 | 36.2 | 28.3 | 6 | 75.6 | 59.1 | 6 | 115.0 | 89.9 | 6 | 154.5 | 120.7 | 6 | 193.9 | 151.5 | 6 | 233.3 | 182.2 |
| 7 | 37.0 | 28.9 | 7 | 76.4 | 59.7 | 7 | 115.8 | 90.5 | 7 | 155.2 | 121.3 | 7 | 194.6 | 152.1 | 7 | 234.0 | 182.9 |
| 8 | 37.8 | 29.6 | 8 | 77.2 | 60.3 | 8 | 116.6 | 91.1 | 8 | 156.0 | 121.9 | 8 | 195.4 | 152.7 | 8 | 234.8 | 183.5 |
| 9 | 38.6 | 30.2 | 9 | 78.0 | 61.0 | 9 | 117.4 | 91.7 | 9 | 156.8 | 122.5 | 9 | 196.2 | 153.3 | 9 | 235.6 | 184.1 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 308 315
269 232 225

R

089 052° 045
091 128 135

R ou φm

R

TABELA 1

R ou φm

359 322° 315
181 218 225

TÁBUAS DE CARTEAÇÃO

001 038 045
179 142 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 236.4 | 184.7 | 350 | 275.8 | 215.5 | 400 | 315.2 | 246.3 | 450 | 354.6 | 277.0 | 500 | 394.0 | 307.8 | 550 | 433.4 | 338.6 |
| 1 | 237.2 | 185.3 | 1 | 276.6 | 216.1 | 1 | 316.0 | 246.9 | 1 | 355.4 | 277.7 | 1 | 394.8 | 308.4 | 1 | 434.2 | 339.2 |
| 2 | 238.0 | 185.9 | 2 | 277.4 | 216.7 | 2 | 316.8 | 247.5 | 2 | 356.2 | 278.3 | 2 | 395.6 | 309.1 | 2 | 435.0 | 339.8 |
| 3 | 238.8 | 186.5 | 3 | 278.2 | 217.3 | 3 | 317.6 | 248.1 | 3 | 357.0 | 278.9 | 3 | 396.4 | 309.7 | 3 | 435.8 | 340.5 |
| 4 | 239.6 | 187.2 | 4 | 279.0 | 217.9 | 4 | 318.4 | 248.7 | 4 | 357.8 | 279.5 | 4 | 397.2 | 310.3 | 4 | 436.6 | 341.1 |
| 5 | 240.3 | 187.8 | 5 | 279.7 | 218.6 | 5 | 319.1 | 249.3 | 5 | 358.5 | 280.1 | 5 | 397.9 | 310.9 | 5 | 437.3 | 341.7 |
| 6 | 241.1 | 188.4 | 6 | 280.5 | 219.2 | 6 | 319.9 | 250.0 | 6 | 359.3 | 280.7 | 6 | 398.7 | 311.5 | 6 | 438.1 | 342.3 |
| 7 | 241.9 | 189.0 | 7 | 281.3 | 219.8 | 7 | 320.7 | 250.6 | 7 | 360.1 | 281.4 | 7 | 399.5 | 312.1 | 7 | 438.9 | 342.9 |
| 8 | 242.7 | 189.6 | 8 | 282.1 | 220.4 | 8 | 321.5 | 251.2 | 8 | 360.9 | 282.0 | 8 | 400.3 | 312.8 | 8 | 439.7 | 343.5 |
| 9 | 243.5 | 190.2 | 9 | 282.9 | 221.0 | 9 | 322.3 | 251.8 | 9 | 361.7 | 282.6 | 9 | 401.1 | 313.4 | 9 | 440.5 | 344.2 |
| 310 | 244.3 | 190.9 | 360 | 283.7 | 221.6 | 410 | 323.1 | 252.4 | 460 | 362.5 | 283.2 | 510 | 401.9 | 314.0 | 560 | 441.3 | 344.8 |
| 1 | 245.1 | 191.5 | 1 | 284.5 | 222.3 | 1 | 323.9 | 253.0 | 1 | 363.3 | 283.8 | 1 | 402.7 | 314.6 | 1 | 442.1 | 345.4 |
| 2 | 245.9 | 192.1 | 2 | 285.3 | 222.9 | 2 | 324.7 | 253.7 | 2 | 364.1 | 284.4 | 2 | 403.5 | 315.2 | 2 | 442.9 | 346.0 |
| 3 | 246.6 | 192.7 | 3 | 286.0 | 223.5 | 3 | 325.4 | 254.3 | 3 | 364.8 | 285.1 | 3 | 404.2 | 315.8 | 3 | 443.6 | 346.6 |
| 4 | 247.4 | 193.3 | 4 | 286.8 | 224.1 | 4 | 326.2 | 254.9 | 4 | 365.6 | 285.7 | 4 | 405.0 | 316.4 | 4 | 444.4 | 347.2 |
| 5 | 248.2 | 193.9 | 5 | 287.6 | 224.7 | 5 | 327.0 | 255.5 | 5 | 366.4 | 286.3 | 5 | 405.8 | 317.1 | 5 | 445.2 | 347.8 |
| 6 | 249.0 | 194.5 | 6 | 288.4 | 225.3 | 6 | 327.8 | 256.1 | 6 | 367.2 | 286.9 | 6 | 406.6 | 317.7 | 6 | 446.0 | 348.5 |
| 7 | 249.8 | 195.2 | 7 | 289.2 | 225.9 | 7 | 328.6 | 256.7 | 7 | 368.0 | 287.5 | 7 | 407.4 | 318.3 | 7 | 446.8 | 349.1 |
| 8 | 250.6 | 195.8 | 8 | 290.0 | 226.6 | 8 | 329.4 | 257.3 | 8 | 368.8 | 288.1 | 8 | 408.2 | 318.9 | 8 | 447.6 | 349.7 |
| 9 | 251.4 | 196.4 | 9 | 290.8 | 227.2 | 9 | 330.2 | 258.0 | 9 | 369.6 | 288.7 | 9 | 409.0 | 319.5 | 9 | 448.4 | 350.3 |
| 320 | 252.2 | 197.0 | 370 | 291.6 | 227.8 | 420 | 331.0 | 258.6 | 470 | 370.4 | 289.4 | 520 | 409.8 | 320.1 | 570 | 449.2 | 350.9 |
| 1 | 253.0 | 197.6 | 1 | 292.4 | 228.4 | 1 | 331.8 | 259.2 | 1 | 371.2 | 290.0 | 1 | 410.6 | 320.8 | 1 | 450.0 | 351.5 |
| 2 | 253.7 | 198.2 | 2 | 293.1 | 229.0 | 2 | 332.5 | 259.8 | 2 | 371.9 | 290.6 | 2 | 411.3 | 321.4 | 2 | 450.7 | 352.2 |
| 3 | 254.5 | 198.9 | 3 | 293.9 | 229.6 | 3 | 333.3 | 260.4 | 3 | 372.7 | 291.2 | 3 | 412.1 | 322.0 | 3 | 451.5 | 352.8 |
| 4 | 255.3 | 199.5 | 4 | 294.7 | 230.3 | 4 | 334.1 | 261.0 | 4 | 373.5 | 291.8 | 4 | 412.9 | 322.6 | 4 | 452.3 | 353.4 |
| 5 | 256.1 | 200.1 | 5 | 295.5 | 230.9 | 5 | 334.9 | 261.7 | 5 | 374.3 | 292.4 | 5 | 413.7 | 323.2 | 5 | 453.1 | 354.0 |
| 6 | 256.9 | 200.7 | 6 | 296.3 | 231.5 | 6 | 335.7 | 262.3 | 6 | 375.1 | 293.1 | 6 | 414.5 | 323.8 | 6 | 453.9 | 354.6 |
| 7 | 257.7 | 201.3 | 7 | 297.1 | 232.1 | 7 | 336.5 | 262.9 | 7 | 375.9 | 293.7 | 7 | 415.3 | 324.5 | 7 | 454.7 | 355.2 |
| 8 | 258.5 | 201.9 | 8 | 297.9 | 232.7 | 8 | 337.3 | 263.5 | 8 | 376.7 | 294.3 | 8 | 416.1 | 325.1 | 8 | 455.5 | 355.9 |
| 9 | 259.3 | 202.6 | 9 | 298.7 | 233.3 | 9 | 338.1 | 264.1 | 9 | 377.5 | 294.9 | 9 | 416.9 | 325.7 | 9 | 456.3 | 356.5 |
| 330 | 260.0 | 203.2 | 380 | 299.4 | 234.0 | 430 | 338.8 | 264.7 | 480 | 378.2 | 295.5 | 530 | 417.6 | 326.3 | 580 | 457.0 | 357.1 |
| 1 | 260.8 | 203.8 | 1 | 300.2 | 234.6 | 1 | 339.6 | 265.3 | 1 | 379.0 | 296.1 | 1 | 418.4 | 326.9 | 1 | 457.8 | 357.7 |
| 2 | 261.6 | 204.4 | 2 | 301.0 | 235.2 | 2 | 340.4 | 266.0 | 2 | 379.8 | 296.7 | 2 | 419.2 | 327.5 | 2 | 458.6 | 358.3 |
| 3 | 262.4 | 205.0 | 3 | 301.8 | 235.8 | 3 | 341.2 | 266.6 | 3 | 380.6 | 297.4 | 3 | 420.0 | 328.1 | 3 | 459.4 | 358.9 |
| 4 | 263.2 | 205.6 | 4 | 302.6 | 236.4 | 4 | 342.0 | 267.2 | 4 | 381.4 | 298.0 | 4 | 420.8 | 328.8 | 4 | 460.2 | 359.5 |
| 5 | 264.0 | 206.2 | 5 | 303.4 | 237.0 | 5 | 342.8 | 267.8 | 5 | 382.2 | 298.6 | 5 | 421.6 | 329.4 | 5 | 461.0 | 360.2 |
| 6 | 264.8 | 206.9 | 6 | 304.2 | 237.6 | 6 | 343.6 | 268.4 | 6 | 383.0 | 299.2 | 6 | 422.4 | 330.0 | 6 | 461.8 | 360.8 |
| 7 | 265.6 | 207.5 | 7 | 305.0 | 238.3 | 7 | 344.4 | 269.0 | 7 | 383.8 | 299.8 | 7 | 423.2 | 330.6 | 7 | 462.6 | 361.4 |
| 8 | 266.3 | 208.1 | 8 | 305.7 | 238.9 | 8 | 345.1 | 269.7 | 8 | 384.6 | 300.4 | 8 | 423.9 | 331.2 | 8 | 463.4 | 362.0 |
| 9 | 267.1 | 208.7 | 9 | 306.5 | 239.5 | 9 | 345.9 | 270.3 | 9 | 385.3 | 301.1 | 9 | 424.7 | 331.8 | 9 | 464.1 | 362.6 |
| 340 | 267.9 | 209.3 | 390 | 307.3 | 240.1 | 440 | 346.7 | 270.9 | 490 | 386.1 | 301.7 | 540 | 425.5 | 332.5 | 590 | 464.9 | 363.2 |
| 1 | 268.7 | 209.9 | 1 | 308.1 | 240.7 | 1 | 347.5 | 271.5 | 1 | 386.9 | 302.3 | 1 | 426.3 | 333.1 | 1 | 465.7 | 363.9 |
| 2 | 269.5 | 210.6 | 2 | 308.9 | 241.3 | 2 | 348.3 | 272.1 | 2 | 387.7 | 302.9 | 2 | 427.1 | 333.7 | 2 | 466.5 | 364.5 |
| 3 | 270.3 | 211.2 | 3 | 309.7 | 242.0 | 3 | 349.1 | 272.7 | 3 | 388.5 | 303.5 | 3 | 427.9 | 334.3 | 3 | 467.3 | 365.1 |
| 4 | 271.1 | 211.8 | 4 | 310.5 | 242.6 | 4 | 349.9 | 273.4 | 4 | 389.3 | 304.1 | 4 | 428.7 | 334.9 | 4 | 468.1 | 365.7 |
| 5 | 271.9 | 212.4 | 5 | 311.3 | 243.2 | 5 | 350.7 | 274.0 | 5 | 390.1 | 304.8 | 5 | 429.5 | 335.5 | 5 | 468.9 | 366.3 |
| 6 | 272.7 | 213.0 | 6 | 312.1 | 243.8 | 6 | 351.5 | 274.6 | 6 | 390.9 | 305.4 | 6 | 430.3 | 336.2 | 6 | 469.7 | 366.9 |
| 7 | 273.4 | 213.6 | 7 | 312.8 | 244.4 | 7 | 352.2 | 275.2 | 7 | 391.6 | 306.0 | 7 | 431.0 | 336.8 | 7 | 470.4 | 367.5 |
| 8 | 274.2 | 214.3 | 8 | 313.6 | 245.0 | 8 | 353.0 | 275.8 | 8 | 392.4 | 306.6 | 8 | 431.8 | 337.4 | 8 | 471.2 | 368.2 |
| 9 | 275.0 | 214.9 | 9 | 314.4 | 245.6 | 9 | 353.8 | 276.4 | 9 | 393.2 | 307.2 | 9 | 432.6 | 338.0 | 9 | 472.0 | 368.8 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 308 315
269 232 225

R

089 052° 045
091 128 135

R ou φm

R

TABELA 1

R ou φm

359 321° 315
181 219 225

TÁBUAS DE CARTEAÇÃO

001 039 045
179 141 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 38.9 | 31.5 | 100 | 77.7 | 62.9 | 150 | 116.6 | 94.4 | 200 | 155.4 | 125.9 | 250 | 194.3 | 157.3 |
| 1 | 0.8 | 0.6 | 1 | 39.6 | 32.1 | 1 | 78.5 | 63.6 | 1 | 117.3 | 95.0 | 1 | 156.2 | 126.5 | 1 | 195.1 | 158.0 |
| 2 | 1.6 | 1.3 | 2 | 40.4 | 32.7 | 2 | 79.3 | 64.2 | 2 | 118.1 | 95.7 | 2 | 157.0 | 127.1 | 2 | 195.8 | 158.6 |
| 3 | 2.3 | 1.9 | 3 | 41.2 | 33.4 | 3 | 80.0 | 64.8 | 3 | 118.9 | 96.3 | 3 | 157.8 | 127.8 | 3 | 196.6 | 159.2 |
| 4 | 3.1 | 2.5 | 4 | 42.0 | 34.0 | 4 | 80.8 | 65.4 | 4 | 119.7 | 96.9 | 4 | 158.5 | 128.4 | 4 | 197.4 | 159.8 |
| 5 | 3.9 | 3.1 | 5 | 42.7 | 34.6 | 5 | 81.6 | 66.1 | 5 | 120.5 | 97.5 | 5 | 159.3 | 129.0 | 5 | 198.2 | 160.5 |
| 6 | 4.7 | 3.8 | 6 | 43.5 | 35.2 | 6 | 82.4 | 66.7 | 6 | 121.2 | 98.2 | 6 | 160.1 | 129.6 | 6 | 198.9 | 161.1 |
| 7 | 5.4 | 4.4 | 7 | 44.3 | 35.9 | 7 | 83.2 | 67.3 | 7 | 122.0 | 98.8 | 7 | 160.9 | 130.3 | 7 | 199.7 | 161.7 |
| 8 | 6.2 | 5.0 | 8 | 45.1 | 36.5 | 8 | 83.9 | 68.0 | 8 | 122.8 | 99.4 | 8 | 161.6 | 130.9 | 8 | 200.5 | 162.4 |
| 9 | 7.0 | 5.7 | 9 | 45.9 | 37.1 | 9 | 84.7 | 68.6 | 9 | 123.6 | 100.1 | 9 | 162.4 | 131.5 | 9 | 201.3 | 163.0 |
| 10 | 7.8 | 6.3 | 60 | 46.6 | 37.8 | 110 | 85.5 | 69.2 | 160 | 124.3 | 100.7 | 210 | 163.2 | 132.2 | 260 | 202.1 | 163.6 |
| 1 | 8.5 | 6.9 | 1 | 47.4 | 38.4 | 1 | 86.3 | 69.9 | 1 | 125.1 | 101.3 | 1 | 164.0 | 132.8 | 1 | 202.8 | 164.3 |
| 2 | 9.3 | 7.6 | 2 | 48.2 | 39.0 | 2 | 87.0 | 70.5 | 2 | 125.9 | 101.9 | 2 | 164.8 | 133.4 | 2 | 203.6 | 164.9 |
| 3 | 10.1 | 8.2 | 3 | 49.0 | 39.6 | 3 | 87.8 | 71.1 | 3 | 126.7 | 102.6 | 3 | 165.5 | 134.0 | 3 | 204.4 | 165.5 |
| 4 | 10.9 | 8.8 | 4 | 49.7 | 40.3 | 4 | 88.6 | 71.7 | 4 | 127.5 | 103.2 | 4 | 166.3 | 134.7 | 4 | 205.2 | 166.1 |
| 5 | 11.7 | 9.4 | 5 | 50.5 | 40.9 | 5 | 89.4 | 72.4 | 5 | 128.2 | 103.8 | 5 | 167.1 | 135.3 | 5 | 205.9 | 166.8 |
| 6 | 12.4 | 10.1 | 6 | 51.3 | 41.5 | 6 | 90.1 | 73.0 | 6 | 129.0 | 104.5 | 6 | 167.9 | 135.9 | 6 | 206.7 | 167.4 |
| 7 | 13.2 | 10.7 | 7 | 52.1 | 42.2 | 7 | 90.9 | 73.6 | 7 | 129.8 | 105.1 | 7 | 168.6 | 136.6 | 7 | 207.5 | 168.0 |
| 8 | 14.0 | 11.3 | 8 | 52.8 | 42.8 | 8 | 91.7 | 74.3 | 8 | 130.6 | 105.7 | 8 | 169.4 | 137.2 | 8 | 208.3 | 168.7 |
| 9 | 14.8 | 12.0 | 9 | 53.6 | 43.4 | 9 | 92.5 | 74.9 | 9 | 131.3 | 106.4 | 9 | 170.2 | 137.8 | 9 | 209.1 | 169.3 |
| 20 | 15.5 | 12.6 | 70 | 54.4 | 44.1 | 120 | 93.3 | 75.5 | 170 | 132.1 | 107.0 | 220 | 171.0 | 138.5 | 270 | 209.8 | 169.9 |
| 1 | 16.3 | 13.2 | 1 | 55.2 | 44.7 | 1 | 94.0 | 76.1 | 1 | 132.9 | 107.6 | 1 | 171.7 | 139.1 | 1 | 210.6 | 170.5 |
| 2 | 17.1 | 13.8 | 2 | 56.0 | 45.3 | 2 | 94.8 | 76.8 | 2 | 133.7 | 108.2 | 2 | 172.5 | 139.7 | 2 | 211.4 | 171.2 |
| 3 | 17.9 | 14.5 | 3 | 56.7 | 45.9 | 3 | 95.6 | 77.4 | 3 | 134.4 | 108.9 | 3 | 173.3 | 140.3 | 3 | 212.2 | 171.8 |
| 4 | 18.7 | 15.1 | 4 | 57.5 | 46.6 | 4 | 96.4 | 78.0 | 4 | 135.2 | 109.5 | 4 | 174.1 | 141.0 | 4 | 212.9 | 172.4 |
| 5 | 19.4 | 15.7 | 5 | 58.3 | 47.2 | 5 | 97.1 | 78.7 | 5 | 136.0 | 110.1 | 5 | 174.9 | 141.6 | 5 | 213.7 | 173.1 |
| 6 | 20.2 | 16.4 | 6 | 59.1 | 47.8 | 6 | 97.9 | 79.3 | 6 | 136.8 | 110.8 | 6 | 175.6 | 142.2 | 6 | 214.5 | 173.7 |
| 7 | 21.0 | 17.0 | 7 | 59.8 | 48.5 | 7 | 98.7 | 79.9 | 7 | 137.6 | 111.4 | 7 | 176.4 | 142.9 | 7 | 215.3 | 174.3 |
| 8 | 21.8 | 17.6 | 8 | 60.6 | 49.1 | 8 | 99.5 | 80.6 | 8 | 138.3 | 112.0 | 8 | 177.2 | 143.5 | 8 | 216.0 | 175.0 |
| 9 | 22.5 | 18.3 | 9 | 61.4 | 49.7 | 9 | 100.3 | 81.2 | 9 | 139.1 | 112.6 | 9 | 178.0 | 144.1 | 9 | 216.8 | 175.6 |
| 30 | 23.3 | 18.9 | 80 | 62.2 | 50.3 | 130 | 101.0 | 81.8 | 180 | 139.9 | 113.3 | 230 | 178.7 | 144.7 | 280 | 217.6 | 176.2 |
| 1 | 24.1 | 19.5 | 1 | 62.9 | 51.0 | 1 | 101.8 | 82.4 | 1 | 140.7 | 113.9 | 1 | 179.5 | 145.4 | 1 | 218.4 | 176.8 |
| 2 | 24.9 | 20.1 | 2 | 63.7 | 51.6 | 2 | 102.6 | 83.1 | 2 | 141.4 | 114.5 | 2 | 180.3 | 146.0 | 2 | 219.2 | 177.5 |
| 3 | 25.6 | 20.8 | 3 | 64.5 | 52.2 | 3 | 103.4 | 83.7 | 3 | 142.2 | 115.2 | 3 | 181.1 | 146.6 | 3 | 219.9 | 178.1 |
| 4 | 26.4 | 21.4 | 4 | 65.3 | 52.9 | 4 | 104.1 | 84.3 | 4 | 143.0 | 115.8 | 4 | 181.9 | 147.3 | 4 | 220.7 | 178.7 |
| 5 | 27.2 | 22.0 | 5 | 66.1 | 53.5 | 5 | 104.9 | 85.0 | 5 | 143.8 | 116.4 | 5 | 182.6 | 147.9 | 5 | 221.5 | 179.4 |
| 6 | 28.0 | 22.7 | 6 | 66.8 | 54.1 | 6 | 105.7 | 85.6 | 6 | 144.5 | 117.1 | 6 | 183.4 | 148.5 | 6 | 222.3 | 180.0 |
| 7 | 28.8 | 23.3 | 7 | 67.6 | 54.8 | 7 | 106.5 | 86.2 | 7 | 145.3 | 117.7 | 7 | 184.2 | 149.1 | 7 | 223.0 | 180.6 |
| 8 | 29.5 | 23.9 | 8 | 68.4 | 55.4 | 8 | 107.2 | 86.8 | 8 | 146.1 | 118.3 | 8 | 185.0 | 149.8 | 8 | 223.8 | 181.2 |
| 9 | 30.3 | 24.5 | 9 | 69.2 | 56.0 | 9 | 108.0 | 87.5 | 9 | 146.9 | 118.9 | 9 | 185.7 | 150.4 | 9 | 224.6 | 181.9 |
| 40 | 31.1 | 25.2 | 90 | 69.9 | 56.6 | 140 | 108.8 | 88.1 | 190 | 147.7 | 119.6 | 240 | 186.5 | 151.0 | 290 | 225.4 | 182.5 |
| 1 | 31.9 | 25.8 | 1 | 70.7 | 57.3 | 1 | 109.6 | 88.7 | 1 | 148.4 | 120.2 | 1 | 187.3 | 151.7 | 1 | 226.1 | 183.1 |
| 2 | 32.6 | 26.4 | 2 | 71.5 | 57.9 | 2 | 110.4 | 89.4 | 2 | 149.2 | 120.8 | 2 | 188.1 | 152.3 | 2 | 226.9 | 183.8 |
| 3 | 33.4 | 27.1 | 3 | 72.3 | 58.5 | 3 | 111.1 | 90.0 | 3 | 150.0 | 121.5 | 3 | 188.8 | 152.9 | 3 | 227.7 | 184.4 |
| 4 | 34.2 | 27.7 | 4 | 73.1 | 59.2 | 4 | 111.9 | 90.6 | 4 | 150.8 | 122.1 | 4 | 189.6 | 153.6 | 4 | 228.5 | 185.0 |
| 5 | 35.0 | 28.3 | 5 | 73.8 | 59.8 | 5 | 112.7 | 91.3 | 5 | 151.5 | 122.7 | 5 | 190.4 | 154.2 | 5 | 229.3 | 185.6 |
| 6 | 35.7 | 28.9 | 6 | 74.6 | 60.4 | 6 | 113.5 | 91.9 | 6 | 152.3 | 123.3 | 6 | 191.2 | 154.8 | 6 | 230.0 | 186.3 |
| 7 | 36.5 | 29.6 | 7 | 75.4 | 61.0 | 7 | 114.2 | 92.5 | 7 | 153.1 | 124.0 | 7 | 192.0 | 155.4 | 7 | 230.8 | 186.9 |
| 8 | 37.3 | 30.2 | 8 | 76.2 | 61.7 | 8 | 115.0 | 93.1 | 8 | 153.9 | 124.6 | 8 | 192.7 | 156.1 | 8 | 231.6 | 187.5 |
| 9 | 38.1 | 30.8 | 9 | 76.9 | 62.3 | 9 | 115.8 | 93.8 | 9 | 154.7 | 125.2 | 9 | 193.5 | 156.7 | 9 | 232.4 | 188.2 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 309 315
269 231 225

R

089 051° 045
091 129 135

R ou φm

R

TABELA 1

R ou φm

359 3 21° 315
181 219 225

TÁBUAS DE CARTEAÇÃO

001 039 045
179 141 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 233.1 | 188.8 | 350 | 272.0 | 220.3 | 400 | 310.9 | 251.7 | 450 | 349.7 | 283.2 | 500 | 388.6 | 314.7 | 550 | 427.4 | 346.1 |
| 1 | 233.9 | 189.4 | 1 | 272.8 | 220.9 | 1 | 311.6 | 252.4 | 1 | 350.5 | 283.8 | 1 | 389.4 | 315.3 | 1 | 428.2 | 346.8 |
| 2 | 234.7 | 190.1 | 2 | 273.6 | 221.5 | 2 | 312.4 | 253.0 | 2 | 351.3 | 284.5 | 2 | 390.1 | 315.9 | 2 | 429.0 | 347.4 |
| 3 | 235.5 | 190.7 | 3 | 274.3 | 222.2 | 3 | 313.2 | 253.6 | 3 | 352.0 | 285.1 | 3 | 390.9 | 316.5 | 3 | 429.8 | 348.0 |
| 4 | 236.3 | 191.3 | 4 | 275.1 | 222.8 | 4 | 314.0 | 254.2 | 4 | 352.8 | 285.7 | 4 | 391.7 | 317.2 | 4 | 430.5 | 348.6 |
| 5 | 237.0 | 191.9 | 5 | 275.9 | 223.4 | 5 | 314.7 | 254.9 | 5 | 353.6 | 286.3 | 5 | 392.5 | 317.8 | 5 | 431.3 | 349.3 |
| 6 | 237.8 | 192.6 | 6 | 276.7 | 224.0 | 6 | 315.5 | 255.5 | 6 | 354.4 | 287.0 | 6 | 393.2 | 318.4 | 6 | 432.1 | 349.9 |
| 7 | 238.6 | 193.2 | 7 | 277.4 | 224.7 | 7 | 316.3 | 256.1 | 7 | 355.2 | 287.6 | 7 | 394.0 | 319.1 | 7 | 432.9 | 350.5 |
| 8 | 239.4 | 193.8 | 8 | 278.2 | 225.3 | 8 | 317.1 | 256.8 | 8 | 355.9 | 288.2 | 8 | 394.8 | 319.7 | 8 | 433.6 | 351.2 |
| 9 | 240.1 | 194.5 | 9 | 279.0 | 225.9 | 9 | 317.9 | 257.4 | 9 | 356.7 | 288.9 | 9 | 395.6 | 320.3 | 9 | 434.4 | 351.8 |
| 310 | 240.9 | 195.1 | 360 | 279.8 | 226.6 | 410 | 318.6 | 258.0 | 460 | 357.5 | 289.5 | 510 | 396.3 | 321.0 | 560 | 435.2 | 352.4 |
| 1 | 241.7 | 195.7 | 1 | 280.5 | 227.2 | 1 | 319.4 | 258.7 | 1 | 358.3 | 290.1 | 1 | 397.1 | 321.6 | 1 | 436.0 | 353.0 |
| 2 | 242.5 | 196.3 | 2 | 281.3 | 227.8 | 2 | 320.2 | 259.3 | 2 | 359.0 | 290.7 | 2 | 397.9 | 322.2 | 2 | 436.8 | 353.7 |
| 3 | 243.2 | 197.0 | 3 | 282.1 | 228.4 | 3 | 321.0 | 259.9 | 3 | 359.8 | 291.4 | 3 | 398.7 | 322.8 | 3 | 437.5 | 354.3 |
| 4 | 244.0 | 197.6 | 4 | 282.9 | 229.1 | 4 | 321.7 | 260.5 | 4 | 360.6 | 292.0 | 4 | 399.5 | 323.5 | 4 | 438.3 | 354.9 |
| 5 | 244.8 | 198.2 | 5 | 283.7 | 229.7 | 5 | 322.5 | 261.2 | 5 | 361.4 | 292.6 | 5 | 400.2 | 324.1 | 5 | 439.1 | 355.6 |
| 6 | 245.6 | 198.9 | 6 | 284.4 | 230.3 | 6 | 323.3 | 261.8 | 6 | 362.1 | 293.3 | 6 | 401.0 | 324.7 | 6 | 439.9 | 356.2 |
| 7 | 246.4 | 199.5 | 7 | 285.2 | 231.0 | 7 | 324.1 | 262.4 | 7 | 362.9 | 293.9 | 7 | 401.8 | 325.4 | 7 | 440.6 | 356.8 |
| 8 | 247.1 | 200.1 | 8 | 286.0 | 231.6 | 8 | 324.8 | 263.1 | 8 | 363.7 | 294.5 | 8 | 402.6 | 326.0 | 8 | 441.4 | 357.5 |
| 9 | 247.9 | 200.8 | 9 | 286.8 | 232.2 | 9 | 325.6 | 263.7 | 9 | 364.5 | 295.2 | 9 | 403.3 | 326.6 | 9 | 442.2 | 358.1 |
| 320 | 248.7 | 201.4 | 370 | 287.5 | 232.8 | 420 | 326.4 | 264.3 | 470 | 365.3 | 295.8 | 520 | 404.1 | 327.2 | 570 | 443.0 | 358.7 |
| 1 | 249.5 | 202.0 | 1 | 288.3 | 233.5 | 1 | 327.2 | 264.9 | 1 | 366.0 | 296.4 | 1 | 404.9 | 327.9 | 1 | 443.8 | 359.3 |
| 2 | 250.2 | 202.6 | 2 | 289.1 | 234.1 | 2 | 328.0 | 265.6 | 2 | 366.8 | 297.0 | 2 | 405.7 | 328.5 | 2 | 444.5 | 360.0 |
| 3 | 251.0 | 203.3 | 3 | 289.9 | 234.7 | 3 | 328.7 | 266.2 | 3 | 367.6 | 297.7 | 3 | 406.4 | 329.1 | 3 | 445.3 | 360.6 |
| 4 | 251.8 | 203.9 | 4 | 290.7 | 235.4 | 4 | 329.5 | 266.8 | 4 | 368.4 | 298.3 | 4 | 407.2 | 329.8 | 4 | 446.1 | 361.2 |
| 5 | 252.6 | 204.5 | 5 | 291.4 | 236.0 | 5 | 330.3 | 267.5 | 5 | 369.1 | 298.9 | 5 | 408.0 | 330.4 | 5 | 446.9 | 361.9 |
| 6 | 253.3 | 205.2 | 6 | 292.2 | 236.6 | 6 | 331.1 | 268.1 | 6 | 369.9 | 299.6 | 6 | 408.8 | 331.0 | 6 | 447.6 | 362.5 |
| 7 | 254.1 | 205.8 | 7 | 293.0 | 237.3 | 7 | 331.8 | 268.7 | 7 | 370.7 | 300.2 | 7 | 409.6 | 331.7 | 7 | 448.4 | 363.1 |
| 8 | 254.9 | 206.4 | 8 | 293.8 | 237.9 | 8 | 332.6 | 269.3 | 8 | 371.5 | 300.8 | 8 | 410.3 | 332.3 | 8 | 449.2 | 363.7 |
| 9 | 255.7 | 207.0 | 9 | 294.5 | 238.5 | 9 | 333.4 | 270.0 | 9 | 372.3 | 301.4 | 9 | 411.1 | 332.9 | 9 | 450.0 | 364.4 |
| 330 | 256.5 | 207.7 | 380 | 295.3 | 239.1 | 430 | 334.2 | 270.6 | 480 | 373.0 | 302.1 | 530 | 411.9 | 333.5 | 580 | 450.7 | 365.0 |
| 1 | 257.2 | 208.3 | 1 | 296.1 | 239.8 | 1 | 334.9 | 271.2 | 1 | 373.8 | 302.7 | 1 | 412.7 | 334.2 | 1 | 451.5 | 365.6 |
| 2 | 258.0 | 208.9 | 2 | 296.9 | 240.4 | 2 | 335.7 | 271.9 | 2 | 374.6 | 303.3 | 2 | 413.4 | 334.8 | 2 | 452.3 | 366.3 |
| 3 | 258.8 | 209.6 | 3 | 297.6 | 241.0 | 3 | 336.5 | 272.5 | 3 | 375.4 | 304.0 | 3 | 414.2 | 335.4 | 3 | 453.1 | 366.9 |
| 4 | 259.6 | 210.2 | 4 | 298.4 | 241.7 | 4 | 337.3 | 273.1 | 4 | 376.1 | 304.6 | 4 | 415.0 | 336.1 | 4 | 453.9 | 367.5 |
| 5 | 260.3 | 210.8 | 5 | 299.2 | 242.3 | 5 | 338.1 | 273.8 | 5 | 376.9 | 305.2 | 5 | 415.8 | 336.7 | 5 | 454.6 | 368.2 |
| 6 | 261.1 | 211.5 | 6 | 300.0 | 242.9 | 6 | 338.8 | 274.4 | 6 | 377.7 | 305.8 | 6 | 416.6 | 337.3 | 6 | 455.4 | 368.8 |
| 7 | 261.9 | 212.1 | 7 | 300.8 | 243.5 | 7 | 339.6 | 275.0 | 7 | 378.5 | 306.5 | 7 | 417.3 | 337.9 | 7 | 456.2 | 369.4 |
| 8 | 262.7 | 212.7 | 8 | 301.5 | 244.2 | 8 | 340.4 | 275.6 | 8 | 379.2 | 307.1 | 8 | 418.1 | 338.6 | 8 | 457.0 | 370.0 |
| 9 | 263.5 | 213.3 | 9 | 302.3 | 244.8 | 9 | 341.2 | 276.3 | 9 | 380.0 | 307.7 | 9 | 418.9 | 339.2 | 9 | 457.7 | 370.7 |
| 340 | 264.2 | 214.0 | 390 | 303.1 | 245.4 | 440 | 341.9 | 276.9 | 490 | 380.8 | 308.4 | 540 | 419.7 | 339.8 | 590 | 458.5 | 371.3 |
| 1 | 265.0 | 214.6 | 1 | 303.9 | 246.1 | 1 | 342.7 | 277.5 | 1 | 381.6 | 309.0 | 1 | 420.4 | 340.5 | 1 | 459.3 | 371.9 |
| 2 | 265.8 | 215.2 | 2 | 304.6 | 246.7 | 2 | 343.5 | 278.2 | 2 | 382.4 | 309.6 | 2 | 421.2 | 341.1 | 2 | 460.1 | 372.6 |
| 3 | 266.6 | 215.9 | 3 | 305.4 | 247.3 | 3 | 344.3 | 278.8 | 3 | 383.1 | 310.3 | 3 | 422.0 | 341.7 | 3 | 460.8 | 373.2 |
| 4 | 267.3 | 216.5 | 4 | 306.2 | 248.0 | 4 | 345.1 | 279.4 | 4 | 383.9 | 310.9 | 4 | 422.8 | 342.4 | 4 | 461.6 | 373.8 |
| 5 | 268.1 | 217.1 | 5 | 307.0 | 248.6 | 5 | 345.8 | 280.0 | 5 | 384.7 | 311.5 | 5 | 423.5 | 343.0 | 5 | 462.4 | 374.4 |
| 6 | 268.9 | 217.7 | 6 | 307.7 | 249.2 | 6 | 346.6 | 280.7 | 6 | 385.5 | 312.1 | 6 | 424.3 | 343.6 | 6 | 463.2 | 375.1 |
| 7 | 269.7 | 218.4 | 7 | 308.5 | 249.8 | 7 | 347.4 | 281.3 | 7 | 386.2 | 312.8 | 7 | 425.1 | 344.2 | 7 | 464.0 | 375.7 |
| 8 | 270.4 | 219.0 | 8 | 309.3 | 250.5 | 8 | 348.2 | 281.9 | 8 | 387.0 | 313.4 | 8 | 425.9 | 344.9 | 8 | 464.7 | 376.3 |
| 9 | 271.2 | 219.6 | 9 | 310.1 | 251.1 | 9 | 348.9 | 282.6 | 9 | 387.8 | 314.0 | 9 | 426.7 | 345.5 | 9 | 465.5 | 377.0 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 309 316
269 231 225

089 051° 045
091 129 135

R

R ou φm

R

TABELA 1

R ou φm

359 320° 315
181 220 225

TÁBUAS DE CARTEAÇÃO

001 040 045
179 140 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 38.3 | 32.1 | 100 | 76.6 | 64.3 | 150 | 114.9 | 96.4 | 200 | 153.2 | 128.6 | 250 | 191.5 | 160.7 |
| 1 | 0.8 | 0.6 | 1 | 39.1 | 32.8 | 1 | 77.4 | 64.9 | 1 | 115.7 | 97.1 | 1 | 154.0 | 129.2 | 1 | 192.3 | 161.3 |
| 2 | 1.5 | 1.3 | 2 | 39.8 | 33.4 | 2 | 78.1 | 65.6 | 2 | 116.4 | 97.7 | 2 | 154.7 | 129.8 | 2 | 193.0 | 162.0 |
| 3 | 2.3 | 1.9 | 3 | 40.6 | 34.1 | 3 | 78.9 | 66.2 | 3 | 117.2 | 98.3 | 3 | 155.5 | 130.5 | 3 | 193.8 | 162.6 |
| 4 | 3.1 | 2.6 | 4 | 41.4 | 34.7 | 4 | 79.7 | 66.8 | 4 | 118.0 | 99.0 | 4 | 156.3 | 131.1 | 4 | 194.6 | 163.3 |
| 5 | 3.8 | 3.2 | 5 | 42.1 | 35.4 | 5 | 80.4 | 67.5 | 5 | 118.7 | 99.6 | 5 | 157.0 | 131.8 | 5 | 195.3 | 163.9 |
| 6 | 4.6 | 3.9 | 6 | 42.9 | 36.0 | 6 | 81.2 | 68.1 | 6 | 119.5 | 100.3 | 6 | 157.8 | 132.4 | 6 | 196.1 | 164.6 |
| 7 | 5.4 | 4.5 | 7 | 43.7 | 36.6 | 7 | 82.0 | 68.8 | 7 | 120.3 | 100.9 | 7 | 158.6 | 133.1 | 7 | 196.9 | 165.2 |
| 8 | 6.1 | 5.1 | 8 | 44.4 | 37.3 | 8 | 82.7 | 69.4 | 8 | 121.0 | 101.6 | 8 | 159.3 | 133.7 | 8 | 197.6 | 165.8 |
| 9 | 6.9 | 5.8 | 9 | 45.2 | 37.9 | 9 | 83.5 | 70.1 | 9 | 121.8 | 102.2 | 9 | 160.1 | 134.3 | 9 | 198.4 | 166.5 |
| 10 | 7.7 | 6.4 | 60 | 46.0 | 38.6 | 110 | 84.3 | 70.7 | 160 | 122.6 | 102.8 | 210 | 160.9 | 135.0 | 260 | 199.2 | 167.1 |
| 1 | 8.4 | 7.1 | 1 | 46.7 | 39.2 | 1 | 85.0 | 71.3 | 1 | 123.3 | 103.5 | 1 | 161.6 | 135.6 | 1 | 199.9 | 167.8 |
| 2 | 9.2 | 7.7 | 2 | 47.5 | 39.9 | 2 | 85.8 | 72.0 | 2 | 124.1 | 104.1 | 2 | 162.4 | 136.3 | 2 | 200.7 | 168.4 |
| 3 | 10.0 | 8.4 | 3 | 48.3 | 40.5 | 3 | 86.6 | 72.6 | 3 | 124.9 | 104.8 | 3 | 163.2 | 136.9 | 3 | 201.5 | 169.1 |
| 4 | 10.7 | 9.0 | 4 | 49.0 | 41.1 | 4 | 87.3 | 73.3 | 4 | 125.6 | 105.4 | 4 | 163.9 | 137.6 | 4 | 202.2 | 169.7 |
| 5 | 11.5 | 9.6 | 5 | 49.8 | 41.8 | 5 | 88.1 | 73.9 | 5 | 126.4 | 106.1 | 5 | 164.7 | 138.2 | 5 | 203.0 | 170.3 |
| 6 | 12.3 | 10.3 | 6 | 50.6 | 42.4 | 6 | 88.9 | 74.6 | 6 | 127.2 | 106.7 | 6 | 165.5 | 138.8 | 6 | 203.8 | 171.0 |
| 7 | 13.0 | 10.9 | 7 | 51.3 | 43.1 | 7 | 89.6 | 75.2 | 7 | 127.9 | 107.3 | 7 | 166.2 | 139.5 | 7 | 204.5 | 171.6 |
| 8 | 13.8 | 11.6 | 8 | 52.1 | 43.7 | 8 | 90.4 | 75.8 | 8 | 128.7 | 108.0 | 8 | 167.0 | 140.1 | 8 | 205.3 | 172.3 |
| 9 | 14.6 | 12.2 | 9 | 52.9 | 44.4 | 9 | 91.2 | 76.5 | 9 | 129.5 | 108.6 | 9 | 167.8 | 140.8 | 9 | 206.1 | 172.9 |
| 20 | 15.3 | 12.9 | 70 | 53.6 | 45.0 | 120 | 91.9 | 77.1 | 170 | 130.2 | 109.3 | 220 | 168.5 | 141.4 | 270 | 206.8 | 173.6 |
| 1 | 16.1 | 13.5 | 1 | 54.4 | 45.6 | 1 | 92.7 | 77.8 | 1 | 131.0 | 109.9 | 1 | 169.3 | 142.1 | 1 | 207.6 | 174.2 |
| 2 | 16.9 | 14.1 | 2 | 55.2 | 46.3 | 2 | 93.5 | 78.4 | 2 | 131.8 | 110.6 | 2 | 170.1 | 142.7 | 2 | 208.4 | 174.8 |
| 3 | 17.6 | 14.8 | 3 | 55.9 | 46.9 | 3 | 94.2 | 79.1 | 3 | 132.5 | 111.2 | 3 | 170.8 | 143.3 | 3 | 209.1 | 175.5 |
| 4 | 18.4 | 15.4 | 4 | 56.7 | 47.6 | 4 | 95.0 | 79.7 | 4 | 133.3 | 111.8 | 4 | 171.6 | 144.0 | 4 | 209.9 | 176.1 |
| 5 | 19.2 | 16.1 | 5 | 57.5 | 48.2 | 5 | 95.8 | 80.3 | 5 | 134.1 | 112.5 | 5 | 172.4 | 144.6 | 5 | 210.7 | 176.8 |
| 6 | 19.9 | 16.7 | 6 | 58.2 | 48.9 | 6 | 96.5 | 81.0 | 6 | 134.8 | 113.1 | 6 | 173.1 | 145.3 | 6 | 211.4 | 177.4 |
| 7 | 20.7 | 17.4 | 7 | 59.0 | 49.5 | 7 | 97.3 | 81.6 | 7 | 135.6 | 113.8 | 7 | 173.9 | 145.9 | 7 | 212.2 | 178.1 |
| 8 | 21.4 | 18.0 | 8 | 59.8 | 50.1 | 8 | 98.1 | 82.3 | 8 | 136.4 | 114.4 | 8 | 174.7 | 146.6 | 8 | 213.0 | 178.7 |
| 9 | 22.2 | 18.6 | 9 | 60.5 | 50.8 | 9 | 98.8 | 82.9 | 9 | 137.1 | 115.1 | 9 | 175.4 | 147.2 | 9 | 213.7 | 179.3 |
| 30 | 23.0 | 19.3 | 80 | 61.3 | 51.4 | 130 | 99.6 | 83.6 | 180 | 137.9 | 115.7 | 230 | 176.2 | 147.8 | 280 | 214.5 | 180.0 |
| 1 | 23.7 | 19.9 | 1 | 62.0 | 52.1 | 1 | 100.4 | 84.2 | 1 | 138.7 | 116.3 | 1 | 177.0 | 148.5 | 1 | 215.3 | 180.6 |
| 2 | 24.5 | 20.6 | 2 | 62.8 | 52.7 | 2 | 101.1 | 84.8 | 2 | 139.4 | 117.0 | 2 | 177.7 | 149.1 | 2 | 216.0 | 181.3 |
| 3 | 25.3 | 21.2 | 3 | 63.6 | 53.4 | 3 | 101.9 | 85.5 | 3 | 140.2 | 117.6 | 3 | 178.5 | 149.8 | 3 | 216.8 | 181.9 |
| 4 | 26.0 | 21.9 | 4 | 64.3 | 54.0 | 4 | 102.6 | 86.1 | 4 | 141.0 | 118.3 | 4 | 179.3 | 150.4 | 4 | 217.6 | 182.6 |
| 5 | 26.8 | 22.5 | 5 | 65.1 | 54.6 | 5 | 103.4 | 86.8 | 5 | 141.7 | 118.9 | 5 | 180.0 | 151.1 | 5 | 218.3 | 183.2 |
| 6 | 27.6 | 23.1 | 6 | 65.9 | 55.3 | 6 | 104.2 | 87.4 | 6 | 142.5 | 119.6 | 6 | 180.8 | 151.7 | 6 | 219.1 | 183.8 |
| 7 | 28.3 | 23.8 | 7 | 66.6 | 55.9 | 7 | 104.9 | 88.1 | 7 | 143.3 | 120.2 | 7 | 181.6 | 152.3 | 7 | 219.9 | 184.5 |
| 8 | 29.1 | 24.4 | 8 | 67.4 | 56.6 | 8 | 105.7 | 88.7 | 8 | 144.0 | 120.8 | 8 | 182.3 | 153.0 | 8 | 220.6 | 185.1 |
| 9 | 29.9 | 25.1 | 9 | 68.2 | 57.2 | 9 | 106.5 | 89.3 | 9 | 144.8 | 121.5 | 9 | 183.1 | 153.6 | 9 | 221.4 | 185.8 |
| 40 | 30.6 | 25.7 | 90 | 68.9 | 57.9 | 140 | 107.2 | 90.0 | 190 | 145.5 | 122.1 | 240 | 183.9 | 154.3 | 290 | 222.2 | 186.4 |
| 1 | 31.4 | 26.4 | 1 | 69.7 | 58.5 | 1 | 108.0 | 90.6 | 1 | 146.3 | 122.8 | 1 | 184.6 | 154.9 | 1 | 222.9 | 187.1 |
| 2 | 32.2 | 27.0 | 2 | 70.5 | 59.1 | 2 | 108.8 | 91.3 | 2 | 147.1 | 123.4 | 2 | 185.4 | 155.6 | 2 | 223.7 | 187.7 |
| 3 | 32.9 | 27.6 | 3 | 71.2 | 59.8 | 3 | 109.5 | 91.9 | 3 | 147.8 | 124.1 | 3 | 186.1 | 156.2 | 3 | 224.5 | 188.3 |
| 4 | 33.7 | 28.3 | 4 | 72.0 | 60.4 | 4 | 110.3 | 92.6 | 4 | 148.6 | 124.7 | 4 | 186.9 | 156.8 | 4 | 225.2 | 189.0 |
| 5 | 34.5 | 28.9 | 5 | 72.8 | 61.1 | 5 | 111.1 | 93.2 | 5 | 149.4 | 125.3 | 5 | 187.7 | 157.5 | 5 | 226.0 | 189.6 |
| 6 | 35.2 | 29.6 | 6 | 73.5 | 61.7 | 6 | 111.8 | 93.8 | 6 | 150.1 | 126.0 | 6 | 188.4 | 158.1 | 6 | 226.7 | 190.3 |
| 7 | 36.0 | 30.2 | 7 | 74.3 | 62.4 | 7 | 112.6 | 94.5 | 7 | 150.9 | 126.6 | 7 | 189.2 | 158.8 | 7 | 227.5 | 190.9 |
| 8 | 36.8 | 30.9 | 8 | 75.1 | 63.0 | 8 | 113.4 | 95.1 | 8 | 151.7 | 127.3 | 8 | 190.0 | 159.4 | 8 | 228.3 | 191.6 |
| 9 | 37.5 | 31.5 | 9 | 75.8 | 63.6 | 9 | 114.1 | 95.8 | 9 | 152.4 | 127.9 | 9 | 190.7 | 160.1 | 9 | 229.0 | 192.2 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 310 315
289 230 225

R

089 050° 045
091 130 135

R ou φm

R

TABELA 1

R ou φm

359 320° 315
181 220 225

TÁBUAS DE CARTEAÇÃO

001 040 045
179 140 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 229.8 | 192.8 | 350 | 268.1 | 225.0 | 400 | 306.4 | 257.1 | 450 | 344.7 | 289.3 | 500 | 383.0 | 321.4 | 550 | 421.3 | 353.5 |
| 1 | 230.6 | 193.5 | 1 | 268.9 | 225.6 | 1 | 307.2 | 257.8 | 1 | 345.5 | 289.9 | 1 | 383.8 | 322.0 | 1 | 422.1 | 354.2 |
| 2 | 231.3 | 194.1 | 2 | 269.6 | 226.3 | 2 | 307.9 | 258.4 | 2 | 346.3 | 290.5 | 2 | 384.6 | 322.7 | 2 | 422.9 | 354.8 |
| 3 | 232.1 | 194.8 | 3 | 270.4 | 226.9 | 3 | 308.7 | 259.0 | 3 | 347.0 | 291.2 | 3 | 385.3 | 323.3 | 3 | 423.6 | 355.5 |
| 4 | 232.9 | 195.4 | 4 | 271.2 | 227.5 | 4 | 309.5 | 259.7 | 4 | 347.8 | 291.8 | 4 | 386.1 | 324.0 | 4 | 424.4 | 356.1 |
| 5 | 233.6 | 196.1 | 5 | 271.9 | 228.2 | 5 | 310.2 | 260.3 | 5 | 348.6 | 292.5 | 5 | 386.9 | 324.6 | 5 | 425.2 | 356.7 |
| 6 | 234.4 | 196.7 | 6 | 272.7 | 228.8 | 6 | 311.0 | 261.0 | 6 | 349.3 | 293.1 | 6 | 387.6 | 325.3 | 6 | 425.9 | 357.4 |
| 7 | 235.2 | 197.3 | 7 | 273.5 | 229.5 | 7 | 311.8 | 261.6 | 7 | 350.1 | 293.8 | 7 | 388.4 | 325.9 | 7 | 426.7 | 358.0 |
| 8 | 235.9 | 198.0 | 8 | 274.2 | 230.1 | 8 | 312.5 | 262.3 | 8 | 350.8 | 294.4 | 8 | 389.2 | 326.5 | 8 | 427.5 | 358.7 |
| 9 | 236.7 | 198.6 | 9 | 275.0 | 230.8 | 9 | 313.3 | 262.9 | 9 | 351.6 | 295.0 | 9 | 389.9 | 327.2 | 9 | 428.2 | 359.3 |
| 310 | 237.5 | 199.3 | 360 | 275.8 | 231.4 | 410 | 314.1 | 263.5 | 460 | 352.4 | 295.7 | 510 | 390.7 | 327.8 | 560 | 429.0 | 360.0 |
| 1 | 238.2 | 199.9 | 1 | 276.5 | 232.0 | 1 | 314.8 | 264.2 | 1 | 353.1 | 296.3 | 1 | 391.4 | 328.5 | 1 | 429.8 | 360.6 |
| 2 | 239.0 | 200.5 | 2 | 277.3 | 232.7 | 2 | 315.6 | 264.8 | 2 | 353.9 | 297.0 | 2 | 392.2 | 329.1 | 2 | 430.5 | 361.2 |
| 3 | 239.8 | 201.2 | 3 | 278.1 | 233.3 | 3 | 316.4 | 265.5 | 3 | 354.7 | 297.6 | 3 | 393.0 | 329.8 | 3 | 431.3 | 361.9 |
| 4 | 240.5 | 201.8 | 4 | 278.8 | 234.0 | 4 | 317.1 | 266.1 | 4 | 355.4 | 298.3 | 4 | 393.7 | 330.4 | 4 | 432.0 | 362.5 |
| 5 | 241.3 | 202.5 | 5 | 279.6 | 234.6 | 5 | 317.9 | 266.8 | 5 | 356.2 | 298.9 | 5 | 394.5 | 331.0 | 5 | 432.8 | 363.2 |
| 6 | 242.1 | 203.1 | 6 | 280.4 | 235.3 | 6 | 318.7 | 267.4 | 6 | 357.0 | 299.5 | 6 | 395.3 | 331.7 | 6 | 433.6 | 363.8 |
| 7 | 242.8 | 203.8 | 7 | 281.1 | 235.9 | 7 | 319.4 | 268.0 | 7 | 357.7 | 300.2 | 7 | 396.0 | 332.3 | 7 | 434.3 | 364.5 |
| 8 | 243.6 | 204.4 | 8 | 281.9 | 236.5 | 8 | 320.2 | 268.7 | 8 | 358.5 | 300.8 | 8 | 396.8 | 333.0 | 8 | 435.1 | 365.1 |
| 9 | 244.4 | 205.0 | 9 | 282.7 | 237.2 | 9 | 321.0 | 269.3 | 9 | 359.3 | 301.5 | 9 | 397.6 | 333.6 | 9 | 435.9 | 365.7 |
| 320 | 245.1 | 205.7 | 370 | 283.4 | 237.8 | 420 | 321.7 | 270.0 | 470 | 360.0 | 302.1 | 520 | 398.3 | 334.2 | 570 | 436.6 | 366.4 |
| 1 | 245.9 | 206.3 | 1 | 284.2 | 238.5 | 1 | 322.5 | 270.6 | 1 | 360.8 | 302.8 | 1 | 399.1 | 334.9 | 1 | 437.4 | 367.0 |
| 2 | 246.7 | 207.0 | 2 | 285.0 | 239.1 | 2 | 323.3 | 271.3 | 2 | 361.6 | 303.4 | 2 | 399.9 | 335.5 | 2 | 438.2 | 367.7 |
| 3 | 247.4 | 207.6 | 3 | 285.7 | 239.8 | 3 | 324.0 | 271.9 | 3 | 362.3 | 304.0 | 3 | 400.6 | 336.2 | 3 | 438.9 | 368.3 |
| 4 | 248.2 | 208.3 | 4 | 286.5 | 240.4 | 4 | 324.8 | 272.5 | 4 | 363.1 | 304.7 | 4 | 401.4 | 336.8 | 4 | 439.7 | 369.0 |
| 5 | 249.0 | 208.9 | 5 | 287.3 | 241.0 | 5 | 325.6 | 273.2 | 5 | 363.9 | 305.3 | 5 | 402.2 | 337.5 | 5 | 440.5 | 369.6 |
| 6 | 249.7 | 209.5 | 6 | 288.0 | 241.7 | 6 | 326.3 | 273.8 | 6 | 364.6 | 306.0 | 6 | 402.9 | 338.1 | 6 | 441.2 | 370.2 |
| 7 | 250.5 | 210.2 | 7 | 288.8 | 242.3 | 7 | 327.1 | 274.5 | 7 | 365.4 | 306.6 | 7 | 403.7 | 338.7 | 7 | 442.0 | 370.9 |
| 8 | 251.3 | 210.8 | 8 | 289.6 | 243.0 | 8 | 327.9 | 275.1 | 8 | 366.2 | 307.3 | 8 | 404.5 | 339.4 | 8 | 442.8 | 371.5 |
| 9 | 252.0 | 211.5 | 9 | 290.3 | 243.6 | 9 | 328.6 | 275.8 | 9 | 366.9 | 307.9 | 9 | 405.2 | 340.0 | 9 | 443.5 | 372.2 |
| 330 | 252.8 | 212.1 | 380 | 291.1 | 244.3 | 430 | 329.4 | 276.4 | 480 | 367.7 | 308.5 | 530 | 406.0 | 340.7 | 580 | 444.3 | 372.8 |
| 1 | 253.6 | 212.8 | 1 | 291.9 | 244.9 | 1 | 330.2 | 277.0 | 1 | 368.5 | 309.2 | 1 | 406.8 | 341.3 | 1 | 445.1 | 373.5 |
| 2 | 254.3 | 213.4 | 2 | 292.6 | 245.5 | 2 | 330.9 | 277.7 | 2 | 369.2 | 309.8 | 2 | 407.5 | 342.0 | 2 | 445.8 | 374.1 |
| 3 | 255.1 | 214.0 | 3 | 293.4 | 246.2 | 3 | 331.7 | 278.3 | 3 | 370.0 | 310.5 | 3 | 408.3 | 342.6 | 3 | 446.6 | 374.7 |
| 4 | 255.9 | 214.7 | 4 | 294.2 | 246.8 | 4 | 332.5 | 279.0 | 4 | 370.8 | 311.1 | 4 | 409.1 | 343.2 | 4 | 447.4 | 375.4 |
| 5 | 256.6 | 215.3 | 5 | 294.9 | 247.5 | 5 | 333.2 | 279.6 | 5 | 371.5 | 311.8 | 5 | 409.8 | 343.9 | 5 | 448.1 | 376.0 |
| 6 | 257.4 | 216.0 | 6 | 295.7 | 248.1 | 6 | 334.0 | 280.3 | 6 | 372.3 | 312.4 | 6 | 410.6 | 344.5 | 6 | 448.9 | 376.7 |
| 7 | 258.2 | 216.6 | 7 | 296.5 | 248.8 | 7 | 334.8 | 280.9 | 7 | 373.1 | 313.0 | 7 | 411.4 | 345.2 | 7 | 449.7 | 377.3 |
| 8 | 258.9 | 217.3 | 8 | 297.2 | 249.4 | 8 | 335.5 | 281.5 | 8 | 373.8 | 313.7 | 8 | 412.1 | 345.8 | 8 | 450.4 | 378.0 |
| 9 | 259.7 | 217.9 | 9 | 298.0 | 250.0 | 9 | 336.3 | 282.2 | 9 | 374.6 | 314.3 | 9 | 412.9 | 346.5 | 9 | 451.2 | 378.6 |
| 340 | 260.5 | 218.5 | 390 | 298.8 | 250.7 | 440 | 337.1 | 282.8 | 490 | 375.4 | 315.0 | 540 | 413.7 | 347.1 | 590 | 452.0 | 379.2 |
| 1 | 261.2 | 219.2 | 1 | 299.5 | 251.3 | 1 | 337.8 | 283.5 | 1 | 376.1 | 315.6 | 1 | 414.4 | 347.7 | 1 | 452.7 | 379.9 |
| 2 | 262.0 | 219.8 | 2 | 300.3 | 252.0 | 2 | 338.6 | 284.1 | 2 | 376.9 | 316.3 | 2 | 415.2 | 348.4 | 2 | 453.5 | 380.5 |
| 3 | 262.8 | 220.5 | 3 | 301.1 | 252.6 | 3 | 339.4 | 284.8 | 3 | 377.7 | 316.9 | 3 | 416.0 | 349.0 | 3 | 454.3 | 381.2 |
| 4 | 263.5 | 221.1 | 4 | 301.8 | 253.3 | 4 | 340.1 | 285.4 | 4 | 378.4 | 317.5 | 4 | 416.7 | 349.7 | 4 | 455.0 | 381.8 |
| 5 | 264.3 | 221.8 | 5 | 302.6 | 253.9 | 5 | 340.9 | 286.0 | 5 | 379.2 | 318.2 | 5 | 417.5 | 350.3 | 5 | 455.8 | 382.5 |
| 6 | 265.1 | 222.4 | 6 | 303.4 | 254.5 | 6 | 341.7 | 286.7 | 6 | 380.0 | 318.8 | 6 | 418.3 | 351.0 | 6 | 456.6 | 383.1 |
| 7 | 265.8 | 223.0 | 7 | 304.1 | 255.2 | 7 | 342.4 | 287.3 | 7 | 380.7 | 319.5 | 7 | 419.0 | 351.6 | 7 | 457.3 | 383.7 |
| 8 | 266.6 | 223.7 | 8 | 304.9 | 255.8 | 8 | 343.2 | 288.0 | 8 | 381.5 | 320.1 | 8 | 419.8 | 352.2 | 8 | 458.1 | 384.4 |
| 9 | 267.3 | 224.3 | 9 | 305.7 | 256.5 | 9 | 344.0 | 288.6 | 9 | 382.3 | 320.8 | 9 | 420.6 | 352.9 | 9 | 458.9 | 385.0 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 310 315
269 230 225

R

089 050° 045
091 130 135

R ou φm

R
359 319° 315
181 221 225

TABELA 1
TÁBUAS DE CARTEAÇÃO

R ou φ m
001 041 045
179 139 135

| ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap |
|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|
| D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap |
| 0 | 0.0 | 0.0 | 50 | 37.7 | 32.8 | 100 | 75.5 | 65.6 | 150 | 113.2 | 98.4 | 200 | 150.9 | 131.2 | 250 | 188.7 | 164.0 |
| 1 | 0.8 | 0.7 | 1 | 38.5 | 33.5 | 1 | 76.2 | 66.3 | 1 | 114.0 | 99.1 | 1 | 151.7 | 131.9 | 1 | 189.4 | 164.7 |
| 2 | 1.5 | 1.3 | 2 | 39.2 | 34.1 | 2 | 77.0 | 66.9 | 2 | 114.7 | 99.7 | 2 | 152.5 | 132.5 | 2 | 190.2 | 165.3 |
| 3 | 2.3 | 2.0 | 3 | 40.0 | 34.8 | 3 | 77.7 | 67.6 | 3 | 115.5 | 100.4 | 3 | 153.2 | 133.2 | 3 | 190.9 | 166.0 |
| 4 | 3.0 | 2.6 | 4 | 40.8 | 35.4 | 4 | 78.5 | 68.2 | 4 | 116.2 | 101.0 | 4 | 154.0 | 133.8 | 4 | 191.7 | 166.6 |
| 5 | 3.8 | 3.3 | 5 | 41.5 | 36.1 | 5 | 79.2 | 68.9 | 5 | 117.0 | 101.7 | 5 | 154.7 | 134.5 | 5 | 192.5 | 167.3 |
| 6 | 4.5 | 3.9 | 6 | 42.3 | 36.7 | 6 | 80.0 | 69.5 | 6 | 117.7 | 102.3 | 6 | 155.5 | 135.1 | 6 | 193.2 | 168.0 |
| 7 | 5.3 | 4.6 | 7 | 43.0 | 37.4 | 7 | 80.8 | 70.2 | 7 | 118.5 | 103.0 | 7 | 156.2 | 135.8 | 7 | 194.0 | 168.6 |
| 8 | 6.0 | 5.2 | 8 | 43.8 | 38.1 | 8 | 81.5 | 70.9 | 8 | 119.2 | 103.7 | 8 | 157.0 | 136.5 | 8 | 194.7 | 169.3 |
| 9 | 6.8 | 5.9 | 9 | 44.5 | 38.7 | 9 | 82.3 | 71.5 | 9 | 120.0 | 104.3 | 9 | 157.7 | 137.1 | 9 | 195.5 | 169.9 |
| 10 | 7.5 | 6.6 | 60 | 45.3 | 39.4 | 110 | 83.0 | 72.2 | 160 | 120.8 | 105.0 | 210 | 158.5 | 137.8 | 260 | 196.2 | 170.6 |
| 1 | 8.3 | 7.2 | 1 | 46.0 | 40.0 | 1 | 83.8 | 72.8 | 1 | 121.5 | 105.6 | 1 | 159.2 | 138.4 | 1 | 197.0 | 171.2 |
| 2 | 9.1 | 7.9 | 2 | 46.8 | 40.7 | 2 | 84.5 | 73.5 | 2 | 122.3 | 106.3 | 2 | 160.0 | 139.1 | 2 | 197.7 | 171.9 |
| 3 | 9.8 | 8.5 | 3 | 47.5 | 41.3 | 3 | 85.3 | 74.1 | 3 | 123.0 | 106.9 | 3 | 160.8 | 139.7 | 3 | 198.5 | 172.5 |
| 4 | 10.6 | 9.2 | 4 | 48.3 | 42.0 | 4 | 86.0 | 74.8 | 4 | 123.8 | 107.6 | 4 | 161.5 | 140.4 | 4 | 199.2 | 173.2 |
| 5 | 11.3 | 9.8 | 5 | 49.1 | 42.6 | 5 | 86.8 | 75.4 | 5 | 124.5 | 108.2 | 5 | 162.3 | 141.1 | 5 | 200.0 | 173.9 |
| 6 | 12.1 | 10.5 | 6 | 49.8 | 43.3 | 6 | 87.5 | 76.1 | 6 | 125.3 | 108.9 | 6 | 163.0 | 141.7 | 6 | 200.8 | 174.5 |
| 7 | 12.8 | 11.2 | 7 | 50.6 | 44.0 | 7 | 88.3 | 76.8 | 7 | 126.0 | 109.6 | 7 | 163.8 | 142.4 | 7 | 201.5 | 175.2 |
| 8 | 13.6 | 11.8 | 8 | 51.3 | 44.6 | 8 | 89.1 | 77.4 | 8 | 126.8 | 110.2 | 8 | 164.5 | 143.0 | 8 | 202.3 | 175.8 |
| 9 | 14.3 | 12.5 | 9 | 52.1 | 45.3 | 9 | 89.8 | 78.1 | 9 | 127.5 | 110.9 | 9 | 165.3 | 143.7 | 9 | 203.0 | 176.5 |
| 20 | 15.1 | 13.1 | 70 | 52.8 | 45.9 | 120 | 90.6 | 78.7 | 170 | 128.3 | 111.5 | 220 | 166.0 | 144.3 | 270 | 203.8 | 177.1 |
| 1 | 15.8 | 13.8 | 1 | 53.6 | 46.6 | 1 | 91.3 | 79.4 | 1 | 129.1 | 112.2 | 1 | 166.8 | 145.0 | 1 | 204.5 | 177.8 |
| 2 | 16.6 | 14.4 | 2 | 54.3 | 47.2 | 2 | 92.1 | 80.0 | 2 | 129.8 | 112.8 | 2 | 167.5 | 145.6 | 2 | 205.3 | 178.4 |
| 3 | 17.4 | 15.1 | 3 | 55.1 | 47.9 | 3 | 92.8 | 80.7 | 3 | 130.6 | 113.5 | 3 | 168.3 | 146.3 | 3 | 206.0 | 179.1 |
| 4 | 18.1 | 15.7 | 4 | 55.8 | 48.5 | 4 | 93.6 | 81.4 | 4 | 131.3 | 114.2 | 4 | 169.1 | 147.0 | 4 | 206.8 | 179.8 |
| 5 | 18.9 | 16.4 | 5 | 56.6 | 49.2 | 5 | 94.3 | 82.0 | 5 | 132.1 | 114.8 | 5 | 169.8 | 147.6 | 5 | 207.5 | 180.4 |
| 6 | 19.6 | 17.1 | 6 | 57.4 | 49.9 | 6 | 95.1 | 82.7 | 6 | 132.8 | 115.5 | 6 | 170.6 | 148.3 | 6 | 208.3 | 181.1 |
| 7 | 20.4 | 17.7 | 7 | 58.1 | 50.5 | 7 | 95.8 | 83.3 | 7 | 133.6 | 116.1 | 7 | 171.3 | 148.9 | 7 | 209.1 | 181.7 |
| 8 | 21.1 | 18.4 | 8 | 58.9 | 51.2 | 8 | 96.6 | 84.0 | 8 | 134.3 | 116.8 | 8 | 172.1 | 149.6 | 8 | 209.8 | 182.4 |
| 9 | 21.9 | 19.0 | 9 | 59.6 | 51.8 | 9 | 97.4 | 84.6 | 9 | 135.1 | 117.4 | 9 | 172.8 | 150.2 | 9 | 210.6 | 183.0 |
| 30 | 22.6 | 19.7 | 80 | 60.4 | 52.5 | 130 | 98.1 | 85.3 | 180 | 135.8 | 118.1 | 230 | 173.6 | 150.9 | 280 | 211.3 | 183.7 |
| 1 | 23.4 | 20.3 | 1 | 61.1 | 53.1 | 1 | 98.9 | 85.9 | 1 | 136.6 | 118.7 | 1 | 174.3 | 151.5 | 1 | 212.1 | 184.4 |
| 2 | 24.2 | 21.0 | 2 | 61.9 | 53.8 | 2 | 99.6 | 86.6 | 2 | 137.4 | 119.4 | 2 | 175.1 | 152.2 | 2 | 212.8 | 185.0 |
| 3 | 24.9 | 21.6 | 3 | 62.6 | 54.5 | 3 | 100.4 | 87.3 | 3 | 138.1 | 120.1 | 3 | 175.8 | 152.9 | 3 | 213.6 | 185.7 |
| 4 | 25.7 | 22.3 | 4 | 63.4 | 55.1 | 4 | 101.1 | 87.9 | 4 | 138.9 | 120.7 | 4 | 176.6 | 153.5 | 4 | 214.3 | 186.3 |
| 5 | 26.4 | 23.0 | 5 | 64.2 | 55.8 | 5 | 101.9 | 88.6 | 5 | 139.6 | 121.4 | 5 | 177.4 | 154.2 | 5 | 215.1 | 187.0 |
| 6 | 27.2 | 23.6 | 6 | 64.9 | 56.4 | 6 | 102.6 | 89.2 | 6 | 140.4 | 122.0 | 6 | 178.1 | 154.8 | 6 | 215.8 | 187.6 |
| 7 | 27.9 | 24.3 | 7 | 65.7 | 57.1 | 7 | 103.4 | 89.9 | 7 | 141.1 | 122.7 | 7 | 178.9 | 155.5 | 7 | 216.6 | 188.3 |
| 8 | 28.7 | 24.9 | 8 | 66.4 | 57.7 | 8 | 104.1 | 90.5 | 8 | 141.9 | 123.3 | 8 | 179.6 | 156.1 | 8 | 217.4 | 188.9 |
| 9 | 29.4 | 25.6 | 9 | 67.2 | 58.4 | 9 | 104.9 | 91.2 | 9 | 142.6 | 124.0 | 9 | 180.4 | 156.8 | 9 | 218.1 | 189.6 |
| 40 | 30.2 | 26.2 | 90 | 67.9 | 59.0 | 140 | 105.7 | 91.8 | 190 | 143.4 | 124.7 | 240 | 181.1 | 157.5 | 290 | 218.9 | 190.3 |
| 1 | 30.9 | 26.9 | 1 | 68.7 | 59.7 | 1 | 106.4 | 92.5 | 1 | 144.1 | 125.3 | 1 | 181.9 | 158.1 | 1 | 219.6 | 190.9 |
| 2 | 31.7 | 27.6 | 2 | 69.4 | 60.4 | 2 | 107.2 | 93.2 | 2 | 144.9 | 126.0 | 2 | 182.6 | 158.8 | 2 | 220.4 | 191.6 |
| 3 | 32.5 | 28.2 | 3 | 70.2 | 61.0 | 3 | 107.9 | 93.8 | 3 | 145.7 | 126.6 | 3 | 183.4 | 159.4 | 3 | 221.1 | 192.2 |
| 4 | 33.2 | 28.9 | 4 | 70.9 | 61.7 | 4 | 108.7 | 94.5 | 4 | 146.4 | 127.3 | 4 | 184.1 | 160.1 | 4 | 221.9 | 192.9 |
| 5 | 34.0 | 29.5 | 5 | 71.7 | 62.3 | 5 | 109.4 | 95.1 | 5 | 147.2 | 127.9 | 5 | 184.9 | 160.7 | 5 | 222.6 | 193.5 |
| 6 | 34.7 | 30.2 | 6 | 72.5 | 63.0 | 6 | 110.2 | 95.8 | 6 | 147.9 | 128.6 | 6 | 185.7 | 161.4 | 6 | 223.4 | 194.2 |
| 7 | 35.5 | 30.8 | 7 | 73.2 | 63.6 | 7 | 110.9 | 96.4 | 7 | 148.7 | 129.2 | 7 | 186.4 | 162.0 | 7 | 224.1 | 194.8 |
| 8 | 36.2 | 31.5 | 8 | 74.0 | 64.3 | 8 | 111.7 | 97.1 | 8 | 149.4 | 129.9 | 8 | 187.2 | 162.7 | 8 | 224.9 | 195.5 |
| 9 | 37.0 | 32.1 | 9 | 74.7 | 64.9 | 9 | 112.5 | 97.8 | 9 | 150.2 | 130.6 | 9 | 187.9 | 163.4 | 9 | 225.7 | 196.2 |
| D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 311 315
269 229 225

R

089 049° 045
091 131 135

R ou φ m

R

TABELA 1

R ou φm

359 319° 315
181 221 225

TÁBUAS DE CARTEAÇÃO

001 041 045
179 139 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 226.4 | 196.8 | 350 | 264.1 | 229.6 | 400 | 301.9 | 262.4 | 450 | 339.6 | 295.2 | 500 | 377.4 | 328.0 | 550 | 415.1 | 360.8 |
| 1 | 227.2 | 197.5 | 1 | 264.9 | 230.3 | 1 | 302.6 | 263.1 | 1 | 340.4 | 295.9 | 1 | 378.1 | 328.7 | 1 | 415.8 | 361.5 |
| 2 | 227.9 | 198.1 | 2 | 265.7 | 230.9 | 2 | 303.4 | 263.7 | 2 | 341.1 | 296.5 | 2 | 378.9 | 329.3 | 2 | 416.6 | 362.1 |
| 3 | 228.7 | 198.8 | 3 | 266.4 | 231.6 | 3 | 304.1 | 264.4 | 3 | 341.9 | 297.2 | 3 | 379.6 | 330.0 | 3 | 417.4 | 362.8 |
| 4 | 229.4 | 199.4 | 4 | 267.2 | 232.2 | 4 | 304.9 | 265.0 | 4 | 342.6 | 297.9 | 4 | 380.4 | 330.7 | 4 | 418.1 | 363.5 |
| 5 | 230.2 | 200.1 | 5 | 267.9 | 232.9 | 5 | 305.7 | 265.7 | 5 | 343.4 | 298.5 | 5 | 381.1 | 331.3 | 5 | 418.9 | 364.1 |
| 6 | 230.9 | 200.8 | 6 | 268.7 | 233.6 | 6 | 306.4 | 266.4 | 6 | 344.1 | 299.2 | 6 | 381.9 | 332.0 | 6 | 419.6 | 364.8 |
| 7 | 231.7 | 201.4 | 7 | 269.4 | 234.2 | 7 | 307.2 | 267.0 | 7 | 344.9 | 299.8 | 7 | 382.6 | 332.6 | 7 | 420.4 | 365.4 |
| 8 | 232.5 | 202.1 | 8 | 270.2 | 234.9 | 8 | 307.9 | 267.7 | 8 | 345.7 | 300.5 | 8 | 383.4 | 333.3 | 8 | 421.1 | 366.1 |
| 9 | 233.2 | 202.7 | 9 | 270.9 | 235.5 | 9 | 308.7 | 268.3 | 9 | 346.4 | 301.1 | 9 | 384.1 | 333.9 | 9 | 421.9 | 366.7 |
| 310 | 234.0 | 203.4 | 360 | 271.7 | 236.2 | 410 | 309.4 | 269.0 | 460 | 347.2 | 301.8 | 510 | 384.9 | 334.6 | 560 | 422.6 | 367.4 |
| 1 | 234.7 | 204.0 | 1 | 272.4 | 236.8 | 1 | 310.2 | 269.6 | 1 | 347.9 | 302.4 | 1 | 385.7 | 335.2 | 1 | 423.4 | 368.0 |
| 2 | 235.5 | 204.7 | 2 | 273.2 | 237.5 | 2 | 310.9 | 270.3 | 2 | 348.7 | 303.1 | 2 | 386.4 | 335.9 | 2 | 424.1 | 368.7 |
| 3 | 236.2 | 205.3 | 3 | 274.0 | 238.1 | 3 | 311.7 | 271.0 | 3 | 349.4 | 303.8 | 3 | 387.2 | 336.6 | 3 | 424.9 | 369.4 |
| 4 | 237.0 | 206.0 | 4 | 274.7 | 238.8 | 4 | 312.4 | 271.6 | 4 | 350.2 | 304.4 | 4 | 387.9 | 337.2 | 4 | 425.7 | 370.0 |
| 5 | 237.7 | 206.7 | 5 | 275.5 | 239.5 | 5 | 313.2 | 272.3 | 5 | 350.9 | 305.1 | 5 | 388.7 | 337.9 | 5 | 426.4 | 370.7 |
| 6 | 238.5 | 207.3 | 6 | 276.2 | 240.1 | 6 | 314.0 | 272.9 | 6 | 351.7 | 305.7 | 6 | 389.4 | 338.5 | 6 | 427.2 | 371.3 |
| 7 | 239.2 | 208.0 | 7 | 277.0 | 240.8 | 7 | 314.7 | 273.6 | 7 | 352.4 | 306.4 | 7 | 390.2 | 339.2 | 7 | 427.9 | 372.0 |
| 8 | 240.0 | 208.6 | 8 | 277.7 | 241.4 | 8 | 315.5 | 274.2 | 8 | 353.2 | 307.0 | 8 | 390.9 | 339.8 | 8 | 428.7 | 372.6 |
| 9 | 240.8 | 209.3 | 9 | 278.5 | 242.1 | 9 | 316.2 | 274.9 | 9 | 354.0 | 307.7 | 9 | 391.7 | 340.5 | 9 | 429.4 | 373.3 |
| 320 | 241.5 | 209.9 | 370 | 279.2 | 242.7 | 420 | 317.0 | 275.5 | 470 | 354.7 | 308.3 | 520 | 392.4 | 341.2 | 570 | 430.2 | 374.0 |
| 1 | 242.3 | 210.6 | 1 | 280.0 | 243.4 | 1 | 317.7 | 276.2 | 1 | 355.5 | 309.0 | 1 | 393.2 | 341.8 | 1 | 430.9 | 374.6 |
| 2 | 243.0 | 211.3 | 2 | 280.8 | 244.1 | 2 | 318.5 | 276.9 | 2 | 356.2 | 309.7 | 2 | 394.0 | 342.5 | 2 | 431.7 | 375.3 |
| 3 | 243.8 | 211.9 | 3 | 281.5 | 244.7 | 3 | 319.2 | 277.5 | 3 | 357.0 | 310.3 | 3 | 394.7 | 343.1 | 3 | 432.4 | 375.9 |
| 4 | 244.5 | 212.6 | 4 | 282.3 | 245.4 | 4 | 320.0 | 278.2 | 4 | 357.7 | 311.0 | 4 | 395.5 | 343.8 | 4 | 433.2 | 376.6 |
| 5 | 245.3 | 213.2 | 5 | 283.0 | 246.0 | 5 | 320.8 | 278.8 | 5 | 358.5 | 311.6 | 5 | 396.2 | 344.4 | 5 | 434.0 | 377.2 |
| 6 | 246.0 | 213.9 | 6 | 283.8 | 246.7 | 6 | 321.5 | 279.5 | 6 | 359.2 | 312.3 | 6 | 397.0 | 345.1 | 6 | 434.7 | 377.9 |
| 7 | 246.8 | 214.5 | 7 | 284.5 | 247.3 | 7 | 322.3 | 280.1 | 7 | 360.0 | 312.9 | 7 | 397.7 | 345.7 | 7 | 435.5 | 378.5 |
| 8 | 247.5 | 215.2 | 8 | 285.3 | 248.0 | 8 | 323.0 | 280.8 | 8 | 360.8 | 313.6 | 8 | 398.5 | 346.4 | 8 | 436.2 | 379.2 |
| 9 | 248.3 | 215.8 | 9 | 286.0 | 248.6 | 9 | 323.8 | 281.4 | 9 | 361.5 | 314.3 | 9 | 399.2 | 347.1 | 9 | 437.0 | 379.9 |
| 330 | 249.1 | 216.5 | 380 | 286.8 | 249.3 | 430 | 324.5 | 282.1 | 480 | 362.3 | 314.9 | 530 | 400.0 | 347.7 | 580 | 437.7 | 380.5 |
| 1 | 249.8 | 217.2 | 1 | 287.5 | 250.0 | 1 | 325.3 | 282.8 | 1 | 363.0 | 315.6 | 1 | 400.8 | 348.4 | 1 | 438.5 | 381.2 |
| 2 | 250.6 | 217.8 | 2 | 288.3 | 250.6 | 2 | 326.0 | 283.4 | 2 | 363.8 | 316.2 | 2 | 401.5 | 349.0 | 2 | 439.2 | 381.8 |
| 3 | 251.3 | 218.5 | 3 | 289.1 | 251.3 | 3 | 326.8 | 284.1 | 3 | 364.5 | 316.9 | 3 | 402.3 | 349.7 | 3 | 440.0 | 382.5 |
| 4 | 252.1 | 219.1 | 4 | 289.8 | 251.9 | 4 | 327.5 | 284.7 | 4 | 365.3 | 317.5 | 4 | 403.0 | 350.3 | 4 | 440.8 | 383.1 |
| 5 | 252.8 | 219.8 | 5 | 290.6 | 252.6 | 5 | 328.3 | 285.4 | 5 | 366.0 | 318.2 | 5 | 403.8 | 351.0 | 5 | 441.5 | 383.8 |
| 6 | 253.6 | 220.4 | 6 | 291.3 | 253.2 | 6 | 329.1 | 286.0 | 6 | 366.8 | 318.8 | 6 | 404.5 | 351.6 | 6 | 442.3 | 384.5 |
| 7 | 254.3 | 221.1 | 7 | 292.1 | 253.9 | 7 | 329.8 | 286.7 | 7 | 367.5 | 319.5 | 7 | 405.3 | 352.3 | 7 | 443.0 | 385.1 |
| 8 | 255.1 | 221.7 | 8 | 292.8 | 254.6 | 8 | 330.6 | 287.4 | 8 | 368.3 | 320.2 | 8 | 406.0 | 353.0 | 8 | 443.8 | 385.8 |
| 9 | 255.8 | 222.4 | 9 | 293.6 | 255.2 | 9 | 331.3 | 288.0 | 9 | 369.1 | 320.8 | 9 | 406.8 | 353.6 | 9 | 444.5 | 386.4 |
| 340 | 256.6 | 223.1 | 390 | 294.3 | 255.9 | 440 | 332.1 | 288.7 | 490 | 369.8 | 321.5 | 540 | 407.5 | 354.3 | 590 | 445.3 | 387.1 |
| 1 | 257.4 | 223.7 | 1 | 295.1 | 256.5 | 1 | 332.8 | 289.3 | 1 | 370.6 | 322.1 | 1 | 408.3 | 354.9 | 1 | 446.0 | 387.7 |
| 2 | 258.1 | 224.4 | 2 | 295.8 | 257.2 | 2 | 333.6 | 290.0 | 2 | 371.3 | 322.8 | 2 | 409.1 | 355.6 | 2 | 446.8 | 388.4 |
| 3 | 258.9 | 225.0 | 3 | 296.6 | 257.8 | 3 | 334.3 | 290.6 | 3 | 372.1 | 323.4 | 3 | 409.8 | 356.2 | 3 | 447.5 | 389.0 |
| 4 | 259.6 | 225.7 | 4 | 297.4 | 258.5 | 4 | 335.1 | 291.3 | 4 | 372.8 | 324.1 | 4 | 410.6 | 356.9 | 4 | 448.3 | 389.7 |
| 5 | 260.4 | 226.3 | 5 | 298.1 | 259.1 | 5 | 335.8 | 291.9 | 5 | 373.6 | 324.7 | 5 | 411.3 | 357.6 | 5 | 449.1 | 390.4 |
| 6 | 261.1 | 227.0 | 6 | 298.9 | 259.8 | 6 | 336.6 | 292.6 | 6 | 374.3 | 325.4 | 6 | 412.1 | 358.2 | 6 | 449.8 | 391.0 |
| 7 | 261.9 | 227.7 | 7 | 299.6 | 260.5 | 7 | 337.4 | 293.3 | 7 | 375.1 | 326.1 | 7 | 412.8 | 358.9 | 7 | 450.6 | 391.7 |
| 8 | 262.6 | 228.3 | 8 | 300.4 | 261.1 | 8 | 338.1 | 293.9 | 8 | 375.8 | 326.7 | 8 | 413.6 | 359.5 | 8 | 451.3 | 392.3 |
| 9 | 263.4 | 229.0 | 9 | 301.1 | 261.8 | 9 | 338.9 | 294.6 | 9 | 376.6 | 327.4 | 9 | 414.3 | 360.2 | 9 | 452.1 | 393.0 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 311 315
289 229 225

R

089 049° 045
091 131 135

R ou φm

R
359 **318°** 315
181 **222** 225

TABELA 1
TÁBUAS DE CARTEAÇÃO

R ou ϕm
001 **042** 045
179 **138** 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|------------|--------------|--------------|
| D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap | D | $\Delta\phi$ | ap |
| 0 | 0.0 | 0.0 | 50 | 37.2 | 33.5 | 100 | 74.3 | 66.9 | 150 | 111.5 | 100.4 | 200 | 148.6 | 133.8 | 250 | 185.8 | 167.3 |
| 1 | 0.7 | 0.7 | 1 | 37.9 | 34.1 | 1 | 75.1 | 67.6 | 1 | 112.2 | 101.0 | 1 | 149.4 | 134.5 | 1 | 186.5 | 168.0 |
| 2 | 1.5 | 1.3 | 2 | 38.6 | 34.8 | 2 | 75.8 | 68.3 | 2 | 113.0 | 101.7 | 2 | 150.1 | 135.2 | 2 | 187.3 | 168.6 |
| 3 | 2.2 | 2.0 | 3 | 39.4 | 35.5 | 3 | 76.5 | 68.9 | 3 | 113.7 | 102.4 | 3 | 150.9 | 135.8 | 3 | 188.0 | 169.3 |
| 4 | 3.0 | 2.7 | 4 | 40.1 | 36.1 | 4 | 77.3 | 69.6 | 4 | 114.4 | 103.0 | 4 | 151.6 | 136.5 | 4 | 188.8 | 170.0 |
| 5 | 3.7 | 3.3 | 5 | 40.9 | 36.8 | 5 | 78.0 | 70.3 | 5 | 115.2 | 103.7 | 5 | 152.3 | 137.2 | 5 | 189.5 | 170.6 |
| 6 | 4.5 | 4.0 | 6 | 41.6 | 37.5 | 6 | 78.8 | 70.9 | 6 | 115.9 | 104.4 | 6 | 153.1 | 137.8 | 6 | 190.2 | 171.3 |
| 7 | 5.2 | 4.7 | 7 | 42.4 | 38.1 | 7 | 79.5 | 71.6 | 7 | 116.7 | 105.1 | 7 | 153.8 | 138.5 | 7 | 191.0 | 172.0 |
| 8 | 5.9 | 5.4 | 8 | 43.1 | 38.8 | 8 | 80.3 | 72.3 | 8 | 117.4 | 105.7 | 8 | 154.6 | 139.2 | 8 | 191.7 | 172.6 |
| 9 | 6.7 | 6.0 | 9 | 43.8 | 39.5 | 9 | 81.0 | 72.9 | 9 | 118.2 | 106.4 | 9 | 155.3 | 139.8 | 9 | 192.5 | 173.3 |
| 10 | 7.4 | 6.7 | 60 | 44.6 | 40.1 | 110 | 81.7 | 73.6 | 160 | 118.9 | 107.1 | 210 | 156.1 | 140.5 | 260 | 193.2 | 174.0 |
| 1 | 8.2 | 7.4 | 1 | 45.3 | 40.8 | 1 | 82.5 | 74.3 | 1 | 119.6 | 107.7 | 1 | 156.8 | 141.2 | 1 | 194.0 | 174.6 |
| 2 | 8.9 | 8.0 | 2 | 46.1 | 41.5 | 2 | 83.2 | 74.9 | 2 | 120.4 | 108.4 | 2 | 157.5 | 141.9 | 2 | 194.7 | 175.3 |
| 3 | 9.7 | 8.7 | 3 | 46.8 | 42.2 | 3 | 84.0 | 75.6 | 3 | 121.1 | 109.1 | 3 | 158.3 | 142.6 | 3 | 195.4 | 176.0 |
| 4 | 10.4 | 9.4 | 4 | 47.6 | 42.8 | 4 | 84.7 | 76.3 | 4 | 121.9 | 109.7 | 4 | 159.0 | 143.2 | 4 | 196.2 | 176.7 |
| 5 | 11.1 | 10.0 | 5 | 48.3 | 43.5 | 5 | 85.5 | 77.0 | 5 | 122.6 | 110.4 | 5 | 159.8 | 143.9 | 5 | 196.9 | 177.3 |
| 6 | 11.9 | 10.7 | 6 | 49.0 | 44.2 | 6 | 86.2 | 77.6 | 6 | 123.4 | 111.1 | 6 | 160.5 | 144.5 | 6 | 197.7 | 178.0 |
| 7 | 12.6 | 11.4 | 7 | 49.8 | 44.8 | 7 | 86.9 | 78.3 | 7 | 124.1 | 111.7 | 7 | 161.3 | 145.2 | 7 | 198.4 | 178.7 |
| 8 | 13.4 | 12.0 | 8 | 50.5 | 45.5 | 8 | 87.7 | 79.0 | 8 | 124.8 | 112.4 | 8 | 162.0 | 145.9 | 8 | 199.2 | 179.3 |
| 9 | 14.1 | 12.7 | 9 | 51.3 | 46.2 | 9 | 88.4 | 79.6 | 9 | 125.6 | 113.1 | 9 | 162.7 | 146.5 | 9 | 199.9 | 180.0 |
| 20 | 14.9 | 13.4 | 70 | 52.0 | 46.8 | 120 | 89.2 | 80.3 | 170 | 126.3 | 113.8 | 220 | 163.5 | 147.2 | 270 | 200.6 | 180.7 |
| 1 | 15.6 | 14.1 | 1 | 52.8 | 47.5 | 1 | 89.9 | 81.0 | 1 | 127.1 | 114.4 | 1 | 164.2 | 147.9 | 1 | 201.4 | 181.3 |
| 2 | 16.3 | 14.7 | 2 | 53.5 | 48.2 | 2 | 90.7 | 81.6 | 2 | 127.8 | 115.1 | 2 | 165.0 | 148.6 | 2 | 202.1 | 182.0 |
| 3 | 17.1 | 15.4 | 3 | 54.2 | 48.8 | 3 | 91.4 | 82.3 | 3 | 128.6 | 115.8 | 3 | 165.7 | 149.2 | 3 | 202.9 | 182.7 |
| 4 | 17.8 | 16.1 | 4 | 55.0 | 49.5 | 4 | 92.1 | 83.0 | 4 | 129.3 | 116.4 | 4 | 166.5 | 149.9 | 4 | 203.6 | 183.3 |
| 5 | 18.6 | 16.7 | 5 | 55.7 | 50.2 | 5 | 92.9 | 83.6 | 5 | 130.1 | 117.1 | 5 | 167.2 | 150.6 | 5 | 204.4 | 184.0 |
| 6 | 19.3 | 17.4 | 6 | 56.5 | 50.9 | 6 | 93.6 | 84.3 | 6 | 130.8 | 117.8 | 6 | 168.0 | 151.2 | 6 | 205.1 | 184.7 |
| 7 | 20.1 | 18.1 | 7 | 57.2 | 51.5 | 7 | 94.4 | 85.0 | 7 | 131.5 | 118.4 | 7 | 168.7 | 151.9 | 7 | 205.9 | 185.3 |
| 8 | 20.8 | 18.7 | 8 | 58.0 | 52.2 | 8 | 95.1 | 85.6 | 8 | 132.3 | 119.1 | 8 | 169.4 | 152.6 | 8 | 206.6 | 186.0 |
| 9 | 21.6 | 19.4 | 9 | 58.7 | 52.9 | 9 | 95.9 | 86.3 | 9 | 133.0 | 119.8 | 9 | 170.2 | 153.2 | 9 | 207.3 | 186.7 |
| 30 | 22.3 | 20.1 | 80 | 59.5 | 53.5 | 130 | 96.6 | 87.0 | 180 | 133.8 | 120.4 | 230 | 170.9 | 153.9 | 280 | 208.1 | 187.4 |
| 1 | 23.0 | 20.7 | 1 | 60.2 | 54.2 | 1 | 97.4 | 87.7 | 1 | 134.5 | 121.1 | 1 | 171.7 | 154.6 | 1 | 208.8 | 188.0 |
| 2 | 23.8 | 21.4 | 2 | 60.9 | 54.9 | 2 | 98.1 | 88.3 | 2 | 135.3 | 121.8 | 2 | 172.4 | 155.2 | 2 | 209.6 | 188.7 |
| 3 | 24.5 | 22.1 | 3 | 61.7 | 55.5 | 3 | 98.8 | 89.0 | 3 | 136.0 | 122.5 | 3 | 173.2 | 155.9 | 3 | 210.3 | 189.4 |
| 4 | 25.3 | 22.8 | 4 | 62.4 | 56.2 | 4 | 99.6 | 89.7 | 4 | 136.7 | 123.1 | 4 | 173.9 | 156.6 | 4 | 211.1 | 190.0 |
| 5 | 26.0 | 23.4 | 5 | 63.2 | 56.9 | 5 | 100.3 | 90.3 | 5 | 137.5 | 123.8 | 5 | 174.6 | 157.2 | 5 | 211.8 | 190.7 |
| 6 | 26.8 | 24.1 | 6 | 63.9 | 57.5 | 6 | 101.1 | 91.0 | 6 | 138.2 | 124.5 | 6 | 175.4 | 157.9 | 6 | 212.5 | 191.4 |
| 7 | 27.5 | 24.8 | 7 | 64.7 | 58.2 | 7 | 101.8 | 91.7 | 7 | 139.0 | 125.1 | 7 | 176.1 | 158.6 | 7 | 213.3 | 192.0 |
| 8 | 28.2 | 25.4 | 8 | 65.4 | 58.9 | 8 | 102.6 | 92.3 | 8 | 139.7 | 125.8 | 8 | 176.9 | 159.3 | 8 | 214.0 | 192.7 |
| 9 | 29.0 | 26.1 | 9 | 66.1 | 59.6 | 9 | 103.3 | 93.0 | 9 | 140.5 | 126.5 | 9 | 177.6 | 159.9 | 9 | 214.8 | 193.4 |
| 40 | 29.7 | 26.8 | 90 | 66.9 | 60.2 | 140 | 104.0 | 93.7 | 190 | 141.2 | 127.1 | 240 | 178.4 | 160.6 | 290 | 215.5 | 194.0 |
| 1 | 30.5 | 27.4 | 1 | 67.6 | 60.9 | 1 | 104.8 | 94.3 | 1 | 141.9 | 127.8 | 1 | 179.1 | 161.3 | 1 | 216.3 | 194.7 |
| 2 | 31.2 | 28.1 | 2 | 68.4 | 61.6 | 2 | 105.5 | 95.0 | 2 | 142.7 | 128.5 | 2 | 179.8 | 161.9 | 2 | 217.0 | 195.4 |
| 3 | 32.0 | 28.8 | 3 | 69.1 | 62.2 | 3 | 106.3 | 95.7 | 3 | 143.4 | 129.1 | 3 | 180.6 | 162.6 | 3 | 217.7 | 196.1 |
| 4 | 32.7 | 29.4 | 4 | 69.9 | 62.9 | 4 | 107.0 | 96.4 | 4 | 144.2 | 129.8 | 4 | 181.3 | 163.3 | 4 | 218.5 | 196.7 |
| 5 | 33.4 | 30.1 | 5 | 70.6 | 63.6 | 5 | 107.8 | 97.0 | 5 | 144.9 | 130.5 | 5 | 182.1 | 163.9 | 5 | 219.2 | 197.4 |
| 6 | 34.2 | 30.8 | 6 | 71.3 | 64.2 | 6 | 108.5 | 97.7 | 6 | 145.7 | 131.1 | 6 | 182.8 | 164.6 | 6 | 220.0 | 198.1 |
| 7 | 34.9 | 31.4 | 7 | 72.1 | 64.9 | 7 | 109.2 | 98.4 | 7 | 146.4 | 131.8 | 7 | 183.6 | 165.3 | 7 | 220.7 | 198.7 |
| 8 | 35.7 | 32.1 | 8 | 72.8 | 65.6 | 8 | 110.0 | 99.0 | 8 | 147.1 | 132.5 | 8 | 184.3 | 165.9 | 8 | 221.5 | 199.4 |
| 9 | 36.4 | 32.8 | 9 | 73.6 | 66.2 | 9 | 110.7 | 99.7 | 9 | 147.9 | 133.2 | 9 | 185.0 | 166.6 | 9 | 222.2 | 200.1 |
| D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ | D | ap | $\Delta\phi$ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 **312** 315
269 **228** 225
R

089 **048°** 045
091 **132** 135
R ou ϕm

R

TABELA 1

R ou φ m

TÁBUAS DE CARTEAÇÃO

359 318° 315
181 222 225

001 042 045
179 138 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|------------|-----------------|-----------------|
| D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap | D | $\Delta\varphi$ | ap |
| 300 | 222.9 | 200.7 | 350 | 260.1 | 234.2 | 400 | 297.3 | 267.7 | 450 | 334.4 | 301.1 | 500 | 371.6 | 334.6 | 550 | 408.7 | 368.0 |
| 1 | 223.7 | 201.4 | 1 | 260.8 | 234.9 | 1 | 298.0 | 268.3 | 1 | 335.2 | 301.8 | 1 | 372.3 | 335.2 | 1 | 409.5 | 368.7 |
| 2 | 224.4 | 202.1 | 2 | 261.6 | 235.5 | 2 | 298.7 | 269.0 | 2 | 335.9 | 302.4 | 2 | 373.1 | 335.9 | 2 | 410.2 | 369.4 |
| 3 | 225.2 | 202.7 | 3 | 262.3 | 236.2 | 3 | 299.5 | 269.7 | 3 | 336.6 | 303.1 | 3 | 373.8 | 336.6 | 3 | 411.0 | 370.0 |
| 4 | 225.9 | 203.4 | 4 | 263.1 | 236.9 | 4 | 300.2 | 270.3 | 4 | 337.4 | 303.8 | 4 | 374.5 | 337.2 | 4 | 411.7 | 370.7 |
| 5 | 226.7 | 204.1 | 5 | 263.8 | 237.5 | 5 | 301.0 | 271.0 | 5 | 338.1 | 304.5 | 5 | 375.3 | 337.9 | 5 | 412.4 | 371.4 |
| 6 | 227.4 | 204.8 | 6 | 264.6 | 238.2 | 6 | 301.7 | 271.7 | 6 | 338.9 | 305.1 | 6 | 376.0 | 338.6 | 6 | 413.2 | 372.0 |
| 7 | 228.1 | 205.4 | 7 | 265.3 | 238.9 | 7 | 302.5 | 272.3 | 7 | 339.6 | 305.8 | 7 | 376.8 | 339.2 | 7 | 413.9 | 372.7 |
| 8 | 228.9 | 206.1 | 8 | 266.0 | 239.5 | 8 | 303.2 | 273.0 | 8 | 340.4 | 306.5 | 8 | 377.5 | 339.9 | 8 | 414.7 | 373.4 |
| 9 | 229.6 | 206.8 | 9 | 266.8 | 240.2 | 9 | 303.9 | 273.7 | 9 | 341.1 | 307.1 | 9 | 378.3 | 340.6 | 9 | 415.4 | 374.0 |
| 310 | 230.4 | 207.4 | 360 | 267.5 | 240.9 | 410 | 304.7 | 274.3 | 460 | 341.8 | 307.8 | 510 | 379.0 | 341.3 | 560 | 416.2 | 374.7 |
| 1 | 231.1 | 208.1 | 1 | 268.3 | 241.6 | 1 | 305.4 | 275.0 | 1 | 342.6 | 308.5 | 1 | 379.7 | 341.9 | 1 | 416.9 | 375.4 |
| 2 | 231.9 | 208.8 | 2 | 269.0 | 242.2 | 2 | 306.2 | 275.7 | 2 | 343.3 | 309.1 | 2 | 380.5 | 342.6 | 2 | 417.6 | 376.1 |
| 3 | 232.6 | 209.4 | 3 | 269.8 | 242.9 | 3 | 306.9 | 276.4 | 3 | 344.1 | 309.8 | 3 | 381.2 | 343.3 | 3 | 418.4 | 376.7 |
| 4 | 233.3 | 210.1 | 4 | 270.5 | 243.6 | 4 | 307.7 | 277.0 | 4 | 344.8 | 310.5 | 4 | 382.0 | 343.9 | 4 | 419.1 | 377.4 |
| 5 | 234.1 | 210.8 | 5 | 271.2 | 244.2 | 5 | 308.4 | 277.7 | 5 | 345.6 | 311.1 | 5 | 382.7 | 344.6 | 5 | 419.9 | 378.1 |
| 6 | 234.8 | 211.4 | 6 | 272.0 | 244.9 | 6 | 309.1 | 278.4 | 6 | 346.3 | 311.8 | 6 | 383.5 | 345.3 | 6 | 420.6 | 378.7 |
| 7 | 235.6 | 212.1 | 7 | 272.7 | 245.6 | 7 | 309.9 | 279.0 | 7 | 347.0 | 312.5 | 7 | 384.2 | 345.9 | 7 | 421.4 | 379.4 |
| 8 | 236.3 | 212.8 | 8 | 273.5 | 246.2 | 8 | 310.6 | 279.7 | 8 | 347.8 | 313.2 | 8 | 384.9 | 346.6 | 8 | 422.1 | 380.1 |
| 9 | 237.1 | 213.5 | 9 | 274.2 | 246.9 | 9 | 311.4 | 280.4 | 9 | 348.5 | 313.8 | 9 | 385.7 | 347.3 | 9 | 422.8 | 380.7 |
| 320 | 237.8 | 214.1 | 370 | 275.0 | 247.6 | 420 | 312.1 | 281.0 | 470 | 349.3 | 314.5 | 520 | 386.4 | 347.9 | 570 | 423.6 | 381.4 |
| 1 | 238.5 | 214.8 | 1 | 275.7 | 248.2 | 1 | 312.9 | 281.7 | 1 | 350.0 | 315.2 | 1 | 387.2 | 348.6 | 1 | 424.3 | 382.1 |
| 2 | 239.3 | 215.5 | 2 | 276.4 | 248.9 | 2 | 313.6 | 282.4 | 2 | 350.8 | 315.8 | 2 | 387.9 | 349.3 | 2 | 425.1 | 382.7 |
| 3 | 240.0 | 216.1 | 3 | 277.2 | 249.6 | 3 | 314.4 | 283.0 | 3 | 351.5 | 316.5 | 3 | 388.7 | 350.0 | 3 | 425.8 | 383.4 |
| 4 | 240.8 | 216.8 | 4 | 277.9 | 250.3 | 4 | 315.1 | 283.7 | 4 | 352.3 | 317.2 | 4 | 389.4 | 350.6 | 4 | 426.6 | 384.1 |
| 5 | 241.5 | 217.5 | 5 | 278.7 | 250.9 | 5 | 315.8 | 284.4 | 5 | 353.0 | 317.8 | 5 | 390.2 | 351.3 | 5 | 427.3 | 384.8 |
| 6 | 242.3 | 218.1 | 6 | 279.4 | 251.6 | 6 | 316.6 | 285.0 | 6 | 353.7 | 318.5 | 6 | 390.9 | 352.0 | 6 | 428.1 | 385.4 |
| 7 | 243.0 | 218.8 | 7 | 280.2 | 252.3 | 7 | 317.3 | 285.7 | 7 | 354.5 | 319.2 | 7 | 391.6 | 352.6 | 7 | 428.8 | 386.1 |
| 8 | 243.8 | 219.5 | 8 | 280.9 | 252.9 | 8 | 318.1 | 286.4 | 8 | 355.2 | 319.8 | 8 | 392.4 | 353.3 | 8 | 429.5 | 386.8 |
| 9 | 244.5 | 220.1 | 9 | 281.7 | 253.6 | 9 | 318.8 | 287.1 | 9 | 356.0 | 320.5 | 9 | 393.1 | 354.0 | 9 | 430.3 | 387.4 |
| 330 | 245.2 | 220.8 | 380 | 282.4 | 254.3 | 430 | 319.6 | 287.7 | 480 | 356.7 | 321.2 | 530 | 393.9 | 354.6 | 580 | 431.0 | 388.1 |
| 1 | 246.0 | 221.5 | 1 | 283.1 | 254.9 | 1 | 320.3 | 288.4 | 1 | 357.5 | 321.9 | 1 | 394.6 | 355.3 | 1 | 431.8 | 388.8 |
| 2 | 246.7 | 222.2 | 2 | 283.9 | 255.6 | 2 | 321.0 | 289.1 | 2 | 358.2 | 322.5 | 2 | 395.4 | 356.0 | 2 | 432.5 | 389.4 |
| 3 | 247.5 | 222.8 | 3 | 284.6 | 256.3 | 3 | 321.8 | 289.7 | 3 | 358.9 | 323.2 | 3 | 396.1 | 356.6 | 3 | 433.3 | 390.1 |
| 4 | 248.2 | 223.5 | 4 | 285.4 | 256.9 | 4 | 322.6 | 290.4 | 4 | 359.7 | 323.9 | 4 | 396.8 | 357.3 | 4 | 434.0 | 390.8 |
| 5 | 249.0 | 224.2 | 5 | 286.1 | 257.6 | 5 | 323.3 | 291.1 | 5 | 360.4 | 324.5 | 5 | 397.6 | 358.0 | 5 | 434.7 | 391.4 |
| 6 | 249.7 | 224.8 | 6 | 286.9 | 258.3 | 6 | 324.0 | 291.7 | 6 | 361.2 | 325.2 | 6 | 398.3 | 358.7 | 6 | 435.5 | 392.1 |
| 7 | 250.4 | 225.5 | 7 | 287.6 | 259.0 | 7 | 324.8 | 292.4 | 7 | 361.9 | 325.9 | 7 | 399.1 | 359.3 | 7 | 436.2 | 392.8 |
| 8 | 251.2 | 226.2 | 8 | 288.3 | 259.6 | 8 | 325.5 | 293.1 | 8 | 362.7 | 326.5 | 8 | 399.8 | 360.0 | 8 | 437.0 | 393.4 |
| 9 | 251.9 | 226.8 | 9 | 289.1 | 260.3 | 9 | 326.2 | 293.7 | 9 | 363.4 | 327.2 | 9 | 400.6 | 360.7 | 9 | 437.7 | 394.1 |
| 340 | 252.7 | 227.5 | 390 | 289.8 | 261.0 | 440 | 327.0 | 294.4 | 490 | 364.1 | 327.9 | 540 | 401.3 | 361.3 | 590 | 438.5 | 394.8 |
| 1 | 253.4 | 228.2 | 1 | 290.6 | 261.6 | 1 | 327.7 | 295.1 | 1 | 364.9 | 328.5 | 1 | 402.0 | 362.0 | 1 | 439.2 | 395.5 |
| 2 | 254.2 | 228.8 | 2 | 291.3 | 262.3 | 2 | 328.5 | 295.8 | 2 | 365.6 | 329.2 | 2 | 402.8 | 362.7 | 2 | 439.9 | 396.1 |
| 3 | 254.9 | 229.5 | 3 | 292.1 | 263.0 | 3 | 329.2 | 296.4 | 3 | 366.4 | 329.9 | 3 | 403.5 | 363.3 | 3 | 440.7 | 396.8 |
| 4 | 255.6 | 230.2 | 4 | 292.8 | 263.6 | 4 | 330.0 | 297.1 | 4 | 367.1 | 330.6 | 4 | 404.3 | 364.0 | 4 | 441.4 | 397.5 |
| 5 | 256.4 | 230.9 | 5 | 293.5 | 264.3 | 5 | 330.7 | 297.8 | 5 | 367.9 | 331.2 | 5 | 405.0 | 364.7 | 5 | 442.2 | 398.1 |
| 6 | 257.1 | 231.5 | 6 | 294.3 | 265.0 | 6 | 331.4 | 298.4 | 6 | 368.6 | 331.9 | 6 | 405.8 | 365.3 | 6 | 442.9 | 398.8 |
| 7 | 257.9 | 232.2 | 7 | 295.0 | 265.6 | 7 | 332.2 | 299.1 | 7 | 369.3 | 332.6 | 7 | 406.5 | 366.0 | 7 | 443.7 | 399.5 |
| 8 | 258.6 | 232.9 | 8 | 295.8 | 266.3 | 8 | 332.9 | 299.8 | 8 | 370.1 | 333.2 | 8 | 407.2 | 366.7 | 8 | 444.4 | 400.1 |
| 9 | 259.4 | 233.5 | 9 | 296.5 | 267.0 | 9 | 333.7 | 300.4 | 9 | 370.8 | 333.9 | 9 | 408.0 | 367.4 | 9 | 445.1 | 400.8 |
| D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ | D | ap | $\Delta\varphi$ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 312 315
269 228 225

R

089 048° 045
091 132 135

R ou φ m

R

TABELA 1

R ou φm

359 317° 315
181 223 225

TÁBUAS DE CARTEAÇÃO

001 043 045
179 137 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|----|------|------|----|------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 36.6 | 34.1 | 100 | 73.1 | 68.2 | 150 | 109.7 | 102.3 | 200 | 146.3 | 136.4 | 250 | 182.8 | 170.5 |
| 1 | 0.7 | 0.7 | 1 | 37.3 | 34.8 | 1 | 73.9 | 68.9 | 1 | 110.4 | 103.0 | 1 | 147.0 | 137.1 | 1 | 183.6 | 171.2 |
| 2 | 1.5 | 1.4 | 2 | 38.0 | 35.5 | 2 | 74.6 | 69.6 | 2 | 111.2 | 103.7 | 2 | 147.7 | 137.8 | 2 | 184.3 | 171.9 |
| 3 | 2.2 | 2.0 | 3 | 38.8 | 36.1 | 3 | 75.3 | 70.2 | 3 | 111.9 | 104.3 | 3 | 148.5 | 138.4 | 3 | 185.0 | 172.5 |
| 4 | 2.9 | 2.7 | 4 | 39.5 | 36.8 | 4 | 76.1 | 70.9 | 4 | 112.6 | 105.0 | 4 | 149.2 | 139.1 | 4 | 185.8 | 173.2 |
| 5 | 3.7 | 3.4 | 5 | 40.2 | 37.5 | 5 | 76.8 | 71.6 | 5 | 113.4 | 105.7 | 5 | 149.9 | 139.8 | 5 | 186.5 | 173.9 |
| 6 | 4.4 | 4.1 | 6 | 41.0 | 38.2 | 6 | 77.5 | 72.3 | 6 | 114.1 | 106.4 | 6 | 150.7 | 140.5 | 6 | 187.2 | 174.6 |
| 7 | 5.1 | 4.8 | 7 | 41.7 | 38.9 | 7 | 78.3 | 73.0 | 7 | 114.8 | 107.1 | 7 | 151.4 | 141.2 | 7 | 188.0 | 175.3 |
| 8 | 5.9 | 5.5 | 8 | 42.4 | 39.6 | 8 | 79.0 | 73.7 | 8 | 115.6 | 107.8 | 8 | 152.1 | 141.9 | 8 | 188.7 | 176.0 |
| 9 | 6.6 | 6.1 | 9 | 43.1 | 40.2 | 9 | 79.7 | 74.3 | 9 | 116.3 | 108.4 | 9 | 152.9 | 142.5 | 9 | 189.4 | 176.6 |
| 10 | 7.3 | 6.8 | 60 | 43.9 | 40.9 | 110 | 80.4 | 75.0 | 160 | 117.0 | 109.1 | 210 | 153.6 | 143.2 | 260 | 190.2 | 177.3 |
| 1 | 8.0 | 7.5 | 1 | 44.6 | 41.6 | 1 | 81.2 | 75.7 | 1 | 117.7 | 109.8 | 1 | 154.3 | 143.9 | 1 | 190.9 | 178.0 |
| 2 | 8.8 | 8.2 | 2 | 45.3 | 42.3 | 2 | 81.9 | 76.4 | 2 | 118.5 | 110.5 | 2 | 155.0 | 144.6 | 2 | 191.6 | 178.7 |
| 3 | 9.5 | 8.9 | 3 | 46.1 | 43.0 | 3 | 82.6 | 77.1 | 3 | 119.2 | 111.2 | 3 | 155.8 | 145.3 | 3 | 192.3 | 179.4 |
| 4 | 10.2 | 9.5 | 4 | 46.8 | 43.6 | 4 | 83.4 | 77.7 | 4 | 119.9 | 111.8 | 4 | 156.5 | 145.9 | 4 | 193.1 | 180.0 |
| 5 | 11.0 | 10.2 | 5 | 47.5 | 44.3 | 5 | 84.1 | 78.4 | 5 | 120.7 | 112.5 | 5 | 157.2 | 146.6 | 5 | 193.8 | 180.7 |
| 6 | 11.7 | 10.9 | 6 | 48.3 | 45.0 | 6 | 84.8 | 79.1 | 6 | 121.4 | 113.2 | 6 | 158.0 | 147.3 | 6 | 194.5 | 181.4 |
| 7 | 12.4 | 11.6 | 7 | 49.0 | 45.7 | 7 | 85.6 | 79.8 | 7 | 122.1 | 113.9 | 7 | 158.7 | 148.0 | 7 | 195.3 | 182.1 |
| 8 | 13.2 | 12.3 | 8 | 49.7 | 46.4 | 8 | 86.3 | 80.5 | 8 | 122.9 | 114.6 | 8 | 159.4 | 148.7 | 8 | 196.0 | 182.8 |
| 9 | 13.9 | 13.0 | 9 | 50.5 | 47.1 | 9 | 87.0 | 81.2 | 9 | 123.6 | 115.3 | 9 | 160.2 | 149.4 | 9 | 196.7 | 183.5 |
| 20 | 14.6 | 13.6 | 70 | 51.2 | 47.7 | 120 | 87.8 | 81.8 | 170 | 124.3 | 115.9 | 220 | 160.9 | 150.0 | 270 | 197.5 | 184.1 |
| 1 | 15.4 | 14.3 | 1 | 51.9 | 48.4 | 1 | 88.5 | 82.5 | 1 | 125.1 | 116.6 | 1 | 161.6 | 150.7 | 1 | 198.2 | 184.8 |
| 2 | 16.1 | 15.0 | 2 | 52.7 | 49.1 | 2 | 89.2 | 83.2 | 2 | 125.8 | 117.3 | 2 | 162.4 | 151.4 | 2 | 198.9 | 185.5 |
| 3 | 16.8 | 15.7 | 3 | 53.4 | 49.8 | 3 | 90.0 | 83.9 | 3 | 126.5 | 118.0 | 3 | 163.1 | 152.1 | 3 | 199.7 | 186.2 |
| 4 | 17.6 | 16.4 | 4 | 54.1 | 50.5 | 4 | 90.7 | 84.6 | 4 | 127.3 | 118.7 | 4 | 163.8 | 152.8 | 4 | 200.4 | 186.9 |
| 5 | 18.3 | 17.0 | 5 | 54.9 | 51.1 | 5 | 91.4 | 85.2 | 5 | 128.0 | 119.3 | 5 | 164.6 | 153.4 | 5 | 201.1 | 187.5 |
| 6 | 19.0 | 17.7 | 6 | 55.6 | 51.8 | 6 | 92.2 | 85.9 | 6 | 128.7 | 120.0 | 6 | 165.3 | 154.1 | 6 | 201.9 | 188.2 |
| 7 | 19.7 | 18.4 | 7 | 56.3 | 52.5 | 7 | 92.9 | 86.6 | 7 | 129.4 | 120.7 | 7 | 166.0 | 154.8 | 7 | 202.6 | 188.9 |
| 8 | 20.5 | 19.1 | 8 | 57.0 | 53.2 | 8 | 93.6 | 87.3 | 8 | 130.2 | 121.4 | 8 | 166.7 | 155.5 | 8 | 203.3 | 189.6 |
| 9 | 21.2 | 19.8 | 9 | 57.8 | 53.9 | 9 | 94.3 | 88.0 | 9 | 130.9 | 122.1 | 9 | 167.5 | 156.2 | 9 | 204.0 | 190.3 |
| 30 | 21.9 | 20.5 | 80 | 58.5 | 54.6 | 130 | 95.1 | 88.7 | 180 | 131.6 | 122.8 | 230 | 168.2 | 156.9 | 280 | 204.8 | 191.0 |
| 1 | 22.7 | 21.1 | 1 | 59.2 | 55.2 | 1 | 95.8 | 89.3 | 1 | 132.4 | 123.4 | 1 | 168.9 | 157.5 | 1 | 205.5 | 191.6 |
| 2 | 23.4 | 21.8 | 2 | 60.0 | 55.9 | 2 | 96.5 | 90.0 | 2 | 133.1 | 124.1 | 2 | 169.7 | 158.2 | 2 | 206.2 | 192.3 |
| 3 | 24.1 | 22.5 | 3 | 60.7 | 56.6 | 3 | 97.3 | 90.7 | 3 | 133.8 | 124.8 | 3 | 170.4 | 158.9 | 3 | 207.0 | 193.0 |
| 4 | 24.9 | 23.2 | 4 | 61.4 | 57.3 | 4 | 98.0 | 91.4 | 4 | 134.6 | 125.5 | 4 | 171.1 | 159.6 | 4 | 207.7 | 193.7 |
| 5 | 25.6 | 23.9 | 5 | 62.2 | 58.0 | 5 | 98.7 | 92.1 | 5 | 135.3 | 126.2 | 5 | 171.9 | 160.3 | 5 | 208.4 | 194.4 |
| 6 | 26.3 | 24.6 | 6 | 62.9 | 58.7 | 6 | 99.5 | 92.8 | 6 | 136.0 | 126.9 | 6 | 172.6 | 161.0 | 6 | 209.2 | 195.1 |
| 7 | 27.1 | 25.2 | 7 | 63.6 | 59.3 | 7 | 100.2 | 93.4 | 7 | 136.8 | 127.5 | 7 | 173.3 | 161.6 | 7 | 209.9 | 195.7 |
| 8 | 27.8 | 25.9 | 8 | 64.4 | 60.0 | 8 | 100.9 | 94.1 | 8 | 137.5 | 128.2 | 8 | 174.1 | 162.3 | 8 | 210.6 | 196.4 |
| 9 | 28.5 | 26.6 | 9 | 65.1 | 60.7 | 9 | 101.7 | 94.8 | 9 | 138.2 | 128.9 | 9 | 174.8 | 163.0 | 9 | 211.4 | 197.1 |
| 40 | 29.3 | 27.3 | 90 | 65.8 | 61.4 | 140 | 102.4 | 95.5 | 190 | 139.0 | 129.6 | 240 | 175.5 | 163.7 | 290 | 212.1 | 197.8 |
| 1 | 30.0 | 28.0 | 1 | 66.6 | 62.1 | 1 | 103.1 | 96.2 | 1 | 139.7 | 130.3 | 1 | 176.3 | 164.4 | 1 | 212.8 | 198.5 |
| 2 | 30.7 | 28.6 | 2 | 67.3 | 62.7 | 2 | 103.9 | 96.8 | 2 | 140.4 | 130.9 | 2 | 177.0 | 165.0 | 2 | 213.6 | 199.1 |
| 3 | 31.4 | 29.3 | 3 | 68.0 | 63.4 | 3 | 104.6 | 97.5 | 3 | 141.2 | 131.6 | 3 | 177.7 | 165.7 | 3 | 214.3 | 199.8 |
| 4 | 32.2 | 30.0 | 4 | 68.7 | 64.1 | 4 | 105.3 | 98.2 | 4 | 141.9 | 132.3 | 4 | 178.5 | 166.4 | 4 | 215.0 | 200.5 |
| 5 | 32.9 | 30.7 | 5 | 69.5 | 64.8 | 5 | 106.0 | 98.9 | 5 | 142.6 | 133.0 | 5 | 179.2 | 167.1 | 5 | 215.7 | 201.2 |
| 6 | 33.6 | 31.4 | 6 | 70.2 | 65.5 | 6 | 106.8 | 99.6 | 6 | 143.3 | 133.7 | 6 | 179.9 | 167.8 | 6 | 216.5 | 201.9 |
| 7 | 34.4 | 32.1 | 7 | 70.9 | 66.2 | 7 | 107.5 | 100.3 | 7 | 144.1 | 134.4 | 7 | 180.6 | 168.5 | 7 | 217.2 | 202.6 |
| 8 | 35.1 | 32.7 | 8 | 71.7 | 66.8 | 8 | 108.2 | 100.9 | 8 | 144.8 | 135.0 | 8 | 181.4 | 169.1 | 8 | 217.9 | 203.2 |
| 9 | 35.8 | 33.4 | 9 | 72.4 | 67.5 | 9 | 109.0 | 101.6 | 9 | 145.5 | 135.7 | 9 | 182.1 | 169.8 | 9 | 218.7 | 203.9 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 313 315
269 227 225

R

089 047° 045
091 133 135

R ou φm

R

TABELA 1

R ou φm

359 317° 315
181 223 225

TÁBUAS DE CARTEAÇÃO

001 043 045
179 137 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 219.4 | 204.6 | 350 | 256.0 | 238.7 | 400 | 292.5 | 272.8 | 450 | 329.1 | 306.9 | 500 | 365.7 | 341.0 | 550 | 402.2 | 375.1 |
| 1 | 220.1 | 205.3 | 1 | 256.7 | 239.4 | 1 | 293.3 | 273.5 | 1 | 329.8 | 307.6 | 1 | 366.4 | 341.7 | 1 | 403.0 | 375.8 |
| 2 | 220.9 | 206.0 | 2 | 257.4 | 240.1 | 2 | 294.0 | 274.2 | 2 | 330.6 | 308.3 | 2 | 367.1 | 342.4 | 2 | 403.7 | 376.5 |
| 3 | 221.6 | 206.6 | 3 | 258.2 | 240.7 | 3 | 294.7 | 274.8 | 3 | 331.3 | 308.9 | 3 | 367.9 | 343.0 | 3 | 404.4 | 377.1 |
| 4 | 222.3 | 207.3 | 4 | 258.9 | 241.4 | 4 | 295.5 | 275.5 | 4 | 332.0 | 309.6 | 4 | 368.6 | 343.7 | 4 | 405.2 | 377.8 |
| 5 | 223.1 | 208.0 | 5 | 259.6 | 242.1 | 5 | 296.2 | 276.2 | 5 | 332.8 | 310.3 | 5 | 369.3 | 344.4 | 5 | 405.9 | 378.5 |
| 6 | 223.8 | 208.7 | 6 | 260.4 | 242.8 | 6 | 296.9 | 276.9 | 6 | 333.5 | 311.0 | 6 | 370.1 | 345.1 | 6 | 406.6 | 379.2 |
| 7 | 224.5 | 209.4 | 7 | 261.1 | 243.5 | 7 | 297.7 | 277.6 | 7 | 334.2 | 311.7 | 7 | 370.8 | 345.8 | 7 | 407.4 | 379.9 |
| 8 | 225.3 | 210.1 | 8 | 261.8 | 244.2 | 8 | 298.4 | 278.3 | 8 | 335.0 | 312.4 | 8 | 371.5 | 346.5 | 8 | 408.1 | 380.6 |
| 9 | 226.0 | 210.7 | 9 | 262.6 | 244.8 | 9 | 299.1 | 278.9 | 9 | 335.7 | 313.0 | 9 | 372.3 | 347.1 | 9 | 408.8 | 381.2 |
| 310 | 226.7 | 211.4 | 360 | 263.3 | 245.5 | 410 | 299.9 | 279.6 | 460 | 336.4 | 313.7 | 510 | 373.0 | 347.8 | 560 | 409.6 | 381.9 |
| 1 | 227.5 | 212.1 | 1 | 264.0 | 246.2 | 1 | 300.6 | 280.3 | 1 | 337.2 | 314.4 | 1 | 373.7 | 348.5 | 1 | 410.3 | 382.6 |
| 2 | 228.2 | 212.8 | 2 | 264.8 | 246.9 | 2 | 301.3 | 281.0 | 2 | 337.9 | 315.1 | 2 | 374.5 | 349.2 | 2 | 411.0 | 383.3 |
| 3 | 228.9 | 213.5 | 3 | 265.5 | 247.6 | 3 | 302.0 | 281.7 | 3 | 338.6 | 315.8 | 3 | 375.2 | 349.9 | 3 | 411.8 | 384.0 |
| 4 | 229.6 | 214.1 | 4 | 266.2 | 248.2 | 4 | 302.8 | 282.3 | 4 | 339.3 | 316.4 | 4 | 375.9 | 350.5 | 4 | 412.5 | 384.6 |
| 5 | 230.4 | 214.8 | 5 | 266.9 | 248.9 | 5 | 303.5 | 283.0 | 5 | 340.1 | 317.1 | 5 | 376.6 | 351.2 | 5 | 413.2 | 385.3 |
| 6 | 231.1 | 215.5 | 6 | 267.7 | 249.6 | 6 | 304.2 | 283.7 | 6 | 340.8 | 317.8 | 6 | 377.4 | 351.9 | 6 | 413.9 | 386.0 |
| 7 | 231.8 | 216.2 | 7 | 268.4 | 250.3 | 7 | 305.0 | 284.4 | 7 | 341.5 | 318.5 | 7 | 378.1 | 352.6 | 7 | 414.7 | 386.7 |
| 8 | 232.6 | 216.9 | 8 | 269.1 | 251.0 | 8 | 305.7 | 285.1 | 8 | 342.3 | 319.2 | 8 | 378.8 | 353.3 | 8 | 415.4 | 387.4 |
| 9 | 233.3 | 217.6 | 9 | 269.9 | 251.7 | 9 | 306.4 | 285.8 | 9 | 343.0 | 319.9 | 9 | 379.6 | 354.0 | 9 | 416.1 | 388.1 |
| 320 | 234.0 | 218.2 | 370 | 270.6 | 252.3 | 420 | 307.2 | 286.4 | 470 | 343.7 | 320.5 | 520 | 380.3 | 354.6 | 570 | 416.9 | 388.7 |
| 1 | 234.8 | 218.9 | 1 | 271.3 | 253.0 | 1 | 307.9 | 287.1 | 1 | 344.5 | 321.2 | 1 | 381.0 | 355.3 | 1 | 417.6 | 389.4 |
| 2 | 235.5 | 219.6 | 2 | 272.1 | 253.7 | 2 | 308.6 | 287.8 | 2 | 345.2 | 321.9 | 2 | 381.8 | 356.0 | 2 | 418.3 | 390.1 |
| 3 | 236.2 | 220.3 | 3 | 272.8 | 254.4 | 3 | 309.4 | 288.5 | 3 | 345.9 | 322.6 | 3 | 382.5 | 356.7 | 3 | 419.1 | 390.8 |
| 4 | 237.0 | 221.0 | 4 | 273.5 | 255.1 | 4 | 310.1 | 289.2 | 4 | 346.7 | 323.3 | 4 | 383.2 | 357.4 | 4 | 419.8 | 391.5 |
| 5 | 237.7 | 221.6 | 5 | 274.3 | 255.7 | 5 | 310.8 | 289.8 | 5 | 347.4 | 323.9 | 5 | 384.0 | 358.0 | 5 | 420.5 | 392.1 |
| 6 | 238.4 | 222.3 | 6 | 275.0 | 256.4 | 6 | 311.6 | 290.5 | 6 | 348.1 | 324.6 | 6 | 384.7 | 358.7 | 6 | 421.3 | 392.8 |
| 7 | 239.2 | 223.0 | 7 | 275.7 | 257.1 | 7 | 312.3 | 291.2 | 7 | 348.9 | 325.3 | 7 | 385.4 | 359.4 | 7 | 422.0 | 393.5 |
| 8 | 239.9 | 223.7 | 8 | 276.5 | 257.8 | 8 | 313.0 | 291.9 | 8 | 349.6 | 326.0 | 8 | 386.2 | 360.1 | 8 | 422.7 | 394.2 |
| 9 | 240.6 | 224.4 | 9 | 277.2 | 258.5 | 9 | 313.8 | 292.6 | 9 | 350.3 | 326.7 | 9 | 386.9 | 360.8 | 9 | 423.5 | 394.9 |
| 330 | 241.3 | 225.1 | 380 | 277.9 | 259.2 | 430 | 314.5 | 293.3 | 480 | 351.0 | 327.4 | 530 | 387.6 | 361.5 | 580 | 424.2 | 395.6 |
| 1 | 242.1 | 225.7 | 1 | 278.6 | 259.8 | 1 | 315.2 | 293.9 | 1 | 351.8 | 328.0 | 1 | 388.3 | 362.1 | 1 | 424.9 | 396.2 |
| 2 | 242.8 | 226.4 | 2 | 279.4 | 260.5 | 2 | 315.9 | 294.6 | 2 | 352.5 | 328.7 | 2 | 389.1 | 362.8 | 2 | 425.6 | 396.9 |
| 3 | 243.5 | 227.1 | 3 | 280.1 | 261.2 | 3 | 316.7 | 295.3 | 3 | 353.2 | 329.4 | 3 | 389.8 | 363.5 | 3 | 426.4 | 397.6 |
| 4 | 244.3 | 227.8 | 4 | 280.8 | 261.9 | 4 | 317.4 | 296.0 | 4 | 354.0 | 330.1 | 4 | 390.5 | 364.2 | 4 | 427.1 | 398.3 |
| 5 | 245.0 | 228.5 | 5 | 281.6 | 262.6 | 5 | 318.1 | 296.7 | 5 | 354.7 | 330.8 | 5 | 391.3 | 364.9 | 5 | 427.8 | 399.0 |
| 6 | 245.7 | 229.2 | 6 | 282.3 | 263.3 | 6 | 318.9 | 297.4 | 6 | 355.4 | 331.5 | 6 | 392.0 | 365.6 | 6 | 428.6 | 399.7 |
| 7 | 246.5 | 229.8 | 7 | 283.0 | 263.9 | 7 | 319.6 | 298.0 | 7 | 356.2 | 332.1 | 7 | 392.7 | 366.2 | 7 | 429.3 | 400.3 |
| 8 | 247.2 | 230.5 | 8 | 283.8 | 264.6 | 8 | 320.3 | 298.7 | 8 | 356.9 | 332.8 | 8 | 393.5 | 366.9 | 8 | 430.0 | 401.0 |
| 9 | 247.9 | 231.2 | 9 | 284.5 | 265.3 | 9 | 321.1 | 299.4 | 9 | 357.6 | 333.5 | 9 | 394.2 | 367.6 | 9 | 430.8 | 401.7 |
| 340 | 248.7 | 231.9 | 390 | 285.2 | 266.0 | 440 | 321.8 | 300.1 | 490 | 358.4 | 334.2 | 540 | 394.9 | 368.3 | 590 | 431.5 | 402.4 |
| 1 | 249.4 | 232.6 | 1 | 286.0 | 266.7 | 1 | 322.5 | 300.8 | 1 | 359.1 | 334.9 | 1 | 395.7 | 369.0 | 1 | 432.2 | 403.1 |
| 2 | 250.1 | 233.2 | 2 | 286.7 | 267.3 | 2 | 323.3 | 301.4 | 2 | 359.8 | 335.5 | 2 | 396.4 | 369.6 | 2 | 433.0 | 403.7 |
| 3 | 250.9 | 233.9 | 3 | 287.4 | 268.0 | 3 | 324.0 | 302.1 | 3 | 360.6 | 336.2 | 3 | 397.1 | 370.3 | 3 | 433.7 | 404.4 |
| 4 | 251.6 | 234.6 | 4 | 288.2 | 268.7 | 4 | 324.7 | 302.8 | 4 | 361.3 | 336.9 | 4 | 397.9 | 371.0 | 4 | 434.4 | 405.1 |
| 5 | 252.3 | 235.3 | 5 | 288.9 | 269.4 | 5 | 325.5 | 303.5 | 5 | 362.0 | 337.6 | 5 | 398.6 | 371.7 | 5 | 435.2 | 405.8 |
| 6 | 253.0 | 236.0 | 6 | 289.6 | 270.1 | 6 | 326.2 | 304.2 | 6 | 362.8 | 338.3 | 6 | 399.3 | 372.4 | 6 | 435.9 | 406.5 |
| 7 | 253.8 | 236.7 | 7 | 290.3 | 270.8 | 7 | 326.9 | 304.9 | 7 | 363.5 | 339.0 | 7 | 400.1 | 373.1 | 7 | 436.6 | 407.2 |
| 8 | 254.5 | 237.3 | 8 | 291.1 | 271.4 | 8 | 327.6 | 305.5 | 8 | 364.2 | 339.6 | 8 | 400.8 | 373.7 | 8 | 437.3 | 407.8 |
| 9 | 255.2 | 238.0 | 9 | 291.8 | 272.1 | 9 | 328.4 | 306.2 | 9 | 364.9 | 340.3 | 9 | 401.5 | 374.4 | 9 | 438.1 | 408.5 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 313 315
269 227 225

R

089 047° 045
091 133 135

R ou φm

R

TABELA 1

R ou φm

359 316° 316
181 224 225

TÁBUAS DE CARTEAÇÃO

001 044 045
179 136 135

| ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap |
|----|------|------|----|------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 36.0 | 34.7 | 100 | 71.9 | 69.5 | 150 | 107.9 | 104.2 | 200 | 143.9 | 138.9 | 250 | 179.8 | 173.7 |
| 1 | 0.7 | 0.7 | 1 | 36.7 | 35.4 | 1 | 72.7 | 70.2 | 1 | 108.6 | 104.9 | 1 | 144.6 | 139.6 | 1 | 180.6 | 174.4 |
| 2 | 1.4 | 1.4 | 2 | 37.4 | 36.1 | 2 | 73.4 | 70.9 | 2 | 109.3 | 105.6 | 2 | 145.3 | 140.3 | 2 | 181.3 | 175.1 |
| 3 | 2.2 | 2.1 | 3 | 38.1 | 36.8 | 3 | 74.1 | 71.5 | 3 | 110.1 | 106.3 | 3 | 146.0 | 141.0 | 3 | 182.0 | 175.7 |
| 4 | 2.9 | 2.8 | 4 | 38.8 | 37.5 | 4 | 74.8 | 72.2 | 4 | 110.8 | 107.0 | 4 | 146.7 | 141.7 | 4 | 182.7 | 176.4 |
| 5 | 3.6 | 3.5 | 5 | 39.6 | 38.2 | 5 | 75.5 | 72.9 | 5 | 111.5 | 107.7 | 5 | 147.5 | 142.4 | 5 | 183.4 | 177.1 |
| 6 | 4.3 | 4.2 | 6 | 40.3 | 38.9 | 6 | 76.3 | 73.6 | 6 | 112.2 | 108.4 | 6 | 148.2 | 143.1 | 6 | 184.2 | 177.8 |
| 7 | 5.0 | 4.9 | 7 | 41.0 | 39.6 | 7 | 77.0 | 74.3 | 7 | 112.9 | 109.1 | 7 | 148.9 | 143.8 | 7 | 184.9 | 178.5 |
| 8 | 5.8 | 5.6 | 8 | 41.7 | 40.3 | 8 | 77.7 | 75.0 | 8 | 113.7 | 109.8 | 8 | 149.6 | 144.5 | 8 | 185.6 | 179.2 |
| 9 | 6.5 | 6.3 | 9 | 42.4 | 41.0 | 9 | 78.4 | 75.7 | 9 | 114.4 | 110.5 | 9 | 150.3 | 145.2 | 9 | 186.3 | 179.9 |
| 10 | 7.2 | 6.9 | 60 | 43.2 | 41.7 | 110 | 79.1 | 76.4 | 160 | 115.1 | 111.1 | 210 | 151.1 | 145.9 | 260 | 187.0 | 180.6 |
| 1 | 7.9 | 7.6 | 1 | 43.9 | 42.4 | 1 | 79.8 | 77.1 | 1 | 115.8 | 111.8 | 1 | 151.8 | 146.6 | 1 | 187.7 | 181.3 |
| 2 | 8.6 | 8.3 | 2 | 44.6 | 43.1 | 2 | 80.6 | 77.8 | 2 | 116.5 | 112.5 | 2 | 152.5 | 147.3 | 2 | 188.5 | 182.0 |
| 3 | 9.4 | 9.0 | 3 | 45.3 | 43.8 | 3 | 81.3 | 78.5 | 3 | 117.3 | 113.2 | 3 | 153.2 | 148.0 | 3 | 189.2 | 182.7 |
| 4 | 10.1 | 9.7 | 4 | 46.0 | 44.5 | 4 | 82.0 | 79.2 | 4 | 118.0 | 113.9 | 4 | 153.9 | 148.7 | 4 | 189.9 | 183.4 |
| 5 | 10.8 | 10.4 | 5 | 46.8 | 45.2 | 5 | 82.7 | 79.9 | 5 | 118.7 | 114.6 | 5 | 154.7 | 149.4 | 5 | 190.6 | 184.1 |
| 6 | 11.5 | 11.1 | 6 | 47.5 | 45.8 | 6 | 83.4 | 80.6 | 6 | 119.4 | 115.3 | 6 | 155.4 | 150.0 | 6 | 191.3 | 184.8 |
| 7 | 12.2 | 11.8 | 7 | 48.2 | 46.5 | 7 | 84.2 | 81.3 | 7 | 120.1 | 116.0 | 7 | 156.1 | 150.7 | 7 | 192.1 | 185.5 |
| 8 | 12.9 | 12.5 | 8 | 48.9 | 47.2 | 8 | 84.9 | 82.0 | 8 | 120.8 | 116.7 | 8 | 156.8 | 151.4 | 8 | 192.8 | 186.2 |
| 9 | 13.7 | 13.2 | 9 | 49.6 | 47.9 | 9 | 85.6 | 82.7 | 9 | 121.6 | 117.4 | 9 | 157.5 | 152.1 | 9 | 193.5 | 186.9 |
| 20 | 14.4 | 13.9 | 70 | 50.4 | 48.6 | 120 | 86.3 | 83.4 | 170 | 122.3 | 118.1 | 220 | 158.3 | 152.8 | 270 | 194.2 | 187.6 |
| 1 | 15.1 | 14.6 | 1 | 51.1 | 49.3 | 1 | 87.0 | 84.1 | 1 | 123.0 | 118.8 | 1 | 159.0 | 153.5 | 1 | 194.9 | 188.3 |
| 2 | 15.8 | 15.3 | 2 | 51.8 | 50.0 | 2 | 87.8 | 84.7 | 2 | 123.7 | 119.5 | 2 | 159.7 | 154.2 | 2 | 195.7 | 188.9 |
| 3 | 16.5 | 16.0 | 3 | 52.5 | 50.7 | 3 | 88.5 | 85.4 | 3 | 124.4 | 120.2 | 3 | 160.4 | 154.9 | 3 | 196.4 | 189.6 |
| 4 | 17.3 | 16.7 | 4 | 53.2 | 51.4 | 4 | 89.2 | 86.1 | 4 | 125.2 | 120.9 | 4 | 161.1 | 155.6 | 4 | 197.1 | 190.3 |
| 5 | 18.0 | 17.4 | 5 | 54.0 | 52.1 | 5 | 89.9 | 86.8 | 5 | 125.9 | 121.6 | 5 | 161.9 | 156.3 | 5 | 197.8 | 191.0 |
| 6 | 18.7 | 18.1 | 6 | 54.7 | 52.8 | 6 | 90.6 | 87.5 | 6 | 126.6 | 122.3 | 6 | 162.6 | 157.0 | 6 | 198.5 | 191.7 |
| 7 | 19.4 | 18.8 | 7 | 55.4 | 53.5 | 7 | 91.4 | 88.2 | 7 | 127.3 | 123.0 | 7 | 163.3 | 157.7 | 7 | 199.3 | 192.4 |
| 8 | 20.1 | 19.5 | 8 | 56.1 | 54.2 | 8 | 92.1 | 88.9 | 8 | 128.0 | 123.6 | 8 | 164.0 | 158.4 | 8 | 200.0 | 193.1 |
| 9 | 20.9 | 20.1 | 9 | 56.8 | 54.9 | 9 | 92.8 | 89.6 | 9 | 128.8 | 124.3 | 9 | 164.7 | 159.1 | 9 | 200.7 | 193.8 |
| 30 | 21.6 | 20.8 | 80 | 57.5 | 55.6 | 130 | 93.5 | 90.3 | 180 | 129.5 | 125.0 | 230 | 165.4 | 159.8 | 280 | 201.4 | 194.5 |
| 1 | 22.3 | 21.5 | 1 | 58.3 | 56.3 | 1 | 94.2 | 91.0 | 1 | 130.2 | 125.7 | 1 | 166.2 | 160.5 | 1 | 202.1 | 195.2 |
| 2 | 23.0 | 22.2 | 2 | 59.0 | 57.0 | 2 | 95.0 | 91.7 | 2 | 130.9 | 126.4 | 2 | 166.9 | 161.2 | 2 | 202.9 | 195.9 |
| 3 | 23.7 | 22.9 | 3 | 59.7 | 57.7 | 3 | 95.7 | 92.4 | 3 | 131.6 | 127.1 | 3 | 167.6 | 161.9 | 3 | 203.6 | 196.6 |
| 4 | 24.5 | 23.6 | 4 | 60.4 | 58.4 | 4 | 96.4 | 93.1 | 4 | 132.4 | 127.8 | 4 | 168.3 | 162.6 | 4 | 204.3 | 197.3 |
| 5 | 25.2 | 24.3 | 5 | 61.1 | 59.0 | 5 | 97.1 | 93.8 | 5 | 133.1 | 128.5 | 5 | 169.0 | 163.2 | 5 | 205.0 | 198.0 |
| 6 | 25.9 | 25.0 | 6 | 61.9 | 59.7 | 6 | 97.8 | 94.5 | 6 | 133.8 | 129.2 | 6 | 169.8 | 163.9 | 6 | 205.7 | 198.7 |
| 7 | 26.6 | 25.7 | 7 | 62.6 | 60.4 | 7 | 98.5 | 95.2 | 7 | 134.5 | 129.9 | 7 | 170.5 | 164.6 | 7 | 206.5 | 199.4 |
| 8 | 27.3 | 26.4 | 8 | 63.3 | 61.1 | 8 | 99.3 | 95.9 | 8 | 135.2 | 130.6 | 8 | 171.2 | 165.3 | 8 | 207.2 | 200.1 |
| 9 | 28.1 | 27.1 | 9 | 64.0 | 61.8 | 9 | 100.0 | 96.6 | 9 | 136.0 | 131.3 | 9 | 171.9 | 166.0 | 9 | 207.9 | 200.8 |
| 40 | 28.8 | 27.8 | 90 | 64.7 | 62.5 | 140 | 100.7 | 97.3 | 190 | 136.7 | 132.0 | 240 | 172.6 | 166.7 | 290 | 208.6 | 201.5 |
| 1 | 29.5 | 28.5 | 1 | 65.5 | 63.2 | 1 | 101.4 | 97.9 | 1 | 137.4 | 132.7 | 1 | 173.4 | 167.4 | 1 | 209.3 | 202.1 |
| 2 | 30.2 | 29.2 | 2 | 66.2 | 63.9 | 2 | 102.1 | 98.6 | 2 | 138.1 | 133.4 | 2 | 174.1 | 168.1 | 2 | 210.0 | 202.8 |
| 3 | 30.9 | 29.9 | 3 | 66.9 | 64.6 | 3 | 102.9 | 99.3 | 3 | 138.8 | 134.1 | 3 | 174.8 | 168.8 | 3 | 210.8 | 203.5 |
| 4 | 31.7 | 30.6 | 4 | 67.6 | 65.3 | 4 | 103.6 | 100.0 | 4 | 139.6 | 134.8 | 4 | 175.5 | 169.5 | 4 | 211.5 | 204.2 |
| 5 | 32.4 | 31.3 | 5 | 68.3 | 66.0 | 5 | 104.3 | 100.7 | 5 | 140.3 | 135.5 | 5 | 176.2 | 170.2 | 5 | 212.2 | 204.9 |
| 6 | 33.1 | 32.0 | 6 | 69.1 | 66.7 | 6 | 105.0 | 101.4 | 6 | 141.0 | 136.2 | 6 | 177.0 | 170.9 | 6 | 212.9 | 205.6 |
| 7 | 33.8 | 32.6 | 7 | 69.8 | 67.4 | 7 | 105.7 | 102.1 | 7 | 141.7 | 136.8 | 7 | 177.7 | 171.6 | 7 | 213.6 | 206.3 |
| 8 | 34.5 | 33.3 | 8 | 70.6 | 68.1 | 8 | 106.5 | 102.8 | 8 | 142.4 | 137.5 | 8 | 178.4 | 172.3 | 8 | 214.4 | 207.0 |
| 9 | 35.2 | 34.0 | 9 | 71.2 | 68.8 | 9 | 107.2 | 103.5 | 9 | 143.1 | 138.2 | 9 | 179.1 | 173.0 | 9 | 215.1 | 207.7 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | | ΔL | | |

271 314 315
269 226 225

R

089 046° 045
091 134 135

R ou φm

R
359 316° 315
181 224 225

TABELA 1
TÁBUAS DE CARTEAÇÃO

R ou φm
001 044 045
179 136 135

| ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap | ΔL | ap |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 215.8 | 208.4 | 350 | 251.8 | 243.1 | 400 | 287.7 | 277.9 | 450 | 323.7 | 312.6 | 500 | 359.7 | 347.3 | 550 | 395.6 | 382.1 |
| 1 | 216.5 | 209.1 | 1 | 252.5 | 243.8 | 1 | 288.5 | 278.6 | 1 | 324.4 | 313.3 | 1 | 360.4 | 348.0 | 1 | 396.4 | 382.8 |
| 2 | 217.2 | 209.8 | 2 | 253.2 | 244.5 | 2 | 289.2 | 279.3 | 2 | 325.1 | 314.0 | 2 | 361.1 | 348.7 | 2 | 397.1 | 383.5 |
| 3 | 218.0 | 210.5 | 3 | 253.9 | 245.2 | 3 | 289.9 | 279.9 | 3 | 325.9 | 314.7 | 3 | 361.8 | 349.4 | 3 | 397.8 | 384.1 |
| 4 | 218.7 | 211.2 | 4 | 254.6 | 245.9 | 4 | 290.6 | 280.6 | 4 | 326.6 | 315.4 | 4 | 362.5 | 350.1 | 4 | 398.5 | 384.8 |
| 5 | 219.4 | 211.9 | 5 | 255.4 | 246.6 | 5 | 291.3 | 281.3 | 5 | 327.3 | 316.1 | 5 | 363.3 | 350.8 | 5 | 399.2 | 385.5 |
| 6 | 220.1 | 212.6 | 6 | 256.1 | 247.3 | 6 | 292.1 | 282.0 | 6 | 328.0 | 316.8 | 6 | 364.0 | 351.5 | 6 | 400.0 | 386.2 |
| 7 | 220.8 | 213.3 | 7 | 256.8 | 248.0 | 7 | 292.8 | 282.7 | 7 | 328.7 | 317.5 | 7 | 364.7 | 352.2 | 7 | 400.7 | 386.9 |
| 8 | 221.6 | 214.0 | 8 | 257.5 | 248.7 | 8 | 293.5 | 283.4 | 8 | 329.5 | 318.2 | 8 | 365.4 | 352.9 | 8 | 401.4 | 387.6 |
| 9 | 222.3 | 214.6 | 9 | 258.2 | 249.4 | 9 | 294.2 | 284.1 | 9 | 330.2 | 318.8 | 9 | 366.1 | 353.6 | 9 | 402.1 | 388.3 |
| 310 | 223.0 | 215.3 | 360 | 259.0 | 250.1 | 410 | 294.9 | 284.8 | 460 | 330.9 | 319.5 | 510 | 366.9 | 354.3 | 560 | 402.8 | 389.0 |
| 1 | 223.7 | 216.0 | 1 | 259.7 | 250.8 | 1 | 295.6 | 285.5 | 1 | 331.6 | 320.2 | 1 | 367.6 | 355.0 | 1 | 403.5 | 389.7 |
| 2 | 224.4 | 216.7 | 2 | 260.4 | 251.5 | 2 | 296.4 | 286.2 | 2 | 332.3 | 320.9 | 2 | 368.3 | 355.7 | 2 | 404.3 | 390.4 |
| 3 | 225.2 | 217.4 | 3 | 261.1 | 252.2 | 3 | 297.1 | 286.9 | 3 | 333.1 | 321.6 | 3 | 369.0 | 356.4 | 3 | 405.0 | 391.1 |
| 4 | 225.9 | 218.1 | 4 | 261.8 | 252.9 | 4 | 297.8 | 287.6 | 4 | 333.8 | 322.3 | 4 | 369.7 | 357.1 | 4 | 405.7 | 391.8 |
| 5 | 226.6 | 218.8 | 5 | 262.6 | 253.6 | 5 | 298.5 | 288.3 | 5 | 334.5 | 323.0 | 5 | 370.5 | 357.7 | 5 | 406.4 | 392.5 |
| 6 | 227.3 | 219.5 | 6 | 263.3 | 254.2 | 6 | 299.2 | 289.0 | 6 | 335.2 | 323.7 | 6 | 371.2 | 358.4 | 6 | 407.1 | 393.2 |
| 7 | 228.0 | 220.2 | 7 | 264.0 | 254.9 | 7 | 300.0 | 289.7 | 7 | 335.9 | 324.4 | 7 | 371.9 | 359.1 | 7 | 407.9 | 393.9 |
| 8 | 228.8 | 220.9 | 8 | 264.7 | 255.6 | 8 | 300.7 | 290.4 | 8 | 336.7 | 325.1 | 8 | 372.6 | 359.8 | 8 | 408.6 | 394.6 |
| 9 | 229.5 | 221.6 | 9 | 265.4 | 256.3 | 9 | 301.4 | 291.1 | 9 | 337.4 | 325.8 | 9 | 373.3 | 360.5 | 9 | 409.3 | 395.3 |
| 320 | 230.2 | 222.3 | 370 | 266.2 | 257.0 | 420 | 302.1 | 291.8 | 470 | 338.1 | 326.5 | 520 | 374.1 | 361.2 | 570 | 410.0 | 396.0 |
| 1 | 230.9 | 223.0 | 1 | 266.9 | 257.7 | 1 | 302.8 | 292.5 | 1 | 338.8 | 327.2 | 1 | 374.8 | 361.9 | 1 | 410.7 | 396.6 |
| 2 | 231.6 | 223.7 | 2 | 267.6 | 258.4 | 2 | 303.6 | 293.1 | 2 | 339.5 | 327.9 | 2 | 375.5 | 362.6 | 2 | 411.5 | 397.3 |
| 3 | 232.3 | 224.4 | 3 | 268.3 | 259.1 | 3 | 304.3 | 293.8 | 3 | 340.2 | 328.6 | 3 | 376.2 | 363.3 | 3 | 412.2 | 398.0 |
| 4 | 233.1 | 225.1 | 4 | 269.0 | 259.8 | 4 | 305.0 | 294.5 | 4 | 341.0 | 329.3 | 4 | 376.9 | 364.0 | 4 | 412.9 | 398.7 |
| 5 | 233.8 | 225.8 | 5 | 269.8 | 260.5 | 5 | 305.7 | 295.2 | 5 | 341.7 | 330.0 | 5 | 377.7 | 364.7 | 5 | 413.6 | 399.4 |
| 6 | 234.5 | 226.5 | 6 | 270.5 | 261.2 | 6 | 306.4 | 295.9 | 6 | 342.4 | 330.7 | 6 | 378.4 | 365.4 | 6 | 414.3 | 400.1 |
| 7 | 235.2 | 227.2 | 7 | 271.2 | 261.9 | 7 | 307.2 | 296.6 | 7 | 343.1 | 331.4 | 7 | 379.1 | 366.1 | 7 | 415.1 | 400.8 |
| 8 | 235.9 | 227.8 | 8 | 271.9 | 262.6 | 8 | 307.9 | 297.3 | 8 | 343.8 | 332.0 | 8 | 379.8 | 366.8 | 8 | 415.8 | 401.5 |
| 9 | 236.7 | 228.5 | 9 | 272.6 | 263.3 | 9 | 308.6 | 298.0 | 9 | 344.6 | 332.7 | 9 | 380.5 | 367.5 | 9 | 416.5 | 402.2 |
| 330 | 237.4 | 229.2 | 380 | 273.3 | 264.0 | 430 | 309.3 | 298.7 | 480 | 345.3 | 333.4 | 530 | 381.3 | 368.2 | 580 | 417.2 | 402.9 |
| 1 | 238.1 | 229.9 | 1 | 274.1 | 264.7 | 1 | 310.0 | 299.4 | 1 | 346.0 | 334.1 | 1 | 382.0 | 368.9 | 1 | 417.9 | 403.6 |
| 2 | 238.8 | 230.6 | 2 | 274.8 | 265.4 | 2 | 310.8 | 300.1 | 2 | 346.7 | 334.8 | 2 | 382.7 | 369.6 | 2 | 418.7 | 404.3 |
| 3 | 239.5 | 231.3 | 3 | 275.5 | 266.1 | 3 | 311.5 | 300.8 | 3 | 347.4 | 335.5 | 3 | 383.4 | 370.3 | 3 | 419.4 | 405.0 |
| 4 | 240.3 | 232.0 | 4 | 276.2 | 266.7 | 4 | 312.2 | 301.5 | 4 | 348.2 | 336.2 | 4 | 384.1 | 370.9 | 4 | 420.1 | 405.7 |
| 5 | 241.0 | 232.7 | 5 | 276.9 | 267.4 | 5 | 312.9 | 302.2 | 5 | 348.9 | 336.9 | 5 | 384.8 | 371.6 | 5 | 420.8 | 406.4 |
| 6 | 241.7 | 233.4 | 6 | 277.7 | 268.1 | 6 | 313.6 | 302.9 | 6 | 349.6 | 337.6 | 6 | 385.6 | 372.3 | 6 | 421.5 | 407.1 |
| 7 | 242.4 | 234.1 | 7 | 278.4 | 268.8 | 7 | 314.4 | 303.6 | 7 | 350.3 | 338.3 | 7 | 386.3 | 373.0 | 7 | 422.3 | 407.8 |
| 8 | 243.1 | 234.8 | 8 | 279.1 | 269.5 | 8 | 315.1 | 304.3 | 8 | 351.0 | 339.0 | 8 | 387.0 | 373.7 | 8 | 423.0 | 408.5 |
| 9 | 243.9 | 235.5 | 9 | 279.8 | 270.2 | 9 | 315.8 | 305.0 | 9 | 351.8 | 339.7 | 9 | 387.7 | 374.4 | 9 | 423.7 | 409.2 |
| 340 | 244.6 | 236.2 | 390 | 280.5 | 270.9 | 440 | 316.5 | 305.6 | 490 | 352.5 | 340.4 | 540 | 388.4 | 375.1 | 590 | 424.4 | 409.8 |
| 1 | 245.3 | 236.9 | 1 | 281.3 | 271.6 | 1 | 317.2 | 306.3 | 1 | 353.2 | 341.1 | 1 | 389.2 | 375.8 | 1 | 425.1 | 410.5 |
| 2 | 246.0 | 237.6 | 2 | 282.0 | 272.3 | 2 | 317.9 | 307.0 | 2 | 353.9 | 341.8 | 2 | 389.9 | 376.5 | 2 | 425.8 | 411.2 |
| 3 | 246.7 | 238.3 | 3 | 282.7 | 273.0 | 3 | 318.7 | 307.7 | 3 | 354.6 | 342.5 | 3 | 390.6 | 377.2 | 3 | 426.6 | 411.9 |
| 4 | 247.5 | 239.0 | 4 | 283.4 | 273.7 | 4 | 319.4 | 308.4 | 4 | 355.4 | 343.2 | 4 | 391.3 | 377.9 | 4 | 427.3 | 412.6 |
| 5 | 248.2 | 239.7 | 5 | 284.1 | 274.4 | 5 | 320.1 | 309.1 | 5 | 356.1 | 343.9 | 5 | 392.0 | 378.6 | 5 | 428.0 | 413.3 |
| 6 | 248.9 | 240.4 | 6 | 284.9 | 275.1 | 6 | 320.8 | 309.8 | 6 | 356.8 | 344.6 | 6 | 392.8 | 379.3 | 6 | 428.7 | 414.0 |
| 7 | 249.6 | 241.0 | 7 | 285.6 | 275.8 | 7 | 321.5 | 310.5 | 7 | 357.5 | 345.2 | 7 | 393.5 | 380.0 | 7 | 429.4 | 414.7 |
| 8 | 250.3 | 241.7 | 8 | 286.3 | 276.5 | 8 | 322.3 | 311.2 | 8 | 358.2 | 345.9 | 8 | 394.2 | 380.7 | 8 | 430.2 | 415.4 |
| 9 | 251.0 | 242.4 | 9 | 287.0 | 277.2 | 9 | 323.0 | 311.9 | 9 | 359.0 | 346.6 | 9 | 394.9 | 381.4 | 9 | 430.9 | 416.1 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 314 315
269 226 225
R

089 046° 045
091 134 135
R ou φm

R

TABELA 1

R ou φm

359 315° 315
181 225 225

TÁBUAS DE CARTEAÇÃO

001 045 045
179 135 135

| ΔL | ap | ap | ΔL | ap | ap | ΔL | ap | ap | ΔL | ap | ap | ΔL | ap | ap | ΔL | ap | ap |
|----|------|------|----|------|------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 0 | 0.0 | 0.0 | 50 | 35.4 | 35.4 | 100 | 70.7 | 70.7 | 150 | 106.1 | 106.1 | 200 | 141.4 | 141.4 | 250 | 176.8 | 176.8 |
| 1 | 0.7 | 0.7 | 1 | 36.1 | 36.1 | 1 | 71.4 | 71.4 | 1 | 106.8 | 106.8 | 1 | 142.1 | 142.1 | 1 | 177.5 | 177.5 |
| 2 | 1.4 | 1.4 | 2 | 36.8 | 36.8 | 2 | 72.1 | 72.1 | 2 | 107.5 | 107.5 | 2 | 142.8 | 142.8 | 2 | 178.2 | 178.2 |
| 3 | 2.1 | 2.1 | 3 | 37.5 | 37.5 | 3 | 72.8 | 72.8 | 3 | 108.2 | 108.2 | 3 | 143.5 | 143.5 | 3 | 178.9 | 178.9 |
| 4 | 2.8 | 2.8 | 4 | 38.2 | 38.2 | 4 | 73.5 | 73.5 | 4 | 108.9 | 108.9 | 4 | 144.2 | 144.2 | 4 | 179.6 | 179.6 |
| 5 | 3.5 | 3.5 | 5 | 38.9 | 38.9 | 5 | 74.2 | 74.2 | 5 | 109.6 | 109.6 | 5 | 145.0 | 145.0 | 5 | 180.3 | 180.3 |
| 6 | 4.2 | 4.2 | 6 | 39.6 | 39.6 | 6 | 75.0 | 75.0 | 6 | 110.3 | 110.3 | 6 | 145.7 | 145.7 | 6 | 181.0 | 181.0 |
| 7 | 4.9 | 4.9 | 7 | 40.3 | 40.3 | 7 | 75.7 | 75.7 | 7 | 111.0 | 111.0 | 7 | 146.4 | 146.4 | 7 | 181.7 | 181.7 |
| 8 | 5.7 | 5.7 | 8 | 41.0 | 41.0 | 8 | 76.4 | 76.4 | 8 | 111.7 | 111.7 | 8 | 147.1 | 147.1 | 8 | 182.4 | 182.4 |
| 9 | 6.4 | 6.4 | 9 | 41.7 | 41.7 | 9 | 77.1 | 77.1 | 9 | 112.4 | 112.4 | 9 | 147.8 | 147.8 | 9 | 183.1 | 183.1 |
| 10 | 7.1 | 7.1 | 60 | 42.4 | 42.4 | 110 | 77.8 | 77.8 | 160 | 113.1 | 113.1 | 210 | 148.5 | 148.5 | 260 | 183.8 | 183.8 |
| 1 | 7.8 | 7.8 | 1 | 43.1 | 43.1 | 1 | 78.5 | 78.5 | 1 | 113.8 | 113.8 | 1 | 149.2 | 149.2 | 1 | 184.6 | 184.6 |
| 2 | 8.5 | 8.5 | 2 | 43.8 | 43.8 | 2 | 79.2 | 79.2 | 2 | 114.6 | 114.6 | 2 | 149.9 | 149.9 | 2 | 185.3 | 185.3 |
| 3 | 9.2 | 9.2 | 3 | 44.5 | 44.5 | 3 | 79.9 | 79.9 | 3 | 115.3 | 115.3 | 3 | 150.6 | 150.6 | 3 | 186.0 | 186.0 |
| 4 | 9.9 | 9.9 | 4 | 45.3 | 45.3 | 4 | 80.6 | 80.6 | 4 | 116.0 | 116.0 | 4 | 151.3 | 151.3 | 4 | 186.7 | 186.7 |
| 5 | 10.6 | 10.6 | 5 | 46.0 | 46.0 | 5 | 81.3 | 81.3 | 5 | 116.7 | 116.7 | 5 | 152.0 | 152.0 | 5 | 187.4 | 187.4 |
| 6 | 11.3 | 11.3 | 6 | 46.7 | 46.7 | 6 | 82.0 | 82.0 | 6 | 117.4 | 117.4 | 6 | 152.7 | 152.7 | 6 | 188.1 | 188.1 |
| 7 | 12.0 | 12.0 | 7 | 47.4 | 47.4 | 7 | 82.7 | 82.7 | 7 | 118.1 | 118.1 | 7 | 153.4 | 153.4 | 7 | 188.8 | 188.8 |
| 8 | 12.7 | 12.7 | 8 | 48.1 | 48.1 | 8 | 83.4 | 83.4 | 8 | 118.8 | 118.8 | 8 | 154.1 | 154.1 | 8 | 189.5 | 189.5 |
| 9 | 13.4 | 13.4 | 9 | 48.8 | 48.8 | 9 | 84.1 | 84.1 | 9 | 119.5 | 119.5 | 9 | 154.9 | 154.9 | 9 | 190.2 | 190.2 |
| 20 | 14.1 | 14.1 | 70 | 49.5 | 49.5 | 120 | 84.9 | 84.9 | 170 | 120.2 | 120.2 | 220 | 155.6 | 155.6 | 270 | 190.9 | 190.9 |
| 1 | 14.8 | 14.8 | 1 | 50.2 | 50.2 | 1 | 85.6 | 85.6 | 1 | 120.9 | 120.9 | 1 | 156.3 | 156.3 | 1 | 191.6 | 191.6 |
| 2 | 15.6 | 15.6 | 2 | 50.9 | 50.9 | 2 | 86.3 | 86.3 | 2 | 121.6 | 121.6 | 2 | 157.0 | 157.0 | 2 | 192.3 | 192.3 |
| 3 | 16.3 | 16.3 | 3 | 51.6 | 51.6 | 3 | 87.0 | 87.0 | 3 | 122.3 | 122.3 | 3 | 157.7 | 157.7 | 3 | 193.0 | 193.0 |
| 4 | 17.0 | 17.0 | 4 | 52.3 | 52.3 | 4 | 87.7 | 87.7 | 4 | 123.0 | 123.0 | 4 | 158.4 | 158.4 | 4 | 193.7 | 193.7 |
| 5 | 17.7 | 17.7 | 5 | 53.0 | 53.0 | 5 | 88.4 | 88.4 | 5 | 123.7 | 123.7 | 5 | 159.1 | 159.1 | 5 | 194.5 | 194.5 |
| 6 | 18.4 | 18.4 | 6 | 53.7 | 53.7 | 6 | 89.1 | 89.1 | 6 | 124.5 | 124.5 | 6 | 159.8 | 159.8 | 6 | 195.2 | 195.2 |
| 7 | 19.1 | 19.1 | 7 | 54.4 | 54.4 | 7 | 89.8 | 89.8 | 7 | 125.2 | 125.2 | 7 | 160.5 | 160.5 | 7 | 195.9 | 195.9 |
| 8 | 19.8 | 19.8 | 8 | 55.2 | 55.2 | 8 | 90.5 | 90.5 | 8 | 125.9 | 125.9 | 8 | 161.2 | 161.2 | 8 | 196.6 | 196.6 |
| 9 | 20.5 | 20.5 | 9 | 55.9 | 55.9 | 9 | 91.2 | 91.2 | 9 | 126.6 | 126.6 | 9 | 161.9 | 161.9 | 9 | 197.3 | 197.3 |
| 30 | 21.2 | 21.2 | 80 | 56.6 | 56.6 | 130 | 91.9 | 91.9 | 180 | 127.3 | 127.3 | 230 | 162.6 | 162.6 | 280 | 198.0 | 198.0 |
| 1 | 21.9 | 21.9 | 1 | 57.3 | 57.3 | 1 | 92.6 | 92.6 | 1 | 128.0 | 128.0 | 1 | 163.3 | 163.3 | 1 | 198.7 | 198.7 |
| 2 | 22.6 | 22.6 | 2 | 58.0 | 58.0 | 2 | 93.3 | 93.3 | 2 | 128.7 | 128.7 | 2 | 164.0 | 164.0 | 2 | 199.4 | 199.4 |
| 3 | 23.3 | 23.3 | 3 | 58.7 | 58.7 | 3 | 94.0 | 94.0 | 3 | 129.4 | 129.4 | 3 | 164.8 | 164.8 | 3 | 200.1 | 200.1 |
| 4 | 24.0 | 24.0 | 4 | 59.4 | 59.4 | 4 | 94.8 | 94.8 | 4 | 130.1 | 130.1 | 4 | 165.5 | 165.5 | 4 | 200.8 | 200.8 |
| 5 | 24.7 | 24.7 | 5 | 60.1 | 60.1 | 5 | 95.5 | 95.5 | 5 | 130.8 | 130.8 | 5 | 166.2 | 166.2 | 5 | 201.5 | 201.5 |
| 6 | 25.5 | 25.5 | 6 | 60.8 | 60.8 | 6 | 96.2 | 96.2 | 6 | 131.5 | 131.5 | 6 | 166.9 | 166.9 | 6 | 202.2 | 202.2 |
| 7 | 26.2 | 26.2 | 7 | 61.5 | 61.5 | 7 | 96.9 | 96.9 | 7 | 132.2 | 132.2 | 7 | 167.6 | 167.6 | 7 | 202.9 | 202.9 |
| 8 | 26.9 | 26.9 | 8 | 62.2 | 62.2 | 8 | 97.6 | 97.6 | 8 | 132.9 | 132.9 | 8 | 168.3 | 168.3 | 8 | 203.6 | 203.6 |
| 9 | 27.6 | 27.6 | 9 | 62.9 | 62.9 | 9 | 98.3 | 98.3 | 9 | 133.6 | 133.6 | 9 | 169.0 | 169.0 | 9 | 204.4 | 204.4 |
| 40 | 28.3 | 28.3 | 90 | 63.6 | 63.6 | 140 | 99.0 | 99.0 | 190 | 134.4 | 134.4 | 240 | 169.7 | 169.7 | 290 | 205.1 | 205.1 |
| 1 | 29.0 | 29.0 | 1 | 64.3 | 64.3 | 1 | 99.7 | 99.7 | 1 | 135.1 | 135.1 | 1 | 170.4 | 170.4 | 1 | 205.8 | 205.8 |
| 2 | 29.7 | 29.7 | 2 | 65.1 | 65.1 | 2 | 100.4 | 100.4 | 2 | 135.8 | 135.8 | 2 | 171.1 | 171.1 | 2 | 206.5 | 206.5 |
| 3 | 30.4 | 30.4 | 3 | 65.8 | 65.8 | 3 | 101.1 | 101.1 | 3 | 136.5 | 136.5 | 3 | 171.8 | 171.8 | 3 | 207.2 | 207.2 |
| 4 | 31.1 | 31.1 | 4 | 66.5 | 66.5 | 4 | 101.8 | 101.8 | 4 | 137.2 | 137.2 | 4 | 172.5 | 172.5 | 4 | 207.9 | 207.9 |
| 5 | 31.8 | 31.8 | 5 | 67.2 | 67.2 | 5 | 102.5 | 102.5 | 5 | 137.9 | 137.9 | 5 | 173.2 | 173.2 | 5 | 208.6 | 208.6 |
| 6 | 32.5 | 32.5 | 6 | 67.9 | 67.9 | 6 | 103.2 | 103.2 | 6 | 138.6 | 138.6 | 6 | 173.9 | 173.9 | 6 | 209.3 | 209.3 |
| 7 | 33.2 | 33.2 | 7 | 68.6 | 68.6 | 7 | 103.9 | 103.9 | 7 | 139.3 | 139.3 | 7 | 174.7 | 174.7 | 7 | 210.0 | 210.0 |
| 8 | 33.9 | 33.9 | 8 | 69.3 | 69.3 | 8 | 104.7 | 104.7 | 8 | 140.0 | 140.0 | 8 | 175.4 | 175.4 | 8 | 210.7 | 210.7 |
| 9 | 34.6 | 34.6 | 9 | 70.0 | 70.0 | 9 | 105.4 | 105.4 | 9 | 140.7 | 140.7 | 9 | 176.1 | 176.1 | 9 | 211.4 | 211.4 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 315 315
269 225 225

R

089 045° 045
091 135 135

R ou φm

R

TABELA 1

R ou φm

359 315° 315

181 225 225

TÁBUAS DE CARTEAÇÃO

001 045° 045

179 135 135

| ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | | ΔL | ap | |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap | D | Δφ | ap |
| 300 | 212.1 | 212.1 | 350 | 247.5 | 247.5 | 400 | 282.8 | 282.8 | 450 | 318.2 | 318.2 | 500 | 353.6 | 353.6 | 550 | 388.9 | 388.9 |
| 1 | 212.8 | 212.8 | 1 | 248.2 | 248.2 | 1 | 283.5 | 283.5 | 1 | 318.9 | 318.9 | 1 | 354.3 | 354.3 | 1 | 389.6 | 389.6 |
| 2 | 213.5 | 213.5 | 2 | 248.9 | 248.9 | 2 | 284.3 | 284.3 | 2 | 319.6 | 319.6 | 2 | 355.0 | 355.0 | 2 | 390.3 | 390.3 |
| 3 | 214.3 | 214.3 | 3 | 249.6 | 249.6 | 3 | 285.0 | 285.0 | 3 | 320.3 | 320.3 | 3 | 355.7 | 355.7 | 3 | 391.0 | 391.0 |
| 4 | 215.0 | 215.0 | 4 | 250.3 | 250.3 | 4 | 285.7 | 285.7 | 4 | 321.0 | 321.0 | 4 | 356.4 | 356.4 | 4 | 391.7 | 391.7 |
| 5 | 215.7 | 215.7 | 5 | 251.0 | 251.0 | 5 | 286.4 | 286.4 | 5 | 321.7 | 321.7 | 5 | 357.1 | 357.1 | 5 | 392.4 | 392.4 |
| 6 | 216.4 | 216.4 | 6 | 251.7 | 251.7 | 6 | 287.1 | 287.1 | 6 | 322.4 | 322.4 | 6 | 357.8 | 357.8 | 6 | 393.2 | 393.2 |
| 7 | 217.1 | 217.1 | 7 | 252.4 | 252.4 | 7 | 287.8 | 287.8 | 7 | 323.1 | 323.1 | 7 | 358.5 | 358.5 | 7 | 393.9 | 393.9 |
| 8 | 217.8 | 217.8 | 8 | 253.1 | 253.1 | 8 | 288.5 | 288.5 | 8 | 323.9 | 323.9 | 8 | 359.2 | 359.2 | 8 | 394.6 | 394.6 |
| 9 | 218.5 | 218.5 | 9 | 253.9 | 253.9 | 9 | 289.2 | 289.2 | 9 | 324.6 | 324.6 | 9 | 359.9 | 359.9 | 9 | 395.3 | 395.3 |
| 310 | 219.2 | 219.2 | 360 | 254.6 | 254.6 | 410 | 289.9 | 289.9 | 460 | 325.3 | 325.3 | 510 | 360.6 | 360.6 | 560 | 396.0 | 396.0 |
| 1 | 219.9 | 219.9 | 1 | 255.3 | 255.3 | 1 | 290.6 | 290.6 | 1 | 326.0 | 326.0 | 1 | 361.3 | 361.3 | 1 | 396.7 | 396.7 |
| 2 | 220.6 | 220.6 | 2 | 256.0 | 256.0 | 2 | 291.3 | 291.3 | 2 | 326.7 | 326.7 | 2 | 362.0 | 362.0 | 2 | 397.4 | 397.4 |
| 3 | 221.3 | 221.3 | 3 | 256.7 | 256.7 | 3 | 292.0 | 292.0 | 3 | 327.4 | 327.4 | 3 | 362.7 | 362.7 | 3 | 398.1 | 398.1 |
| 4 | 222.0 | 222.0 | 4 | 257.4 | 257.4 | 4 | 292.7 | 292.7 | 4 | 328.1 | 328.1 | 4 | 363.5 | 363.5 | 4 | 398.8 | 398.8 |
| 5 | 222.7 | 222.7 | 5 | 258.1 | 258.1 | 5 | 293.4 | 293.4 | 5 | 328.8 | 328.8 | 5 | 364.2 | 364.2 | 5 | 399.5 | 399.5 |
| 6 | 223.4 | 223.4 | 6 | 258.8 | 258.8 | 6 | 294.2 | 294.2 | 6 | 329.5 | 329.5 | 6 | 364.9 | 364.9 | 6 | 400.2 | 400.2 |
| 7 | 224.2 | 224.2 | 7 | 259.5 | 259.5 | 7 | 294.9 | 294.9 | 7 | 330.2 | 330.2 | 7 | 365.6 | 365.6 | 7 | 400.9 | 400.9 |
| 8 | 224.9 | 224.9 | 8 | 260.2 | 260.2 | 8 | 295.6 | 295.6 | 8 | 330.9 | 330.9 | 8 | 366.3 | 366.3 | 8 | 401.6 | 401.6 |
| 9 | 225.6 | 225.6 | 9 | 260.9 | 260.9 | 9 | 296.3 | 296.3 | 9 | 331.6 | 331.6 | 9 | 367.0 | 367.0 | 9 | 402.3 | 402.3 |
| 320 | 226.3 | 226.3 | 370 | 261.6 | 261.6 | 420 | 297.0 | 297.0 | 470 | 332.3 | 332.3 | 520 | 367.7 | 367.7 | 570 | 403.1 | 403.1 |
| 1 | 227.0 | 227.0 | 1 | 262.3 | 262.3 | 1 | 297.7 | 297.7 | 1 | 333.0 | 333.0 | 1 | 368.4 | 368.4 | 1 | 403.8 | 403.8 |
| 2 | 227.7 | 227.7 | 2 | 263.0 | 263.0 | 2 | 298.4 | 298.4 | 2 | 333.8 | 333.8 | 2 | 369.1 | 369.1 | 2 | 404.5 | 404.5 |
| 3 | 228.4 | 228.4 | 3 | 263.8 | 263.8 | 3 | 299.1 | 299.1 | 3 | 334.5 | 334.5 | 3 | 369.8 | 369.8 | 3 | 405.2 | 405.2 |
| 4 | 229.1 | 229.1 | 4 | 264.5 | 264.5 | 4 | 299.8 | 299.8 | 4 | 335.2 | 335.2 | 4 | 370.5 | 370.5 | 4 | 405.9 | 405.9 |
| 5 | 229.8 | 229.8 | 5 | 265.2 | 265.2 | 5 | 300.5 | 300.5 | 5 | 335.9 | 335.9 | 5 | 371.2 | 371.2 | 5 | 406.6 | 406.6 |
| 6 | 230.5 | 230.5 | 6 | 265.9 | 265.9 | 6 | 301.2 | 301.2 | 6 | 336.6 | 336.6 | 6 | 371.9 | 371.9 | 6 | 407.3 | 407.3 |
| 7 | 231.2 | 231.2 | 7 | 266.6 | 266.6 | 7 | 301.9 | 301.9 | 7 | 337.3 | 337.3 | 7 | 372.6 | 372.6 | 7 | 408.0 | 408.0 |
| 8 | 231.9 | 231.9 | 8 | 267.3 | 267.3 | 8 | 302.6 | 302.6 | 8 | 338.0 | 338.0 | 8 | 373.4 | 373.4 | 8 | 408.7 | 408.7 |
| 9 | 232.6 | 232.6 | 9 | 268.0 | 268.0 | 9 | 303.3 | 303.3 | 9 | 338.7 | 338.7 | 9 | 374.1 | 374.1 | 9 | 409.4 | 409.4 |
| 330 | 233.3 | 233.3 | 380 | 268.7 | 268.7 | 430 | 304.1 | 304.1 | 480 | 339.4 | 339.4 | 530 | 374.8 | 374.8 | 580 | 410.1 | 410.1 |
| 1 | 234.1 | 234.1 | 1 | 269.4 | 269.4 | 1 | 304.8 | 304.8 | 1 | 340.1 | 340.1 | 1 | 375.5 | 375.5 | 1 | 410.8 | 410.8 |
| 2 | 234.8 | 234.8 | 2 | 270.1 | 270.1 | 2 | 305.5 | 305.5 | 2 | 340.8 | 340.8 | 2 | 376.2 | 376.2 | 2 | 411.5 | 411.5 |
| 3 | 235.5 | 235.5 | 3 | 270.8 | 270.8 | 3 | 306.2 | 306.2 | 3 | 341.5 | 341.5 | 3 | 376.9 | 376.9 | 3 | 412.2 | 412.2 |
| 4 | 236.2 | 236.2 | 4 | 271.5 | 271.5 | 4 | 306.9 | 306.9 | 4 | 342.2 | 342.2 | 4 | 377.6 | 377.6 | 4 | 413.0 | 413.0 |
| 5 | 236.9 | 236.9 | 5 | 272.2 | 272.2 | 5 | 307.6 | 307.6 | 5 | 342.9 | 342.9 | 5 | 378.3 | 378.3 | 5 | 413.7 | 413.7 |
| 6 | 237.6 | 237.6 | 6 | 272.9 | 272.9 | 6 | 308.3 | 308.3 | 6 | 343.7 | 343.7 | 6 | 379.0 | 379.0 | 6 | 414.4 | 414.4 |
| 7 | 238.3 | 238.3 | 7 | 273.7 | 273.7 | 7 | 309.0 | 309.0 | 7 | 344.4 | 344.4 | 7 | 379.7 | 379.7 | 7 | 415.1 | 415.1 |
| 8 | 239.0 | 239.0 | 8 | 274.4 | 274.4 | 8 | 309.7 | 309.7 | 8 | 345.1 | 345.1 | 8 | 380.4 | 380.4 | 8 | 415.8 | 415.8 |
| 9 | 239.7 | 239.7 | 9 | 275.1 | 275.1 | 9 | 310.4 | 310.4 | 9 | 345.8 | 345.8 | 9 | 381.1 | 381.1 | 9 | 416.5 | 416.5 |
| 340 | 240.4 | 240.4 | 390 | 275.8 | 275.8 | 440 | 311.1 | 311.1 | 490 | 346.5 | 346.5 | 540 | 381.8 | 381.8 | 590 | 417.2 | 417.2 |
| 1 | 241.1 | 241.1 | 1 | 276.5 | 276.5 | 1 | 311.8 | 311.8 | 1 | 347.2 | 347.2 | 1 | 382.5 | 382.5 | 1 | 417.9 | 417.9 |
| 2 | 241.8 | 241.8 | 2 | 277.2 | 277.2 | 2 | 312.5 | 312.5 | 2 | 347.9 | 347.9 | 2 | 383.3 | 383.3 | 2 | 418.6 | 418.6 |
| 3 | 242.5 | 242.5 | 3 | 277.9 | 277.9 | 3 | 313.2 | 313.2 | 3 | 348.6 | 348.6 | 3 | 384.0 | 384.0 | 3 | 419.3 | 419.3 |
| 4 | 243.2 | 243.2 | 4 | 278.6 | 278.6 | 4 | 314.0 | 314.0 | 4 | 349.3 | 349.3 | 4 | 384.7 | 384.7 | 4 | 420.0 | 420.0 |
| 5 | 244.0 | 244.0 | 5 | 279.3 | 279.3 | 5 | 314.7 | 314.7 | 5 | 350.0 | 350.0 | 5 | 385.4 | 385.4 | 5 | 420.7 | 420.7 |
| 6 | 244.7 | 244.7 | 6 | 280.0 | 280.0 | 6 | 315.4 | 315.4 | 6 | 350.7 | 350.7 | 6 | 386.1 | 386.1 | 6 | 421.4 | 421.4 |
| 7 | 245.4 | 245.4 | 7 | 280.7 | 280.7 | 7 | 316.1 | 316.1 | 7 | 351.4 | 351.4 | 7 | 386.8 | 386.8 | 7 | 422.1 | 422.1 |
| 8 | 246.1 | 246.1 | 8 | 281.4 | 281.4 | 8 | 316.8 | 316.8 | 8 | 352.1 | 352.1 | 8 | 387.5 | 387.5 | 8 | 422.8 | 422.8 |
| 9 | 246.8 | 246.8 | 9 | 282.1 | 282.1 | 9 | 317.5 | 317.5 | 9 | 352.8 | 352.8 | 9 | 388.2 | 388.2 | 9 | 423.6 | 423.6 |
| D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ | D | ap | Δφ |
| ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap | ΔL | | ap |

271 315° 315

269 225 225

R

- 91 -

089 045° 045

091 135 135

R ou φm