

## บันทึกวิชาการฉบับที่ 4

ตัวคงที่ของโค้ง Clothoid หรือ Spiral Curve

บริษัท คอนซัลแทนท์ ออฟ เทคโนโลยี จำกัด

# บันทึกวิชาการฉบับที่ 4

## ตัวโค้งของโค้ง Clothoid หรือ Spiral Curve

### สารบัญ

|                                           | หน้า   |
|-------------------------------------------|--------|
| ตัวโค้งของโค้ง Clothoid หรือ Spiral Curve | 1      |
| รูปที่ 1 : องค์ประกอบของโค้ง Spiral       | 2      |
| Clothoid Parameters                       | 3 - 14 |

## คำนำ

ฝ่ายวิศวกรรมทางหลวง ตระหนักถึงความสำคัญสำหรับโค้งเปลี่ยนรัศมี (Transition Curves) ซึ่งมีความสำคัญสำหรับทางหลวงมาตรฐานสูง เช่น Motorway, Expressway, ทางรถไฟและทางแยกต่างระดับ โค้งเปลี่ยนรัศมีที่นิยมใช้กันทั่วไป คือ Spiral Curve หรือ Clothoid เพื่อให้ปรับรัศมีระหว่างเส้นสัมผัสและโค้งวงกลม หรือเป็นโค้งเปลี่ยนรัศมีตลอดจากจุดสัมผัสถึงจุดสัมผัส ที่เรียกว่า Double - spiral Curves ทฤษฎีของโค้ง Spiral โดยพื้นฐานก็คือ โค้งจะมีรัศมีลดลงตามลำดับ โดยที่จุดสัมผัสรัศมีเท่ากับอนันต์ (Infinity) และลดลงตามเป็นสัดส่วนโดยตรงตามความยาวของโค้ง Spiral จนเมื่อบรรจบกับโค้งวงกลมจะมีรัศมีเท่ากับโค้งวงกลมนั้น

การคำนวณโค้ง Spiral หมายถึงการกำหนดจุดเริ่มต้นโค้ง (Tangent to Spiral) จุดเริ่มต้นโค้งวงกลม (Spiral to Circular Curve) ฯลฯ มีความยุ่งยากพอสมควร แตกต่างไปจากโค้งวงกลม ทั้งนี้เนื่องจากมีระยะล่น (Offset) และระยะแนวราบ (Abscissa) ของโค้งวงกลมที่เลื่อนออกไป (Shifted Circular Curve) และในตำราเกี่ยวกับตำแหน่งแนวเส้นทาง (Route Location) มักทำตารางออกมาในรูปแบบต่าง ๆ ซึ่งไม่สะดวกต่อการใช้ ฝ่ายวิศวกรรมทางหลวงจึงได้จัดเตรียมตารางขึ้นมา เรียกว่า Clothoid Parameter เมื่อโค้งเปลี่ยนรัศมีมีระยะทางเปลี่ยนโค้ง (L) และรัศมีของโค้งวงกลม (R) ตามที่กำหนด โดยประสบการณ์ทำให้การกำหนดแนวโค้งหมายถึงการคำนวณกระทำได้ง่ายขึ้นและสะดวก ทั้งนี้เพื่อประโยชน์กับงานของบริษัทฯ

ในอนาคตอันใกล้นี้ ประเทศไทยจะมีทางด่วนระหว่างเมือง (Intercity Motorway) เชื่อมโยงเมืองสำคัญของภูมิภาคต่าง ๆ เป็นระยะทางในเริ่มแรกของการวางแผน 4,000 กิโลเมตร จะเป็นทางหลวงที่มีมาตรฐานสูง โดยให้ความสำคัญกับการเคลื่อนสู่จุดหมาย (Mobility) เช่นเดียวกับในประเทศที่พัฒนาแล้ว การขนส่งทั้งผู้โดยสารและสินค้าโดยทางรถยนต์จะยังคงมีความสำคัญและมีปริมาณสูงถึงร้อยละ 90 ทั้งนี้เนื่องจากความสะดวกในลักษณะจากประตูถึงประตู (Door to Door Service)

### ตัวคงที่ของโค้ง Clothoid หรือ Spiral Curve

ตัวคงที่สำหรับใช้คำนวณมิติของโค้ง Spiral คือ

- Y = ระยะล่น (Offset) จากเส้นสัมผัสไปยังจุด SC (Spiral to Circular Curve)  
 X = ระยะตามเส้นสัมผัสเทียบกับจุด SC  
 K = พิกัดราบของจุด PC ที่เคลื่อนออกไป (Shifted PC) วัดจาก TS (Tangent to Spiral)  
 P = ระยะล่นจากเส้นสัมผัสไปยัง PC ของโค้งวงกลมที่เลื่อน (Shifted Circle)  
 LT = เส้นสัมผัสยาว (Long Tangent)  
 ST = เส้นสัมผัสสั้น (Short Tangent)  
 LC = เส้นตัดโค้งยาว (Long Chord)

ตัวคงที่ดังกล่าวแสดงในรูปที่ 1

ในการคำนวณโค้ง Spiral หรือสร้างโค้ง Spiral จะต้องกำหนดรัศมีของโค้งวงกลมคือ R หรือ  $R_c$  และความยาวของโค้ง Spiral หรือ L หรือ  $I_s$

การคำนวณตัวคงที่ (Parameter) ดังกล่าวขึ้นกับค่า  $\theta_s$  (มุมของโค้ง Spiral ซึ่งความยาว Spiral เท่ากับ  $I_s$ ) คำนวณจาก

$$\theta_s = \frac{I_s}{2R_c}$$

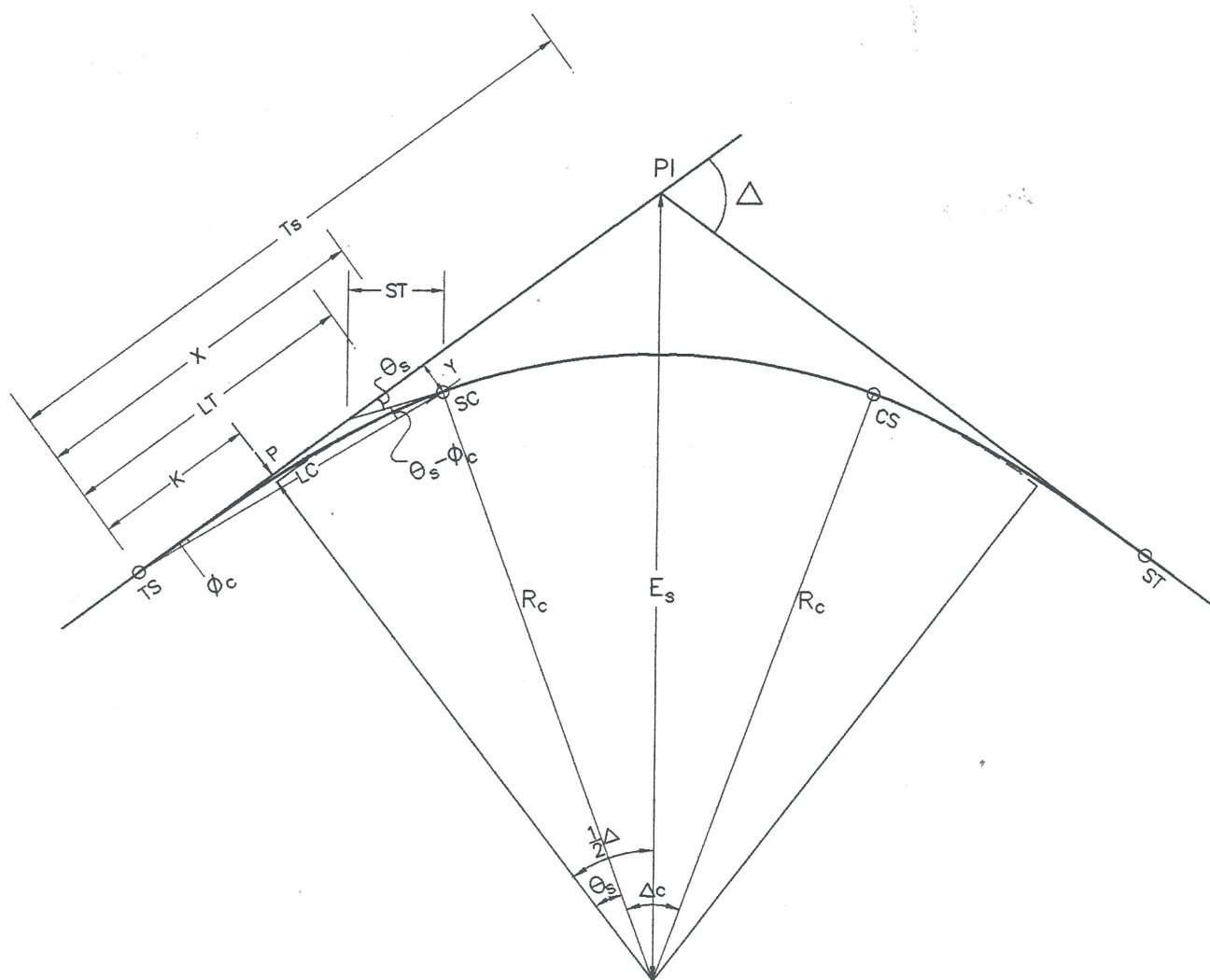
หลังจากนั้นจึงใช้ Function ของ Spiral ซึ่งมีความยาวของโค้ง Spiral เท่ากับ 1 หน่วย คำนวณสำหรับความยาว L หรือ  $I_s$  ที่กำหนดเป็นตัวคงที่ X, Y, K, P, LT, ST และ LC

ที่ต้องการสำหรับการกำหนดตำแหน่งของโค้ง Spiral คือ

$$\begin{aligned} T_s &= \text{ระยะทางเส้นสัมผัสทั้งหมด} = (R_c + P) \tan \frac{\Delta}{2} + K \\ \text{และ } E_s &= \text{ระยะภายนอกทั้งหมด} = (R_c + P) \sec \frac{\Delta}{2} + R_c \\ L_e &= \text{ความยาวของโค้งทั้งหมด} = 2I_s + \frac{R_c \Delta c}{57.29578} \end{aligned}$$

ค่าคงที่ดังกล่าวได้เรียงไว้ในตารางถัดไป โดยค่ารัศมีโค้งวงกลมถึง 15 ถึง 300 เมตร และความยาวโค้ง Spiral ต่าง ๆ กัน ในแต่ละรัศมีโค้งวงกลม





รูปที่ 1 องค์ประกอบของโค้ง SPIRAL

## Clothoid Parameters

| R  | L  | X      | Y      | K      | P     | LT     | ST     | LC     |
|----|----|--------|--------|--------|-------|--------|--------|--------|
| 15 | 15 | 14.629 | 2.456  | 7.438  | 0.620 | 10.134 | 5.122  | 14.834 |
|    | 20 | 19.129 | 4.306  | 9.854  | 1.094 | 13.658 | 6.963  | 19.608 |
|    | 25 | 23.319 | 6.607  | 12.216 | 1.693 | 17.316 | 8.928  | 24.237 |
|    | 30 | 27.136 | 9.308  | 14.514 | 2.401 | 21.159 | 11.062 | 28.688 |
|    | 35 | 30.528 | 12.344 | 16.736 | 3.242 | 25.248 | 13.426 | 32.928 |
|    | 40 | 33.450 | 15.644 | 18.871 | 4.173 | 29.665 | 16.096 | 36.928 |
|    | 45 | 35.877 | 19.133 | 20.914 | 5.194 | 34.519 | 19.180 | 40.659 |
|    | 50 | 37.787 | 22.730 | 22.856 | 6.295 | 39.974 | 22.836 | 44.097 |
| 20 | 20 | 19.506 | 3.274  | 9.917  | 0.826 | 13.512 | 6.830  | 19.778 |
|    | 25 | 24.041 | 5.065  | 12.489 | 1.284 | 17.022 | 8.656  | 24.569 |
|    | 30 | 28.356 | 7.204  | 14.723 | 1.838 | 20.623 | 10.568 | 29.257 |
|    | 35 | 32.413 | 9.663  | 17.063 | 2.483 | 24.343 | 12.590 | 33.823 |
|    | 40 | 36.181 | 12.410 | 19.352 | 3.202 | 28.212 | 14.749 | 38.250 |
|    | 45 | 39.629 | 15.409 | 21.584 | 4.033 | 32.265 | 17.078 | 42.519 |
|    | 50 | 42.732 | 18.620 | 23.753 | 4.926 | 36.546 | 19.623 | 46.613 |
|    | 55 | 46.022 | 22.003 | 25.855 | 5.894 | 41.110 | 22.432 | 50.517 |
| 30 | 60 | 47.836 | 25.511 | 27.885 | 6.926 | 46.025 | 25.574 | 54.212 |
|    | 30 | 29.258 | 4.912  | 14.875 | 1.240 | 20.268 | 10.244 | 29.668 |
|    | 35 | 33.827 | 6.642  | 17.314 | 1.681 | 23.764 | 12.059 | 34.473 |
|    | 40 | 38.258 | 8.611  | 19.707 | 2.187 | 27.315 | 13.925 | 39.215 |
|    | 45 | 42.534 | 10.806 | 22.085 | 2.757 | 30.935 | 15.852 | 43.885 |
|    | 50 | 46.638 | 13.214 | 24.432 | 3.386 | 34.632 | 17.855 | 48.474 |
|    | 55 | 50.555 | 15.823 | 26.748 | 4.077 | 38.422 | 19.939 | 52.973 |
|    | 60 | 54.271 | 18.616 | 29.028 | 4.802 | 42.318 | 22.123 | 57.376 |
| 35 | 65 | 57.775 | 21.577 | 31.269 | 5.628 | 46.337 | 24.421 | 61.672 |
|    | 70 | 61.056 | 24.688 | 33.472 | 6.484 | 50.496 | 26.851 | 65.855 |
|    | 35 | 34.135 | 5.730  | 17.354 | 1.446 | 23.646 | 11.952 | 34.612 |
|    | 40 | 38.713 | 7.442  | 19.785 | 1.882 | 27.137 | 13.762 | 39.423 |
|    | 45 | 43.175 | 9.362  | 22.194 | 2.375 | 30.676 | 15.617 | 44.179 |
|    | 50 | 47.509 | 11.478 | 24.580 | 2.923 | 34.270 | 17.520 | 48.875 |
|    | 55 | 51.700 | 13.782 | 26.944 | 3.523 | 37.927 | 19.484 | 53.506 |
|    | 60 | 55.739 | 16.264 | 29.280 | 4.175 | 41.656 | 21.514 | 58.063 |
| 35 | 65 | 59.615 | 18.913 | 31.588 | 4.878 | 45.468 | 23.620 | 62.543 |
|    | 70 | 63.316 | 21.718 | 33.866 | 5.603 | 49.371 | 25.810 | 66.938 |
|    | 75 | 66.836 | 24.667 | 36.109 | 6.428 | 53.381 | 28.101 | 71.242 |

| R  | L   | X       | Y      | K      | P      | LT     | ST     | LC      |
|----|-----|---------|--------|--------|--------|--------|--------|---------|
| 40 | 40  | 39.012  | 6.549  | 19.834 | 1.652  | 27.024 | 13.660 | 39.557  |
|    | 45  | 43.597  | 8.248  | 22.265 | 2.085  | 30.513 | 15.467 | 44.371  |
|    | 50  | 48.081  | 10.129 | 24.678 | 2.567  | 34.043 | 17.312 | 49.137  |
|    | 55  | 52.457  | 12.184 | 27.073 | 3.098  | 37.617 | 19.201 | 53.854  |
|    | 60  | 56.712  | 14.408 | 29.446 | 3.676  | 41.247 | 21.136 | 58.513  |
|    | 65  | 60.839  | 16.792 | 31.797 | 4.300  | 44.935 | 23.128 | 63.114  |
|    | 70  | 64.827  | 19.327 | 34.126 | 4.967  | 48.687 | 25.180 | 67.647  |
|    | 75  | 68.671  | 22.007 | 36.427 | 5.679  | 52.516 | 27.302 | 72.112  |
|    | 80  | 72.362  | 24.821 | 38.703 | 6.434  | 56.425 | 29.498 | 76.501  |
| 45 | 40  | 39.217  | 5.843  | 19.869 | 1.471  | 26.948 | 13.590 | 39.650  |
|    | 45  | 43.888  | 7.367  | 22.313 | 1.859  | 30.402 | 15.367 | 44.501  |
|    | 50  | 48.479  | 9.058  | 24.746 | 2.288  | 33.887 | 17.171 | 49.318  |
|    | 55  | 52.981  | 10.908 | 27.161 | 2.764  | 37.411 | 19.011 | 54.092  |
|    | 60  | 57.388  | 12.916 | 29.561 | 3.281  | 40.973 | 20.888 | 58.823  |
|    | 65  | 61.690  | 15.074 | 31.943 | 3.840  | 44.579 | 22.804 | 63.506  |
|    | 70  | 65.881  | 17.379 | 34.307 | 4.441  | 48.237 | 24.766 | 68.135  |
|    | 75  | 69.957  | 19.822 | 36.648 | 5.079  | 51.947 | 26.782 | 72.170  |
|    | 80  | 73.905  | 22.397 | 38.970 | 5.760  | 55.722 | 28.850 | 77.227  |
|    | 85  | 77.738  | 25.102 | 41.267 | 6.481  | 59.563 | 30.984 | 81.678  |
|    | 90  | 81.407  | 27.924 | 43.541 | 7.238  | 63.478 | 33.185 | 86.063  |
| 50 | 40  | 39.366  | 5.273  | 19.893 | 1.326  | 26.893 | 13.539 | 39.716  |
|    | 45  | 44.098  | 6.653  | 22.350 | 1.676  | 30.324 | 15.296 | 44.597  |
|    | 50  | 48.765  | 8.186  | 24.793 | 2.066  | 33.779 | 17.075 | 49.446  |
|    | 55  | 53.359  | 9.868  | 27.225 | 2.493  | 37.265 | 18.879 | 54.264  |
|    | 60  | 57.875  | 11.696 | 29.643 | 2.962  | 40.781 | 20.713 | 59.046  |
|    | 65  | 62.306  | 13.664 | 32.048 | 3.468  | 44.333 | 22.578 | 63.787  |
|    | 70  | 66.647  | 15.771 | 34.436 | 4.013  | 47.924 | 24.480 | 68.488  |
|    | 75  | 70.890  | 18.011 | 36.808 | 4.595  | 51.558 | 26.420 | 73.141  |
|    | 80  | 75.028  | 20.377 | 39.164 | 5.215  | 55.238 | 28.408 | 77.748  |
|    | 85  | 79.061  | 22.870 | 41.496 | 5.866  | 58.972 | 30.439 | 82.303  |
|    | 90  | 82.979  | 25.478 | 43.813 | 6.557  | 62.759 | 32.526 | 86.800  |
|    | 95  | 86.776  | 28.198 | 46.106 | 7.283  | 66.612 | 34.667 | 91.243  |
|    | 100 | 90.452  | 31.026 | 48.379 | 8.042  | 70.531 | 36.872 | 95.626  |
|    | 110 | 97.415  | 36.979 | 52.855 | 9.659  | 78.594 | 41.493 | 104.198 |
|    | 120 | 103.833 | 43.281 | 57.231 | 11.403 | 87.009 | 46.438 | 112.492 |



| R  | L   | X       | Y      | K      | P      | LT      | ST     | LC      |
|----|-----|---------|--------|--------|--------|---------|--------|---------|
| 55 | 40  | 39.473  | 4.802  | 19.913 | 1.207  | 26.853  | 13.504 | 39.766  |
|    | 45  | 44.253  | 6.063  | 22.375 | 1.525  | 30.268  | 15.244 | 44.667  |
|    | 50  | 48.977  | 7.465  | 24.829 | 1.880  | 33.701  | 17.002 | 49.542  |
|    | 55  | 53.641  | 9.004  | 27.272 | 2.272  | 37.157  | 18.782 | 54.391  |
|    | 60  | 58.239  | 10.679 | 29.705 | 2.698  | 40.642  | 20.585 | 59.210  |
|    | 65  | 62.766  | 12.487 | 32.124 | 3.160  | 44.154  | 22.415 | 63.997  |
|    | 70  | 67.217  | 14.425 | 34.533 | 3.658  | 47.697  | 24.273 | 68.749  |
|    | 75  | 71.588  | 16.488 | 36.927 | 4.191  | 51.274  | 26.163 | 73.462  |
|    | 80  | 75.871  | 18.672 | 39.304 | 4.758  | 54.889  | 28.088 | 78.136  |
|    | 85  | 80.062  | 20.978 | 41.668 | 5.359  | 58.547  | 30.050 | 82.765  |
|    | 90  | 84.161  | 23.398 | 44.012 | 5.994  | 62.250  | 32.053 | 87.353  |
|    | 95  | 88.154  | 25.925 | 46.343 | 6.657  | 65.998  | 34.104 | 91.887  |
|    | 100 | 92.046  | 28.560 | 48.654 | 7.356  | 69.802  | 36.201 | 96.375  |
|    | 110 | 99.497  | 34.129 | 53.217 | 8.847  | 77.584  | 40.560 | 105.188 |
|    | 120 | 106.483 | 40.065 | 57.697 | 10.456 | 85.632  | 45.166 | 113.772 |
| 60 | 50  | 49.140  | 6.857  | 24.856 | 1.726  | 33.643  | 16.948 | 49.617  |
|    | 55  | 53.856  | 8.278  | 27.309 | 2.085  | 37.079  | 18.708 | 54.488  |
|    | 60  | 58.518  | 9.824  | 29.751 | 2.478  | 40.536  | 20.490 | 59.336  |
|    | 65  | 63.119  | 11.492 | 32.185 | 2.903  | 44.019  | 22.291 | 64.156  |
|    | 70  | 67.655  | 13.284 | 34.606 | 3.361  | 47.527  | 24.118 | 68.947  |
|    | 75  | 72.122  | 15.194 | 37.017 | 3.851  | 51.065  | 25.968 | 73.705  |
|    | 80  | 76.517  | 17.221 | 39.415 | 4.375  | 54.631  | 27.850 | 78.431  |
|    | 85  | 80.833  | 19.362 | 41.798 | 4.928  | 58.232  | 29.760 | 83.119  |
|    | 90  | 85.067  | 21.613 | 44.169 | 5.514  | 61.870  | 31.704 | 87.770  |
|    | 95  | 89.215  | 23.968 | 46.526 | 6.130  | 65.545  | 33.688 | 92.380  |
|    | 100 | 93.276  | 26.429 | 48.863 | 6.772  | 69.263  | 35.709 | 96.947  |
|    | 110 | 101.110 | 31.646 | 53.497 | 8.155  | 76.845  | 39.878 | 105.946 |
|    | 120 | 108.543 | 37.231 | 58.055 | 9.651  | 84.637  | 44.247 | 114.751 |
|    | 130 | 115.550 | 43.153 | 62.538 | 11.256 | 92.673  | 48.842 | 123.345 |
|    | 140 | 122.111 | 49.375 | 66.945 | 12.969 | 100.991 | 53.702 | 131.711 |

| R  | L   | X       | Y      | K      | P      | LT      | ST     | LC      |
|----|-----|---------|--------|--------|--------|---------|--------|---------|
| 65 | 40  | 39.622  | 4.075  | 19.937 | 1.022  | 26.800  | 13.455 | 39.832  |
|    | 45  | 44.463  | 5.149  | 22.411 | 1.293  | 30.190  | 15.172 | 44.760  |
|    | 50  | 49.265  | 6.343  | 24.877 | 1.594  | 33.595  | 16.905 | 49.672  |
|    | 55  | 54.024  | 7.658  | 27.337 | 1.927  | 37.017  | 18.652 | 54.564  |
|    | 60  | 58.735  | 9.092  | 29.789 | 2.291  | 40.456  | 20.415 | 59.433  |
|    | 65  | 63.394  | 10.642 | 32.230 | 2.685  | 43.913  | 22.197 | 64.280  |
|    | 70  | 67.998  | 12.306 | 34.665 | 3.107  | 47.394  | 23.996 | 69.101  |
|    | 75  | 72.542  | 14.084 | 37.088 | 3.563  | 50.901  | 25.821 | 73.896  |
|    | 80  | 77.022  | 15.971 | 39.500 | 4.047  | 54.432  | 27.667 | 78.661  |
|    | 85  | 81.436  | 17.967 | 41.902 | 4.561  | 57.989  | 29.540 | 83.395  |
|    | 90  | 85.782  | 20.067 | 44.292 | 5.104  | 61.578  | 31.440 | 88.099  |
|    | 95  | 90.051  | 22.271 | 46.666 | 5.677  | 65.199  | 33.371 | 92.766  |
|    | 100 | 94.242  | 24.577 | 49.030 | 6.277  | 68.858  | 35.334 | 97.395  |
|    | 110 | 102.380 | 29.475 | 53.713 | 7.560  | 76.288  | 39.366 | 106.540 |
|    | 120 | 110.172 | 34.734 | 58.339 | 8.954  | 83.889  | 43.557 | 115.517 |
|    | 130 | 117.588 | 40.334 | 62.893 | 10.455 | 91.690  | 47.934 | 124.314 |
|    | 140 | 124.612 | 45.366 | 67.378 | 12.054 | 99.719  | 52.523 | 132.914 |
| 70 | 40  | 39.674  | 3.787  | 19.945 | 0.950  | 26.782  | 13.438 | 39.855  |
|    | 45  | 44.537  | 2.786  | 22.423 | 1.201  | 30.164  | 15.149 | 44.794  |
|    | 50  | 49.365  | 5.898  | 24.895 | 1.481  | 33.558  | 16.872 | 49.717  |
|    | 55  | 54.158  | 7.124  | 27.359 | 1.791  | 36.967  | 18.606 | 54.624  |
|    | 60  | 58.908  | 8.459  | 29.817 | 2.129  | 40.392  | 20.356 | 59.511  |
|    | 65  | 63.613  | 9.907  | 32.269 | 2.496  | 43.834  | 22.122 | 64.379  |
|    | 70  | 68.270  | 11.460 | 34.710 | 2.892  | 47.291  | 23.905 | 69.224  |
|    | 75  | 72.876  | 13.120 | 37.144 | 3.312  | 50.772  | 25.703 | 74.046  |
|    | 80  | 77.427  | 14.885 | 39.570 | 3.764  | 54.274  | 27.524 | 78.847  |
|    | 85  | 81.919  | 16.756 | 41.982 | 4.243  | 57.800  | 29.367 | 83.617  |
|    | 90  | 86.349  | 18.725 | 44.387 | 4.750  | 61.353  | 31.234 | 88.359  |
|    | 95  | 90.720  | 20.792 | 46.782 | 5.284  | 64.932  | 33.126 | 93.071  |
|    | 100 | 95.018  | 22.957 | 49.160 | 5.845  | 68.541  | 35.040 | 97.751  |
|    | 110 | 103.400 | 27.564 | 53.887 | 7.046  | 75.854  | 38.969 | 107.011 |
|    | 120 | 111.480 | 32.527 | 58.560 | 8.350  | 83.312  | 43.027 | 116.128 |
|    | 130 | 119.229 | 37.827 | 63.175 | 9.755  | 90.936  | 47.239 | 125.087 |
|    | 140 | 126.633 | 43.437 | 67.731 | 11.259 | 98.743  | 51.621 | 133.876 |
|    | 150 | 133.671 | 49.334 | 72.219 | 12.855 | 106.762 | 56.201 | 142.485 |



| R  | L   | X       | Y      | K      | P      | LT      | ST     | LC      |
|----|-----|---------|--------|--------|--------|---------|--------|---------|
| 75 | 40  | 39.716  | 3.537  | 19.952 | 0.887  | 26.767  | 13.424 | 39.874  |
|    | 45  | 44.596  | 4.471  | 22.428 | 1.121  | 30.143  | 15.130 | 44.820  |
|    | 50  | 49.447  | 5.512  | 24.908 | 1.383  | 33.529  | 16.845 | 49.753  |
|    | 55  | 54.265  | 6.658  | 27.377 | 1.673  | 36.928  | 18.571 | 54.672  |
|    | 60  | 59.049  | 7.910  | 29.840 | 1.989  | 40.340  | 20.308 | 59.575  |
|    | 65  | 63.791  | 9.263  | 32.298 | 2.332  | 43.768  | 22.061 | 64.459  |
|    | 70  | 68.492  | 10.722 | 34.749 | 2.702  | 47.211  | 23.829 | 69.324  |
|    | 75  | 73.147  | 12.279 | 37.189 | 3.098  | 50.669  | 25.612 | 74.169  |
|    | 80  | 77.754  | 13.935 | 39.624 | 3.518  | 54.149  | 27.410 | 78.992  |
|    | 85  | 82.310  | 15.690 | 42.050 | 3.967  | 57.650  | 29.229 | 83.794  |
|    | 90  | 86.813  | 17.543 | 44.465 | 4.442  | 61.172  | 31.068 | 88.569  |
|    | 95  | 91.259  | 19.488 | 46.872 | 4.942  | 64.717  | 32.929 | 93.317  |
|    | 100 | 95.646  | 21.527 | 49.269 | 5.468  | 68.288  | 34.813 | 98.039  |
|    | 110 | 104.230 | 25.873 | 54.029 | 6.595  | 75.512  | 38.655 | 107.393 |
|    | 120 | 112.541 | 30.565 | 58.745 | 7.822  | 82.856  | 42.612 | 116.622 |
|    | 130 | 120.568 | 35.587 | 63.406 | 9.139  | 90.340  | 46.695 | 125.710 |
|    | 140 | 128.286 | 40.920 | 68.014 | 10.556 | 97.983  | 50.921 | 134.656 |
|    | 150 | 135.678 | 46.539 | 72.569 | 12.064 | 105.796 | 55.309 | 143.439 |
| 80 | 50  | 49.513  | 5.172  | 24.919 | 1.298  | 33.505  | 16.824 | 49.783  |
|    | 55  | 54.352  | 6.250  | 27.393 | 1.569  | 36.896  | 18.541 | 54.711  |
|    | 60  | 59.162  | 7.425  | 29.859 | 1.866  | 40.299  | 20.272 | 59.625  |
|    | 65  | 63.936  | 8.698  | 32.322 | 2.188  | 43.715  | 22.013 | 64.525  |
|    | 70  | 68.672  | 10.070 | 34.778 | 2.535  | 47.143  | 23.767 | 69.407  |
|    | 75  | 73.370  | 11.538 | 37.229 | 2.908  | 50.589  | 25.536 | 74.270  |
|    | 80  | 78.023  | 13.097 | 39.669 | 3.305  | 54.047  | 27.320 | 79.113  |
|    | 85  | 82.632  | 14.751 | 42.103 | 3.724  | 57.527  | 29.117 | 83.937  |
|    | 90  | 87.193  | 16.497 | 44.530 | 4.171  | 61.025  | 30.934 | 88.741  |
|    | 95  | 91.705  | 18.334 | 46.947 | 4.642  | 64.544  | 32.770 | 93.520  |
|    | 100 | 96.162  | 20.258 | 49.955 | 5.135  | 68.086  | 34.624 | 98.274  |
|    | 110 | 104.914 | 24.369 | 54.146 | 6.197  | 75.235  | 38.402 | 107.708 |
|    | 120 | 113.423 | 28.817 | 58.892 | 7.352  | 82.493  | 42.272 | 117.026 |
|    | 130 | 121.677 | 33.583 | 63.594 | 8.599  | 89.868  | 46.256 | 126.228 |
|    | 140 | 129.654 | 38.653 | 68.251 | 9.933  | 97.374  | 50.361 | 135.294 |
|    | 150 | 137.342 | 44.015 | 72.853 | 11.357 | 105.032 | 54.603 | 144.225 |
|    | 160 | 144.723 | 49.642 | 77.407 | 12.868 | 112.849 | 58.996 | 153.001 |

| R  | L   | X       | Y      | K      | P      | LT      | ST     | LC      |
|----|-----|---------|--------|--------|--------|---------|--------|---------|
| 85 | 50  | 49.568  | 4.871  | 24.927 | 1.222  | 33.486  | 16.804 | 49.809  |
|    | 55  | 54.426  | 5.887  | 27.404 | 1.477  | 36.870  | 18.518 | 54.745  |
|    | 60  | 59.256  | 6.996  | 29.876 | 1.757  | 40.264  | 20.241 | 59.669  |
|    | 65  | 64.058  | 8.198  | 32.341 | 2.061  | 43.671  | 21.973 | 64.577  |
|    | 70  | 68.823  | 9.491  | 34.803 | 2.388  | 47.089  | 23.717 | 69.475  |
|    | 75  | 73.553  | 10.877 | 37.258 | 2.739  | 50.519  | 25.474 | 74.354  |
|    | 80  | 78.248  | 12.354 | 39.708 | 3.114  | 53.966  | 27.243 | 79.215  |
|    | 85  | 82.900  | 13.916 | 42.147 | 3.512  | 57.425  | 29.027 | 84.058  |
|    | 90  | 87.510  | 15.567 | 44.583 | 3.930  | 60.905  | 30.824 | 88.883  |
|    | 95  | 92.076  | 17.305 | 47.010 | 4.375  | 64.401  | 32.640 | 93.688  |
|    | 100 | 96.594  | 19.128 | 49.427 | 4.840  | 67.918  | 34.474 | 98.470  |
|    | 110 | 105.482 | 23.025 | 54.241 | 5.843  | 75.009  | 38.195 | 107.966 |
|    | 120 | 114.157 | 27.246 | 59.016 | 6.935  | 82.194  | 42.000 | 117.363 |
|    | 130 | 122.600 | 31.776 | 63.754 | 8.115  | 89.478  | 45.903 | 126.654 |
|    | 140 | 130.799 | 36.609 | 68.446 | 9.378  | 96.879  | 49.908 | 135.825 |
|    | 150 | 138.733 | 41.721 | 73.096 | 10.726 | 104.409 | 54.030 | 144.874 |
|    | 160 | 146.397 | 47.111 | 77.692 | 12.159 | 112.080 | 58.286 | 153.793 |
| 90 | 60  | 59.336  | 6.614  | 29.890 | 1.660  | 40.235  | 20.214 | 59.704  |
|    | 65  | 64.156  | 7.750  | 32.360 | 1.947  | 43.632  | 21.940 | 64.624  |
|    | 70  | 68.949  | 8.977  | 34.824 | 2.256  | 47.042  | 23.674 | 69.531  |
|    | 75  | 73.710  | 10.286 | 37.284 | 2.589  | 50.464  | 25.422 | 74.425  |
|    | 80  | 78.434  | 11.686 | 39.739 | 2.943  | 53.895  | 27.180 | 79.301  |
|    | 85  | 83.124  | 13.168 | 42.186 | 3.318  | 57.343  | 28.949 | 84.161  |
|    | 90  | 87.776  | 14.734 | 44.627 | 3.718  | 60.803  | 30.735 | 89.002  |
|    | 95  | 92.387  | 16.383 | 47.062 | 4.136  | 64.282  | 32.531 | 93.828  |
|    | 100 | 96.957  | 18.115 | 49.491 | 4.574  | 67.778  | 34.346 | 98.635  |
|    | 110 | 105.962 | 21.817 | 54.322 | 5.528  | 74.821  | 38.023 | 108.185 |
|    | 120 | 114.775 | 25.832 | 59.122 | 6.562  | 81.946  | 41.775 | 117.646 |
|    | 130 | 123.380 | 30.148 | 63.885 | 7.680  | 89.159  | 45.609 | 127.012 |
|    | 140 | 131.702 | 34.758 | 68.613 | 8.882  | 96.475  | 49.533 | 136.355 |
|    | 150 | 139.914 | 39.643 | 73.295 | 10.159 | 103.895 | 53.564 | 145.421 |
|    | 160 | 147.809 | 44.794 | 77.940 | 11.520 | 111.445 | 57.700 | 154.454 |



| R   | L   | X       | Y      | K      | P      | LT      | ST     | LC      |
|-----|-----|---------|--------|--------|--------|---------|--------|---------|
| 100 | 70  | 69.147  | 8.095  | 34.858 | 2.033  | 46.970  | 23.609 | 69.620  |
|     | 75  | 73.953  | 9.281  | 37.324 | 2.332  | 50.374  | 25.340 | 74.531  |
|     | 80  | 78.732  | 10.546 | 39.786 | 2.652  | 53.786  | 27.078 | 79.432  |
|     | 85  | 83.478  | 11.887 | 42.245 | 2.991  | 57.213  | 28.830 | 84.319  |
|     | 90  | 88.196  | 13.306 | 44.699 | 3.352  | 60.648  | 30.593 | 89.194  |
|     | 95  | 92.879  | 14.801 | 47.144 | 3.731  | 64.098  | 32.363 | 94.051  |
|     | 100 | 97.529  | 16.371 | 49.586 | 4.131  | 67.559  | 34.150 | 98.891  |
|     | 110 | 106.718 | 19.735 | 54.451 | 4.986  | 74.531  | 37.758 | 108.528 |
|     | 120 | 115.750 | 23.391 | 59.286 | 5.923  | 81.562  | 41.425 | 118.092 |
|     | 130 | 124.612 | 27.327 | 64.096 | 6.936  | 88.665  | 45.156 | 127.574 |
|     | 140 | 133.294 | 31.541 | 68.872 | 8.025  | 95.847  | 48.960 | 136.975 |
|     | 150 | 141.779 | 36.021 | 73.615 | 9.190  | 103.116 | 52.840 | 146.282 |
|     | 160 | 150.055 | 40.753 | 78.327 | 10.429 | 110.475 | 56.816 | 155.496 |
| 110 | 60  | 59.554  | 5.425  | 29.925 | 1.360  | 40.158  | 20.143 | 59.802  |
|     | 65  | 64.433  | 6.361  | 32.405 | 1.595  | 43.533  | 21.847 | 64.750  |
|     | 70  | 69.294  | 7.371  | 34.882 | 1.849  | 46.917  | 23.561 | 69.686  |
|     | 75  | 74.131  | 8.453  | 37.356 | 2.122  | 50.308  | 25.279 | 74.613  |
|     | 80  | 78.947  | 9.604  | 39.826 | 2.413  | 53.706  | 27.008 | 79.532  |
|     | 85  | 83.740  | 10.831 | 42.289 | 2.722  | 57.116  | 28.742 | 84.437  |
|     | 90  | 88.506  | 12.125 | 44.750 | 3.050  | 60.536  | 30.487 | 89.333  |
|     | 95  | 93.245  | 13.492 | 47.207 | 3.397  | 63.963  | 32.239 | 94.125  |
|     | 100 | 97.954  | 14.929 | 49.658 | 3.760  | 67.403  | 34.004 | 99.085  |
|     | 110 | 107.282 | 18.009 | 54.544 | 4.544  | 74.315  | 37.564 | 108.781 |
|     | 120 | 116.478 | 21.359 | 59.410 | 5.396  | 81.284  | 41.170 | 118.421 |
|     | 130 | 125.533 | 24.974 | 64.248 | 6.320  | 88.309  | 44.831 | 127.993 |
|     | 140 | 134.434 | 28.850 | 69.066 | 7.317  | 95.394  | 48.546 | 137.497 |
|     | 150 | 143.175 | 32.975 | 73.853 | 8.383  | 102.549 | 52.325 | 146.924 |
|     | 160 | 151.742 | 37.344 | 78.609 | 9.516  | 109.778 | 56.175 | 156.272 |



| R   | L   | X       | Y      | K      | P     | LT      | ST     | LC      |
|-----|-----|---------|--------|--------|-------|---------|--------|---------|
| 120 | 80  | 79.115  | 8.819  | 39.853 | 2.213 | 53.647  | 26.952 | 79.605  |
|     | 85  | 83.939  | 9.945  | 42.323 | 2.498 | 57.043  | 28.677 | 84.527  |
|     | 90  | 88.743  | 11.138 | 44.789 | 2.799 | 60.449  | 30.408 | 89.438  |
|     | 95  | 93.524  | 12.396 | 47.252 | 3.117 | 63.860  | 32.145 | 94.340  |
|     | 100 | 98.280  | 13.714 | 49.712 | 3.452 | 67.286  | 33.896 | 99.234  |
|     | 110 | 107.712 | 16.556 | 54.618 | 4.171 | 74.157  | 37.417 | 108.976 |
|     | 120 | 117.034 | 19.646 | 59.503 | 4.958 | 81.070  | 40.980 | 118.670 |
|     | 130 | 126.237 | 22.985 | 64.369 | 5.807 | 88.037  | 44.582 | 128.313 |
|     | 140 | 135.310 | 26.568 | 69.212 | 6.722 | 95.054  | 48.236 | 137.894 |
|     | 150 | 144.243 | 30.387 | 74.033 | 7.702 | 102.129 | 51.935 | 147.410 |
|     | 160 | 153.033 | 34.443 | 78.829 | 8.749 | 109.261 | 55.700 | 156.861 |
| 130 | 60  | 59.681  | 4.598  | 29.947 | 1.152 | 40.112  | 20.102 | 59.858  |
|     | 70  | 69.493  | 6.249  | 34.915 | 1.566 | 46.846  | 23.496 | 63.774  |
|     | 80  | 79.244  | 8.150  | 39.874 | 2.044 | 53.599  | 26.910 | 79.663  |
|     | 90  | 88.925  | 10.298 | 44.822 | 2.585 | 60.381  | 30.345 | 89.520  |
|     | 100 | 98.531  | 12.686 | 49.754 | 3.188 | 67.191  | 33.810 | 99.344  |
|     | 110 | 108.047 | 15.315 | 54.674 | 3.854 | 74.033  | 37.303 | 109.127 |
|     | 120 | 117.469 | 18.184 | 59.578 | 4.581 | 80.912  | 40.830 | 118.867 |
|     | 130 | 126.788 | 21.283 | 64.461 | 5.371 | 87.827  | 44.394 | 128.560 |
|     | 140 | 135.996 | 24.611 | 69.329 | 6.214 | 94.789  | 47.992 | 138.201 |
|     | 150 | 145.084 | 28.168 | 74.175 | 7.126 | 101.801 | 51.642 | 147.793 |
|     | 160 | 154.045 | 31.943 | 79.000 | 8.094 | 108.864 | 55.334 | 157.322 |
| 140 | 50  | 49.840  | 2.969  | 24.973 | 0.743 | 33.389  | 16.717 | 49.929  |
|     | 60  | 59.724  | 4.272  | 29.954 | 1.070 | 40.096  | 20.088 | 59.877  |
|     | 70  | 69.563  | 5.808  | 34.928 | 1.455 | 46.820  | 23.474 | 69.806  |
|     | 80  | 79.348  | 7.574  | 39.890 | 1.900 | 53.564  | 26.876 | 79.710  |
|     | 90  | 89.073  | 9.572  | 44.846 | 2.402 | 60.329  | 30.298 | 89.588  |
|     | 100 | 98.730  | 11.796 | 49.789 | 2.963 | 67.117  | 33.745 | 99.435  |
|     | 110 | 108.315 | 14.246 | 54.717 | 3.582 | 73.935  | 37.213 | 109.247 |
|     | 120 | 117.816 | 16.918 | 59.635 | 4.259 | 80.784  | 40.713 | 119.179 |
|     | 130 | 127.226 | 19.813 | 64.538 | 4.993 | 87.667  | 44.244 | 128.758 |
|     | 140 | 136.541 | 22.920 | 69.419 | 5.784 | 94.583  | 47.809 | 138.449 |
|     | 150 | 145.752 | 26.240 | 74.289 | 6.625 | 101.544 | 51.406 | 148.093 |
|     | 160 | 154.853 | 29.770 | 79.140 | 7.528 | 108.548 | 55.048 | 157.693 |
|     | 170 | 163.838 | 33.512 | 83.964 | 8.486 | 115.601 | 58.735 | 167.234 |

| R   | L   | X       | Y      | K      | P     | LT      | ST     | LC      |
|-----|-----|---------|--------|--------|-------|---------|--------|---------|
| 150 | 50  | 49.860  | 2.772  | 24.976 | 0.693 | 33.381  | 16.711 | 49.939  |
|     | 60  | 59.759  | 3.989  | 29.960 | 0.998 | 40.084  | 20.077 | 59.894  |
|     | 70  | 69.619  | 5.423  | 34.937 | 1.358 | 46.801  | 23.455 | 69.831  |
|     | 80  | 79.432  | 7.074  | 39.905 | 1.773 | 53.534  | 26.849 | 79.747  |
|     | 90  | 89.193  | 8.942  | 44.865 | 2.243 | 60.285  | 30.260 | 89.640  |
|     | 100 | 98.893  | 11.023 | 49.817 | 2.767 | 67.058  | 33.690 | 99.507  |
|     | 110 | 108.530 | 13.316 | 54.754 | 3.345 | 73.857  | 37.143 | 109.344 |
|     | 120 | 118.097 | 15.819 | 59.680 | 3.978 | 80.680  | 40.617 | 119.149 |
|     | 130 | 127.592 | 18.526 | 64.596 | 4.665 | 87.535  | 44.122 | 128.918 |
|     | 140 | 136.983 | 21.444 | 69.497 | 5.404 | 94.422  | 47.657 | 138.649 |
|     | 150 | 146.294 | 24.557 | 74.378 | 6.197 | 101.339 | 51.225 | 148.338 |
|     | 160 | 155.508 | 27.870 | 79.248 | 7.036 | 108.299 | 54.820 | 157.984 |
|     | 170 | 164.621 | 31.380 | 84.100 | 7.934 | 115.299 | 58.458 | 167.588 |
|     | 180 | 173.625 | 35.086 | 88.929 | 8.883 | 122.344 | 62.137 | 177.138 |
| 160 | 50  | 49.877  | 2.598  | 24.981 | 0.650 | 33.376  | 16.706 | 49.945  |
|     | 60  | 59.788  | 3.740  | 29.964 | 0.936 | 40.075  | 20.066 | 59.905  |
|     | 70  | 69.664  | 5.087  | 34.944 | 1.274 | 46.783  | 23.440 | 69.850  |
|     | 80  | 79.500  | 6.637  | 39.917 | 1.663 | 53.509  | 26.827 | 79.779  |
|     | 90  | 89.290  | 8.390  | 44.881 | 2.103 | 60.251  | 30.228 | 89.684  |
|     | 100 | 99.026  | 10.344 | 49.838 | 2.596 | 67.010  | 33.648 | 99.566  |
|     | 110 | 108.705 | 12.500 | 54.785 | 3.138 | 73.792  | 37.083 | 109.422 |
|     | 120 | 118.325 | 14.850 | 59.718 | 3.732 | 80.598  | 40.543 | 119.250 |
|     | 130 | 127.871 | 17.396 | 64.644 | 4.376 | 87.429  | 44.027 | 129.050 |
|     | 140 | 137.344 | 20.139 | 69.556 | 5.070 | 94.287  | 47.535 | 138.813 |
|     | 150 | 146.740 | 23.075 | 74.457 | 5.816 | 101.177 | 51.071 | 148.539 |
|     | 160 | 156.081 | 26.200 | 79.348 | 6.613 | 108.109 | 54.680 | 158.274 |
| 170 | 50  | 49.891  | 2.446  | 24.982 | 0.612 | 33.371  | 16.701 | 49.952  |
|     | 60  | 59.813  | 3.521  | 29.969 | 0.881 | 40.066  | 20.059 | 59.917  |
|     | 70  | 69.702  | 4.789  | 34.950 | 1.199 | 46.770  | 23.429 | 69.869  |
|     | 80  | 79.557  | 6.250  | 39.927 | 1.565 | 53.489  | 26.807 | 79.803  |
|     | 90  | 89.371  | 7.901  | 44.895 | 1.980 | 60.222  | 30.202 | 89.720  |
|     | 100 | 99.136  | 9.742  | 49.855 | 2.443 | 66.972  | 33.608 | 99.618  |
|     | 110 | 108.852 | 11.775 | 54.809 | 2.955 | 73.741  | 37.036 | 109.490 |
|     | 120 | 118.513 | 13.992 | 59.752 | 3.514 | 80.528  | 40.481 | 118.337 |
|     | 130 | 128.116 | 16.396 | 64.682 | 4.121 | 87.341  | 43.945 | 129.155 |
|     | 140 | 137.646 | 18.981 | 69.606 | 4.776 | 94.178  | 47.435 | 138.950 |



| R   | L   | X       | Y      | K      | P     | LT     | ST     | LC      |
|-----|-----|---------|--------|--------|-------|--------|--------|---------|
| 180 | 60  | 59.832  | 3.326  | 29.971 | 0.832 | 40.058 | 20.053 | 59.926  |
|     | 70  | 69.735  | 4.525  | 34.956 | 1.133 | 46.759 | 23.418 | 69.882  |
|     | 80  | 79.604  | 5.905  | 39.935 | 1.478 | 53.470 | 26.793 | 79.823  |
|     | 90  | 89.438  | 7.467  | 44.907 | 1.871 | 60.198 | 30.180 | 89.751  |
|     | 100 | 99.229  | 9.206  | 49.870 | 2.308 | 66.941 | 33.580 | 99.657  |
|     | 110 | 108.975 | 11.129 | 54.829 | 2.792 | 73.694 | 36.997 | 109.543 |
|     | 120 | 118.672 | 13.228 | 59.780 | 3.320 | 80.470 | 40.428 | 119.408 |
|     | 130 | 128.312 | 15.501 | 64.721 | 3.894 | 87.264 | 43.880 | 129.249 |
|     | 140 | 137.898 | 17.953 | 69.648 | 4.513 | 94.083 | 47.349 | 139.061 |
| 190 | 60  | 59.850  | 3.152  | 29.975 | 0.789 | 40.052 | 20.048 | 59.934  |
|     | 70  | 69.761  | 4.287  | 34.960 | 1.073 | 46.751 | 23.408 | 69.894  |
|     | 80  | 79.646  | 5.596  | 39.941 | 1.401 | 53.458 | 26.780 | 79.842  |
|     | 90  | 89.495  | 7.077  | 44.917 | 1.772 | 60.178 | 30.160 | 89.776  |
|     | 100 | 99.309  | 8.728  | 49.885 | 2.188 | 66.910 | 33.555 | 99.692  |
|     | 110 | 109.080 | 10.550 | 54.846 | 2.645 | 73.658 | 36.961 | 109.592 |
|     | 120 | 118.808 | 12.542 | 59.801 | 3.147 | 80.422 | 40.384 | 119.469 |
| 200 | 60  | 59.864  | 2.994  | 29.978 | 0.749 | 40.047 | 20.044 | 59.939  |
|     | 70  | 69.786  | 4.074  | 34.964 | 1.020 | 46.742 | 23.402 | 69.905  |
|     | 80  | 79.679  | 5.318  | 39.946 | 1.331 | 53.445 | 26.769 | 79.858  |
|     | 90  | 89.543  | 6.726  | 44.925 | 1.684 | 60.158 | 30.145 | 89.796  |
|     | 100 | 99.375  | 8.296  | 49.896 | 2.079 | 66.886 | 33.534 | 99.724  |
|     | 110 | 109.169 | 10.027 | 54.860 | 2.514 | 73.628 | 36.933 | 109.630 |
|     | 120 | 118.923 | 11.923 | 59.820 | 2.990 | 80.380 | 40.347 | 119.520 |
| 210 | 60  | 59.877  | 2.853  | 29.980 | 0.714 | 40.043 | 20.039 | 59.945  |
|     | 70  | 69.804  | 3.880  | 34.967 | 0.971 | 46.734 | 23.395 | 69.914  |
|     | 80  | 79.708  | 5.065  | 39.951 | 1.268 | 53.436 | 26.757 | 79.870  |
|     | 90  | 89.586  | 6.407  | 44.931 | 1.604 | 60.144 | 30.132 | 89.816  |
|     | 100 | 99.432  | 7.905  | 49.907 | 1.980 | 66.867 | 33.513 | 99.748  |
|     | 110 | 109.248 | 9.556  | 54.874 | 2.395 | 73.599 | 36.908 | 109.665 |
|     | 120 | 119.022 | 11.361 | 59.836 | 2.849 | 80.345 | 40.313 | 119.566 |



| R   | L   | X       | Y      | K      | P     | LT     | ST     | LC      |
|-----|-----|---------|--------|--------|-------|--------|--------|---------|
| 220 | 60  | 59.887  | 2.725  | 29.982 | 0.681 | 40.040 | 20.034 | 59.951  |
|     | 70  | 69.823  | 3.705  | 34.970 | 0.927 | 46.729 | 23.390 | 69.921  |
|     | 80  | 79.735  | 4.836  | 39.955 | 1.210 | 53.427 | 26.750 | 79.882  |
|     | 90  | 89.622  | 6.117  | 44.937 | 1.531 | 60.132 | 30.121 | 89.833  |
|     | 100 | 99.485  | 7.548  | 49.914 | 1.890 | 66.848 | 33.498 | 99.771  |
|     | 110 | 109.313 | 9.126  | 54.886 | 2.287 | 73.575 | 36.887 | 109.696 |
|     | 120 | 119.108 | 10.849 | 59.850 | 2.720 | 80.316 | 40.286 | 119.603 |
| 230 | 60  | 59.897  | 2.606  | 29.983 | 0.651 | 40.036 | 20.032 | 59.955  |
|     | 70  | 69.836  | 3.543  | 37.974 | 0.886 | 46.723 | 23.386 | 69.927  |
|     | 80  | 79.757  | 4.626  | 39.958 | 1.157 | 53.412 | 26.743 | 79.894  |
|     | 90  | 89.655  | 5.853  | 44.942 | 1.465 | 60.121 | 30.110 | 89.847  |
|     | 100 | 99.527  | 7.222  | 49.922 | 1.808 | 66.831 | 33.484 | 99.789  |
|     | 110 | 109.500 | 8.733  | 54.896 | 2.187 | 73.555 | 36.866 | 109.721 |
|     | 120 | 119.183 | 10.387 | 59.867 | 2.602 | 80.286 | 40.263 | 119.641 |
| 240 | 60  | 59.906  | 2.497  | 29.984 | 0.625 | 40.033 | 20.030 | 59.958  |
|     | 70  | 69.850  | 3.397  | 34.976 | 0.850 | 46.719 | 23.381 | 69.933  |
|     | 80  | 79.776  | 4.435  | 39.961 | 1.109 | 53.411 | 26.737 | 79.901  |
|     | 90  | 89.682  | 5.610  | 44.946 | 1.404 | 60.112 | 30.099 | 89.858  |
|     | 100 | 99.565  | 6.922  | 49.927 | 1.733 | 66.818 | 33.473 | 99.808  |
|     | 110 | 109.423 | 8.371  | 54.904 | 2.097 | 73.536 | 36.851 | 109.743 |
|     | 120 | 119.251 | 9.956  | 59.876 | 2.494 | 80.263 | 40.240 | 119.668 |
| 250 | 60  | 59.912  | 2.398  | 29.986 | 0.599 | 40.029 | 20.027 | 59.961  |
|     | 70  | 69.863  | 3.262  | 34.977 | 0.816 | 46.715 | 23.377 | 69.939  |
|     | 80  | 79.795  | 4.259  | 39.966 | 1.066 | 53.405 | 26.732 | 79.909  |
|     | 90  | 89.708  | 5.387  | 44.951 | 1.348 | 60.103 | 30.092 | 89.870  |
|     | 100 | 99.599  | 6.647  | 49.933 | 1.664 | 66.807 | 33.462 | 99.823  |
|     | 110 | 109.467 | 8.039  | 54.912 | 2.013 | 73.519 | 36.836 | 109.762 |
|     | 120 | 119.308 | 9.561  | 59.886 | 2.395 | 80.244 | 40.219 | 119.693 |
| 260 | 60  | 59.919  | 2.306  | 29.987 | 0.576 | 40.027 | 20.025 | 59.964  |
|     | 70  | 69.872  | 3.138  | 34.980 | 0.784 | 46.712 | 23.373 | 69.945  |
|     | 80  | 79.809  | 4.094  | 39.970 | 1.024 | 53.400 | 26.728 | 79.915  |
|     | 90  | 89.729  | 5.179  | 44.953 | 1.296 | 60.093 | 30.086 | 89.882  |
|     | 100 | 99.631  | 6.393  | 49.938 | 1.600 | 66.796 | 33.451 | 99.836  |
|     | 110 | 109.508 | 7.732  | 54.918 | 1.936 | 73.506 | 36.824 | 109.781 |
|     | 120 | 119.361 | 9.196  | 59.894 | 2.303 | 80.225 | 40.204 | 119.716 |

| R   | L   | X       | Y     | K      | P     | LT     | ST     | LC      |
|-----|-----|---------|-------|--------|-------|--------|--------|---------|
| 280 | 60  | 59.931  | 2.141 | 29.989 | 0.535 | 40.024 | 20.022 | 59.969  |
|     | 70  | 69.890  | 2.914 | 34.982 | 0.729 | 46.705 | 23.368 | 69.952  |
|     | 80  | 79.836  | 3.803 | 39.973 | 0.951 | 53.391 | 26.719 | 79.927  |
|     | 90  | 89.767  | 4.812 | 44.961 | 1.204 | 60.081 | 30.074 | 89.897  |
|     | 100 | 99.681  | 5.938 | 49.947 | 1.486 | 66.779 | 33.434 | 99.858  |
|     | 110 | 109.575 | 7.182 | 54.929 | 1.798 | 73.482 | 36.803 | 109.812 |
|     | 120 | 119.449 | 8.543 | 59.908 | 2.139 | 80.193 | 40.176 | 119.754 |
| 300 | 60  | 59.939  | 1.999 | 29.990 | 0.499 | 40.021 | 20.020 | 59.974  |
|     | 70  | 69.903  | 2.720 | 34.984 | 0.680 | 46.699 | 23.363 | 69.957  |
|     | 80  | 79.856  | 3.552 | 39.977 | 0.888 | 53.384 | 26.711 | 79.938  |
|     | 90  | 89.796  | 4.491 | 44.968 | 1.123 | 60.071 | 30.065 | 89.909  |
|     | 100 | 99.720  | 5.544 | 49.951 | 1.386 | 66.764 | 33.421 | 99.876  |
|     | 110 | 109.629 | 6.705 | 54.938 | 1.678 | 73.464 | 36.783 | 109.835 |
|     | 120 | 119.519 | 7.977 | 59.920 | 1.997 | 80.168 | 40.154 | 119.787 |