Numerical Formulas and Tables

KOHARA GEAR INDUSTRY CO., LTD.

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NUMERICAL EXPRESSION, UNIT AND OTHER DATA

1 Mathematical formulas

① Trigonometric functions   sin, cos, tan

$$\cos\theta = \frac{x}{r}\ ,\ \ \sin\theta = \frac{y}{r}\ ,\ \ \tan\theta = \frac{y}{x}$$

$$\sin^2\theta + \cos^2\theta = 1,\ \tan\theta = \frac{\sin\theta}{\cos\theta}$$

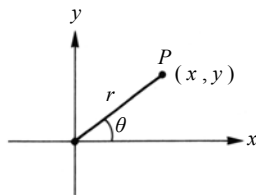$$\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \cos\alpha\sin\beta$$
$$\cos(\alpha \pm \beta) = \cos\alpha\cos\beta \pm \sin\alpha\sin\beta$$

② The relationship between rectangular coordinates (x, y) and polar coordinates (r, θ)

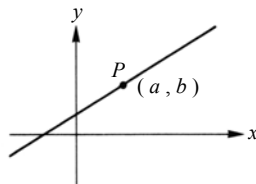$$x = r\cos\theta,\ \ y = r\sin\theta,$$

$$\tan\theta = \frac{y}{x}$$
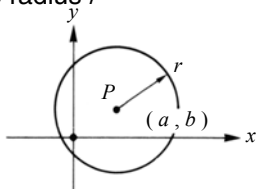
$$r^2 = x^2 + y^2$$

③ The equation for the straight line which passes the point (a, b), with an inclination m

$$(y - b) = m(x - a)$$

④ The equation for the circle, the center of which is the point (a, b), with the radius r

$$(x - a)^2 + (y - b)^2 = r^2$$

⑤ The root of the quadratic equation
$y = ax^2 + bx + c = 0$ (a 0)

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
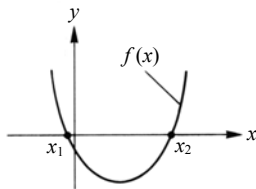
⑥ Function $y = f(x)$ and derivative $y' = f'(x)$
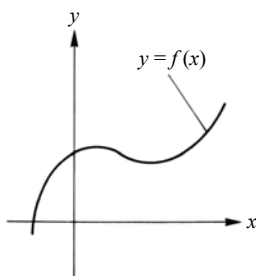
Function $y = f(x)$ and derivative $y' = f'(x)$

$y = f(x)$	$y' = f'(x)$	$y = f(x)$	$y' = f'(x)$
$\cos x$	$-\sin x$	$\dfrac{1}{\cos x}$	$\dfrac{\tan x}{\cos x}$
$\sin x$	$\cos x$	$\dfrac{1}{\sin x}$	$-\dfrac{1}{\sin x \tan x}$
$\tan x$	$\dfrac{1}{\cos^2 x}$	$\dfrac{1}{\tan x}$	$-\dfrac{1}{\sin^2 x}$
$\tan x - x$ NOTE 1.	$\tan^2 x$	$\sin^2 x$	$2\sin x \cos x$
		$\sin^3 x$	$3\sin^2 x \cos x$

NOTE 1. Involute function

An example of the application of the derivative:Newton's law

Introduced here is the method to obtain an approximate value of x_0 when the value of $f(x_0)$ is given in the involute function

$$f(x) = \tan x - x$$
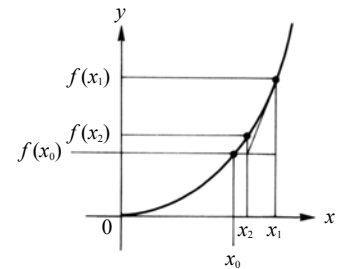
First, with an initial value x_1 optionally chosen, obtain an approximate value x_2 from:

$$x_2 = x_1 - \frac{f(x_1) - f(x_0)}{\tan^2 x_1}$$

where $f'(x_1) = \tan^2 x_1$

Then, when the difference between the approximate value $f(x_2)$ and the given $f(x_0)$ is large, obtain an approximate value x_3 using the same method.

$$x_3 = x_2 - \frac{f(x_2) - f(x_0)}{\tan^2 x_2}$$

The more accurate value of x_0 can be obtained by the repeated calculation using this method.

 The involute function, inv α, is frequently used in the calculation of gearing. Therefore, the Newton's law is really useful.

2 International System of Units (SI)

SI Base unit

Definition of SI base unit

Physical quantum	Base unit	
	Standard International unit	Definition
Length	meter	The length equal to the length of the path traveled by light in vacuum during a time interval of 1/299,792,458 of a second.
Mass	kilogram	The mass equal to the mass of the international prototype kilogram stored at Sèvres, France.
Time	second	The fundamental unit of time equal to 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of an atom of cesium-133.
Current	ampere	One coulomb of electrical charge (6.24 x 1018 charge carriers) moving past a specific point in one second.
Temperature	kelvin	A unit of absolute temperature equal to 1/273.16 of the absolute temperature of the triple point of water.
Amount of substance	mole	An mount of substance of a system which contains as many elementary units as there are atoms of carbon in 0.012 kilogram of the pure nuclide carbon-12.
Luminous intensity	candela	The magnitude of an electromagnetic field, in a specified direction, that has a power level of 1/683 watt (1.46 x 10-3 W) per steradian at a frequency of 540 terahertz (540 THz or 5.40 x 1014 Hz).

SI supplementary unit

Quantum	SI supplementary unit		
	Name	Symbol	Definition
Angle	radian	rad	The angle subtended at the center of a circle by an arc of circumference equal in length to the radius of the circle.
Solid angle	steradian	sr	The solid angle subtended at the center of a sphere of radius r by a portion of the surface of the sphere having an area r^2.

SI derived unit

Quantum	SI derived unit	
	Name	Symbol
Area	square metre	m^2
Volume	cubic metre	m^3
Speed	metre per second	m/s
Acceleration	metre per second squared	m/s^2
Wavenumber	reciprocal metre	m^{-1}
Mass density	kilogram per cubic metre	kg/m^3
Electric current density	ampere per square metre	A/m^2
Magnetic field strength	ampere per metre	A/m
Amount concentration	mole per cubic metre	mol/m^3
Specific volume	cubic metre per kilogram	m^3/kg
Luminance	candela per square metre	cd/m^2

Prefix

Prefix (Symbol)	Factor	Prefix (Symbol)	Factor
yotta (Y)	10^{24}	desi (d)	10^{-1}
zetta (Z)	10^{21}	centi (c)	10^{-2}
exa (E)	10^{18}	milli (m)	10^{-3}
peta (P)	10^{15}	micro (n)	10^{-6}
tera (T)	10^{12}	nano (n)	10^{-9}
giga (G)	10^{9}	pico (p)	10^{-12}
mega (M)	10^{6}	femto (f)	10^{-15}
kilo (k)	10^{3}	atto (a)	10^{-18}
hecto (h)	10^{2}	zepto (z)	10^{-21}
deca (da)	10^{1}	yocto (y)	10^{-24}

Conversion factors for SI (International System of Units)

Name	Equivalents
Force	$1N = 1.01972 \times 10^{-1} kgf$ $1kgf = 9.80665N$
Stress	$1MPa$ or $N/mm^2 = 1.01972 \times 10^{-1} kgf/mm^2$ $1kgf/mm^2 = 9.80665MPa$ or N/mm^2
Work Energy	$1J = 2.77778 \times 10^{-7} kW \cdot h = 1.01972 \times 10^{-1} kgf \cdot m$ $1kgf \cdot m = 9.80665J$, $1kW \cdot h = 3.600 \times 10^{6} J$
Work Power	$1kW = 1.01972 \times 10^{2} kgf \cdot m/s$ $1kgf \cdot m/s = 9.80665 \times 10^{-3} kW$

Newton: The unit of force in the meter-kilogram-second system, equal to the force which will impart an acceleration of 1 meter per second squared to the International Prototype kilogram mass.

Kilogram force: A unit of force equal to the weight of a 1-kilogram mass at a point on the earth's surface where the acceleration of gravity is $9.80665 \ m/s^2$.

3 Formulas of Dynamics

Force, torque and dynamics

Denomination	Symbol and/or formula	SI	Conversion factors
		Gravitational system of units	
Force	F	N (newton)	1 kgf = 9.80665 N
		kgf	
Moment of force (Torque)	T = F r	N ·m	1 kgf · m = 9.80665 N · m
		kgf ·m	
Power (Dynamics)	P = Fv Linear motion	W	When power is P (kW), force is F (kgf), velocity is v (m/s), $P = Fv$ (kgf $\cdot$ m /s) = 9.80665 Fv (W) = $\dfrac{Fv}{102}$ (kW)
		kgf·m/s	
	P = Tω Rotational motion	W	When power is P (kW), torque is T (kgf · m), rotational speed is n (rpm), $P = T\omega$ (kgf · m/s) = 9.80665 T $\cdot \dfrac{\pi n}{30}$ (W) = $\dfrac{Tn}{974}$ (kW)
		kgf · m/s	

NOTE 1. Unit of dynamics $1W = 1 \times 10^3 \, kW = 1J/S = 1N \cdot m/s$
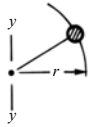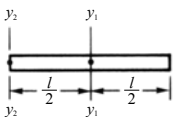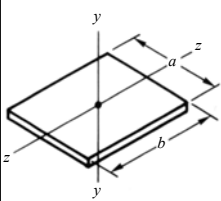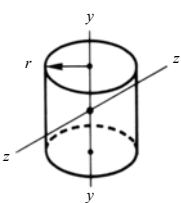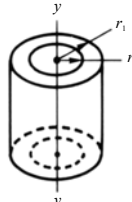
Comparison between linear and rotational motion

Denomination	Linear motion		Rotational motion	
	Symbol and/or formula	Unit	Symbol and/or formula	Unit
Displacement and angular displacement	S	m	θ	rad NOTE 1
Velocity and angular velocity	$v = \dfrac{dS}{dt}$ NOTE 2	m/s	$\omega = \dfrac{d\theta}{dt} = 2\pi n$ NOTE 3	rad/s or 1/s
Acceleration and angular acceleration	$\alpha = \dfrac{dv}{dt}$	m/s^2	$\dot{\omega} = \dfrac{d\omega}{dt}$	rad/s^2 or 1/s^2
Equation of motion	F = mα NOTE 4	N NOTE 5	T = I$\dot{\omega}$ NOTE 6	kg · m^2/s^2 or N ·m
Work	E = Fs	J	E = Tθ	J
Kinetic energy	$E = \dfrac{1}{2} mv^2$ NOTE 7	J	$E = \dfrac{1}{2} I\omega^2$	J
Power(dynamics)	P = Fv	W	P = Tω	W

NOTES 1. Radian (rad), the unit of plane angle θ, is dimesionless.
2. The unit of time(t) is second (s).
3. The unit of rotational speed (n) is 1/s (rps: revolution per second)
4. The unit of mass(m) is kg.

5. 1N (newton) = 1kg · m/s^2
1N (newton) is the force which will impart an acceleration of 1 meter per second (1m/s^2) squared to the International Prototype Kilogram mass (1kg).
6. The unit of "moment of inertia I = mk^2" is kg · m^2.
7. The unit of work and kinetic energy is the same.
1J = 1N · m

Moment of inertia mk^2 (kg ·m²) or $\dfrac{W}{g} k^2$ (kgf ·ms²)

Denomination	Shape	Rotation axis	Moment of inertia·Unit	
			SI kg ·m²	Gravitational system of units kgf ·ms²
Mass point		$y - y$	mr^2	$\dfrac{W}{g} r^2$
Pole		$y_1 - y_1$	$m\dfrac{l^2}{12}$	$\dfrac{W}{g}\dfrac{l^2}{12}$
		$y_2 - y_2$	$m\dfrac{l^2}{3}$	$\dfrac{W}{g}\dfrac{l^2}{3}$
Plate		$y - y$	$m\dfrac{a^2+b^2}{12}$	$\dfrac{W}{g}\dfrac{a^2+b^2}{12}$
		$z - z$	$m\dfrac{a^2}{12}$	$\dfrac{W}{g}\dfrac{a^2}{12}$
Cylinder		$y - y$	$m\dfrac{r^2}{2}$	$\dfrac{W}{g}\dfrac{r^2}{2}$
		$z - z$	$m\dfrac{r^2}{4}$	$\dfrac{W}{g}\dfrac{r^2}{4}$
Hollow cylinder		$y - y$	$m\dfrac{r_1^2+r_2^2}{2}$	$\dfrac{W}{g}\dfrac{r_1^2+r_2^2}{2}$

NOTE 1. m : Mass W : Weight g : Acceleration of gravity = 9.80665m/s²
NOTE 2. GD² = 4gI (kgf · m²)

4 Table for Weight of Steel Bar

Section	Dimension (mm)	Weight of steel bar for 1m (kgf/m)
Round	◯ d ↕	0.00616d²
Square	◻ s ↕	0.00785s²
Hexagon	⬡ h ↕	0.00680h²

Material	Specific gravity (gf/cm³)
Steel	7.85
Cast iron	7.21
Brass	8.10
Bronze	8.56

Weight of round steel bar (kgf/m)

Dia.	0	1	2	3	4	5	6	7	8	9
00	0	0.01	0.02	0.06	0.10	0.15	0.22	0.30	0.39	0.50
10	0.62	0.75	0.89	1.04	1.21	1.39	1.58	1.78	2.00	2.22
20	2.46	2.72	2.98	3.26	3.55	3.85	4.16	4.49	4.83	5.18
30	5.54	5.92	6.31	6.71	7.12	7.55	7.98	8.43	8.90	9.37
40	9.86	10.36	10.87	11.39	11.93	12.47	13.03	13.61	14.19	14.79
50	15.40	16.02	16.66	17.30	17.96	18.63	19.32	20.01	20.72	21.44
60	22.18	22.92	23.68	24.45	25.23	26.03	26.83	27.65	28.48	29.33
70	30.18	31.05	31.93	32.83	33.73	34.65	35.58	36.52	37.48	38.44
80	39.42	40.42	41.42	42.44	43.47	44.51	45.56	46.63	47.70	48.79
90	49.90	51.01	52.14	53.28	54.43	55.59	56.77	57.96	59.16	60.37
100	61.60	62.84	64.09	65.35	66.63	67.91	69.21	70.53	71.85	73.19
110	74.54	75.90	77.27	78.66	80.06	81.47	82.89	84.32	85.77	87.23
120	88.70	90.19	91.69	93.19	94.72	96.25	97.80	99.35	100.93	102.51
130	104.10	105.71	107.33	108.96	110.61	112.27	113.94	115.62	117.31	119.02
140	120.74	122.47	124.21	125.97	127.73	129.51	131.31	133.11	134.93	136.76
150	138.60	140.45	142.32	144.20	146.09	147.99	149.91	151.84	153.78	155.73
160	157.70	159.67	161.66	163.67	165.68	167.71	169.75	171.80	173.86	175.94
170	178.02	180.13	182.24	184.36	186.50	188.65	190.81	192.99	195.17	197.37
180	199.58	201.81	204.04	206.29	208.55	210.83	213.11	215.41	217.72	220.04
190	222.38	224.72	227.08	229.45	231.84	234.23	236.64	239.06	241.50	243.94
200	246.40	248.87	251.35	253.85	256.36	258.87	261.41	263.95	266.51	269.08
210	271.66	274.25	276.86	279.47	282.10	284.75	287.40	290.07	292.75	295.44
220	298.14	300.86	303.59	306.33	309.08	311.85	314.63	317.42	320.22	323.04
230	325.86	328.70	331.56	334.42	337.30	340.19	343.09	346.00	348.93	351.87
240	354.82	357.78	360.75	363.74	366.74	369.75	372.78	375.82	378.87	381.93
250	385.00	388.09	391.19	394.30	397.42	400.55	403.70	406.86	410.03	413.22
260	416.42	419.63	422.85	426.08	429.33	432.59	435.86	439.14	442.44	445.74
270	449.06	452.40	455.74	459.10	462.47	465.85	469.24	472.65	476.07	479.50
280	482.94	486.40	489.87	493.35	496.84	500.35	503.86	507.39	510.94	514.49
290	518.06	521.64	525.23	528.83	532.45	536.07	539.72	543.37	547.03	550.71
300	554.40	558.10	561.82	565.54	569.28	573.03	576.80	580.57	584.36	588.16
310	591.98	595.80	599.64	603.49	607.35	611.23	615.11	619.01	622.92	626.85
320	630.78	634.73	638.69	642.67	646.65	650.65	654.66	658.68	662.72	666.76
330	670.82	674.90	678.98	683.08	687.19	691.31	695.44	699.59	703.74	707.91
340	712.10	716.29	720.50	724.72	728.95	733.19	737.45	741.72	746.00	750.29
350	754.60	758.92	763.25	767.59	771.95	776.31	780.69	785.09	789.49	793.91
360	798.34	802.78	807.23	811.70	816.18	820.67	825.17	829.68	834.21	828.75
370	843.30	847.87	852.45	857.04	861.64	866.25	870.88	875.52	880.17	884.83
380	889.50	894.19	898.89	903.60	908.33	913.07	917.82	922.58	927.35	932.14
390	936.94	941.75	946.57	951.41	956.25	961.11	965.99	970.87	975.77	980.68
400	985.60	990.53	995.48	1000.44	1005.41	1010.39	1015.39	1020.40	1025.42	1030.45
410	1035.50	1040.55	1045.62	1050.71	1055.80	1060.91	1066.02	1071.16	1076.30	1081.46
420	1086.62	1091.80	1097.00	1102.20	1107.42	1112.65	1117.89	1123.15	1128.41	1133.69
430	1138.98	1144.29	1149.60	1154.93	1160.27	1165.63	1170.99	1176.37	1181.76	1187.16
440	1192.58	1198.00	1203.44	1208.89	1214.36	1219.83	1225.32	1230.82	1236.34	1241.86
450	1247.40	1252.95	1258.51	1264.09	1269.67	1275.27	1280.89	1286.51	1292.15	1297.79
460	1303.46	1309.13	1314.82	1320.51	1326.22	1331.95	1337.68	1343.43	1349.19	1354.96
470	1360.74	1366.54	1372.35	1378.17	1384.00	1389.85	1395.71	1401.58	1407.46	1413.36
480	1419.26	1425.18	1431.12	1437.06	1443.02	1448.99	1454.97	1460.96	1466.97	1472.99
490	1479.02	1485.06	1491.11	1497.18	1503.26	1509.35	1515.46	1521.58	1527.70	1533.85
500	1540.00	1546.17	1552.34	1558.54	1564.74	1570.95	1577.18	1583.42	1589.67	1595.94

EXAMPLE: Weight of round steel bar, diameter(128mm) and length(1m), is 100.93kgf.
NOTE: Unit of diameter is millimeter (mm)

5　List of Elements by Symbol and Specific Gravity

Name	Symbol	Specific gravity (20℃) g/cm³	Name	Symbol	Specific gravity (20℃)g/cm³	Name	Symbol	Specific gravity (20℃)g/cm³
Zinc	Zn	7.133(25°)	Bromine	Br	3.12	Sodium	Na	0.9712
Aluminium	Al	2.699	Zirconium	Zr	6.489	Lead	Pb	11.36
Antimony	Sb	6.62	Mercury	Hg	13.546	Niobium	Nb	8.57
Sulfur	S	2.07	Hydrogen	H	0.0899×10^{-3}	Nickel	Ni	8.902(25°)
Ytterbium	Yb	6.96	Tin	Sn	7.2984	Platinum	Pt	21.45
Yttrium	Y	4.47	Strontium	Sr	2.60	Vanadium	V	6.1
Iridium	Ir	22.5	Caesium	Cs	1.903(0°)	Palladium	Pd	12.02
Indium	In	7.31	Cerium	Ce	6.77	Barium	Ba	3.5
Uranium	U	19.07	Selenium	Se	4.79	Arsenic	As	5.72
Chlorine	Cl	3.214×10^{-3}	Bismuth	Bi	9.80	Fluorine	F	1.696×10^{-3}
Cadmium	Cd	8.65	Thallium	Tl	11.85	Plutonium	Pu	19.00〜19.72
Potassium	K	0.86	Tungsten	W	19.3	Beryllium	Be	1.848
Calcium	Ca	1.55	Carbon	C	2.25	Boron	B	2.34
Gold	Au	19.32	Tantalum	Ta	16.6	Magnesium	Mg	1.74
Silver	Ag	10.49	Titanium	Ti	4.507	Manganese	Mn	7.43
Chlorine	Cr	7.19	Nitrogen	N	1.250×10^{-3}	Molybdenum	Mo	10.22
Silicon	Si	2.33(25°)	Iron	Fe	7.87	Iodine	I	4.94
Germanium	Ge	5.323(25°)	Tellurium	Te	6.24	Radium	Ra	5.0
Cobalt	Co	8.85	Copper	Cu	8.96	Lithium	Li	0.534
Oxygen	O	1.429×10^{-3}	Thorium	Th	11.66	Phosphorus	P	1.83

TABLE OF NUMBERS

1 Hardness Comparison Table

Approximate conversion values against Rockwell C hardness of steel materials

HRC	HV	HB			HRA	HRB	HRD	HS	Tensile Strength kgf/mm² (N/mm²) Aprox. value NOTE 1.	HRC	Approx. hardness of principal materials
Rockwell C hardness	Vickers hardness	Brinell hardness 10mm Ball·Load 3000kgf			Rockwell hardness NOTE 2.			Shore hardness		Rockwell C Hardness NOTE 2.	
		Standard ball	Hultgren ball	tungsten-carbide ball	A Scale Load 60kgf brale indenter	B Scale Load 100kgf Dia. 1/16in Ball	D Scale Load 100kgf brale indenter				
68	940	—	—	—	85.6	—	76.9	97	—	68	
67	900	—	—	—	85.0	—	76.1	95	—	67	
66	865	—	—	—	84.5	—	75.4	92	—	66	
65	832	—	—	739	83.9	—	74.5	91	—	65	
64	800	—	—	722	83.4	—	73.8	88	—	64	
63	772	—	—	705	82.8	—	73.0	87	—	63	S45C soft nitriding
62	746	—	—	688	82.3	—	72.2	85	—	62	
61	720	—	—	670	81.8	—	71.5	83	—	61	
60	697	—	613	654	81.2	—	70.7	81	—	60	
59	674	—	599	634	80.7	—	69.9	80	—	59	SCM415 case hardening
58	653	—	587	615	80.1	—	69.2	78	—	58	
57	633	—	575	595	79.6	—	68.5	76	—	57	
56	613	—	561	577	79.0	—	67.7	75	—	56	SCM440 induction hardening
55	595	—	546	560	78.5	—	66.9	74	212 {2079}	55	
54	577	—	534	543	78.0	—	66.1	72	205 {2010}	54	
53	560	—	519	525	77.4	—	65.4	71	199 {1952}	53	
52	544	500	508	512	76.8	—	64.6	69	192 {1883}	52	
51	528	487	494	496	76.3	—	63.8	68	186 {1824}	51	S45C induction hardening
50	513	475	481	481	75.9	—	63.1	67	179 {1755}	50	
49	498	464	469	469	75.2	—	62.1	66	172 {1687}	49	
48	484	451	455	455	74.7	—	61.4	64	167 {1638}	48	
47	471	442	443	443	74.1	—	60.8	63	161 {1579}	47	
46	458	432	432	432	73.6	—	60.0	62	156 {1530}	46	
45	446	421	421	421	73.1	—	59.2	60	151 {1481}	45	
44	434	409	409	409	72.5	—	58.5	58	146 {1432}	44	
43	423	400	400	400	72.0	—	57.7	57	141 {1383}	43	
42	412	390	390	390	71.5	—	56.9	56	136 {1334}	42	
41	402	381	381	381	70.9	—	56.2	55	132 {1294}	41	
40	392	371	371	371	70.4	—	55.4	54	127 {1245}	40	
39	382	362	362	362	69.9	—	54.6	52	124 {1216}	39	
38	372	353	353	353	69.4	—	53.8	51	120 {1177}	38	
37	363	344	344	344	68.9	—	53.1	50	118 {1157}	37	
36	354	336	336	336	68.4	(109.0)	52.3	49	114 {1118}	36	
35	345	327	327	327	67.9	(108.5)	51.5	48	110 {1079}	35	
34	336	319	319	319	67.4	(108.0)	50.8	47	108 {1059}	34	SCM415 core hardness
33	327	311	311	311	66.8	(107.5)	50.0	46	105 {1030}	33	
32	318	301	301	301	66.3	(107.0)	49.2	44	102 {1000}	32	
31	310	294	294	294	65.8	(106.0)	48.4	43	100 { 981}	31	
30	302	286	286	286	65.3	(105.5)	47.7	42	97 { 951}	30	
29	294	279	279	279	64.7	(104.5)	47.0	41	95 { 932}	29	
28	286	271	271	271	64.3	(104.0)	46.1	41	93 { 912}	28	
27	279	264	264	264	63.8	(103.0)	45.2	40	90 { 883}	27	S45C thermal refining
26	272	258	258	258	63.3	(102.5)	44.6	38	88 { 863}	26	
25	266	253	253	253	62.8	(101.5)	43.8	38	86 { 843}	25	
24	260	247	247	247	62.4	(101.0)	43.1	37	84 { 824}	24	
23	254	243	243	243	62.0	100.0	42.1	36	82 { 804}	23	SCM440 core hardness
22	248	237	237	237	61.5	99.0	41.6	35	80 { 785}	22	
21	243	231	231	231	61.0	98.5	40.9	35	79 { 775}	21	
20	238	226	226	226	60.5	97.8	40.1	34	77 { 755}	20	
(18)	230	219	219	219	—	96.7	—	33	75 { 736}	(18)	
(16)	222	212	212	212	—	95.5	—	32	72 { 706}	(16)	
(14)	213	203	203	203	—	93.9	—	31	69 { 677}	(14)	
(12)	204	194	194	194	—	92.3	—	29	66 { 647}	(12)	S45C core hardness
(10)	196	187	187	187	—	90.7	—	28	63 { 618}	(10)	
(8)	188	179	179	179	—	89.5	—	27	61 { 598}	(8)	
(6)	180	171	171	171	—	87.1	—	26	59 { 579}	(6)	SUS303
(4)	173	165	165	165	—	85.5	—	25	56 { 549}	(4)	
(2)	166	158	158	158	—	83.5	—	24	54 { 530}	(2)	
(0)	160	152	152	152	—	81.7	—	24	53 { 520}	(0)	

REMARK: The boldfaced figures are based on ASTM E 140 Table 3 (SAE-ASM-ASTM)

NOTE 1: Approximate values were determined from "Conversion Tables" of JIS Z 8413 and Z 8438.
The units and values in parentheses{ } are based on International System of Units (SI). These are shown for reference. Note that 1N/mm² = 1MPa.

NOTE 2: The parenthesized values in the table are not used so frequently.

2 Comparative Table of Gear Pitch

Dimetral pitch	Pitch in	Pitch mm	Module m
1.	3.1416	79.796	25.4000
1.0053	3 1/8	79.375	25.2656
1.0160	3.0922	78.542	**25.**
1.0472	3.	76.200	24.2550
1.0583	2.9685	75.400	24.
1.0639	2.9528	75.	23.8733
1.0928	2 7/8	73.025	23.2444
1.1400	2.7559	70.	22.2817
1.1424	2 3/4	69.850	22.2339
1.1545	2.7211	69.116	22.
1.1968	2 5/8	66.675	21.2231
1.2276	2.5591	65.	20.6902
1.25	2.5133	63.837	20.3200
1.2566	2 1/2	63.500	20.2127
1.2700	2.4738	62.835	**20.**
1.3228	2 3/8	60.325	19.2019
1.3299	2.3622	60.	19.0986
1.3963	2 1/4	57.150	18.1914
1.4111	2.2264	56.551	18.
1.4508	2.1654	55.	17.5071
1.4784	2 1/8	53.975	17.1806
1.5	2.0944	53.198	16.9333
1.5708	2.	50.800	16.1701
1.5875	1.9790	50.267	**16.**
1.5959	1.9685	50.	15.9155
1.6755	1 7/8	47.625	15.1595
1.6933	1.8553	47.125	15.
1.75	1.7952	45.598	14.5143
1.7732	1.7717	45.	14.3240
1.7952	1 3/4	44.450	14.1489
1.8143	1.7316	43.983	14.
1.9333	1 5/8	41.275	13.1382
1.9538	1.6079	40.841	13.
1.9949	1.5748	40.	12.7324
2.	1.5708	39.898	12.7000
2.0944	1 1/2	38.100	12.1276
2.0999	1.4961	38.	12.0958
2.1167	1.4843	37.701	**12.**
2.1855	1 7/16	36.513	11.6223
2.2166	1.4173	36.	11.4592
2.25	1.3963	35.465	11.2889
2.2848	1 3/8	34.925	11.1170
2.3091	1.3606	34.559	11.
2.3470	1.3386	34.	10.8225
2.3936	1 5/16	33.338	10.6117
2.4937	1.2598	32.	10.1859
2.5	1.2566	31.919	10.1600
2.5133	1 1/4	31.750	10.1063
2.5400	1.2369	31.417	**10.**
2.6456	1 3/16	30.163	9.6010
2.6599	1.1811	30.	9.5493
2.75	1.1424	29.017	9.2364
2.7925	1 1/8	28.575	9.0957
2.8222	1.1132	28.275	9.
2.8499	1.1024	28.	8.9127

Diametral pitch	Pitch in	Pitch mm	Module m
2.9568	1 1/16	26.988	8.5904
3.	1.0472	26.599	8.4667
3.0691	1.0236	26.	8.2761
3.1416	1.	25.400	8.0851
3.1750	.9895	25.133	**8.**
3.1918	.9843	25.	7.9577
3.25	.9666	24.552	7.8153
3.3249	.9449	24.	7.6394
3.3510	15/16	23.813	7.5798
3.5	.8976	22.799	7.2571
3.5904	7/8	22.225	7.0744
3.6271	.8661	22.	7.0023
3.6286	.8658	21.991	7.
3.75	.8378	21.280	6.7733
3.8666	13/16	20.638	6.5691
3.9898	.7874	**20.**	6.3662
4.	.7854	19.949	6.3500
4.1888	3/4	19.050	6.0638
4.1998	.7480	19.	6.0479
4.2333	.7421	18.849	**6.**
4.4332	.7087	18.	5.7296
4.5	.6981	17.733	5.6444
4.5696	11/16	17.463	5.5585
4.6182	.6803	17.280	5.5
4.6939	.6695	17.	5.4113
4.9873	.6299	16.	5.0930
5.	.6283	15.959	5.0800
5.0265	5/8	15.875	5.0532
5.0800	.6184	15.707	5.
5.3198	.5906	**15.**	4.7747
5.5	.5712	14.508	4.6182
5.5851	9/16	14.288	4.5479
5.6444	.5566	14.138	4.5
5.6998	.5512	14.	4.4563
6.	.5236	13.299	4.2333
6.1382	.5118	13.	4.1380
6.2832	1/2	12.700	4.0425
6.35	.4948	12.568	**4.**
6.5	.4833	12.276	3.9077
6.6497	.4724	12.	3.8197
7.	.4488	11.399	3.6286
7.1808	7/16	11.113	3.5372
7.2542	.4331	11.	3.5014
7.2571	.4329	10.996	3.5
7.9797	.3937	**10.**	3.1831
8.	.3927	9.975	3.1750
8.3776	3/8	9.525	3.0319
8.3997	.3740	9.5	3.0240
8.4667	.3711	9.426	**3.**
8.8663	.3543	9.	2.8648
9.	.3491	8.866	2.8222
9.2363	.3401	8.639	2.75
9.3878	.3347	8.5	2.7056
9.9746	.3150	8.	2.5465
10.	.3142	7.980	2.5400

Diametral pitch	Pitch in	Pitch mm	Module m
10.0531	5/16	7.938	2.5266
10.16	.3092	7.854	**2.5**
10.6395	.2953	7.5	2.3873
11.	.2856	7.254	2.3091
11.2889	.2783	7.069	2.25
11.3995	.2756	7.	2.2282
12.	.2618	6.650	2.1167
12.2764	.2559	6.5	2.0690
12.5664	1/4	6.350	2.0213
12.7000	.2474	6.283	**2.**
13.	.2417	6.138	1.9538
13.2993	.2362	6.	1.9099
14.	.2244	5.700	1.8143
14.5083	.2165	5.5	1.7507
14.5143	.2164	5.499	1.75
15.	.2094	5.320	1.6933
15.9593	.1969	**5.**	1.5915
16.	.1963	4.987	1.5875
16.7552	3/16	4.763	1.5160
16.9333	.1855	4.712	**1.5**
17.7326	.1772	4.5	1.4324
18.	.1745	4.433	1.4111
19.9492	.1575	4.	1.2732
20.	.1571	3.990	1.2700
20.32	.1546	3.927	**1.25**
22.	.1428	3.627	1.1545
22.7991	.1378	3.5	1.1141
23.	.1366	3.470	1.1043
24.	.1309	3.325	1.0583
25.	.1257	3.193	1.0160
25.1327	1/8	3.175	1.0106
25.4	.1237	3.142	**1.**
26.	.1208	3.069	.9769
26.5989	.1181	3.	.9549
28.	.1122	2.850	.9071
29.	.1083	2.751	.8759
30.	.1047	2.660	.8467
31.4159	1/10	2.540	.8035
31.9187	.0984	2.5	.7958
32.	.0982	2.494	.7938
33.8663	.0928	2.357	.75
34.	.0924	2.347	.7471
36.	.0873	2.217	.7056
38.	.0827	2.100	.6684
39.8683	.0787	2.	.6366
40.	.0785	1.995	.6350
45.	.0698	1.773	.5644
50.	.0628	1.596	.5080
50.2955	1/16	1.588	.5053
50.8	.0618	1.570	**.5**
53.1977	.0576	1.5	.4775
63.5000	.0498	1.256	**.4**
79.8019	.0394	1.	.3183
84.6667	.0371	.942	**.3**
127.0000	.0247	.628	**.2**

3 **Span Measurement Over *k* Teeth of Standard Spur Gear** $W\ (\ x = 0\ )$ $m = 1\ (\ \alpha = 20°\ )$

z	k	W	z	k	W	z	k	W	z	k	W
			61	7	20.0432	121	14	41.5484	181	21	63.0537
			62	7	20.0572	122	14	41.5624	182	21	63.0677
			63	8	23.0233	123	14	41.5765	183	21	63.0817
			64	8	23.0373	124	14	41.5905	184	21	63.0957
5	2	4.4982	65	8	23.0513	125	14	41.6045	185	21	63.1097
6	2	4.5122	66	8	23.0653	126	15	44.5706	186	21	63.1237
7	2	4.5262	67	8	23.0794	127	15	44.5846	187	21	63.1377
8	2	4.5402	68	8	23.0934	128	15	44.5986	188	21	63.1517
9	2	4.5543	69	8	23.1074	129	15	44.6126	189	22	66.1179
10	2	4.5683	70	8	23.1214	130	15	44.6266	190	22	66.1319
11	2	4.5823	71	8	23.1354	131	15	44.6406	191	22	66.1459
12	2	4.5963	72	9	26.1015	132	15	44.6546	192	22	66.1599
13	2	4.6103	73	9	26.1155	133	15	44.6686	193	22	66.1739
14	2	4.6243	74	9	26.1295	134	15	44.6826	194	22	66.1879
15	2	4.6383	75	9	26.1435	135	16	47.6488	195	22	66.2019
16	2	4.6523	76	9	26.1575	136	16	47.6628	196	22	66.2159
17	2	4.6663	77	9	26.1715	137	16	47.6768	197	22	66.2299
18	3	7.6324	78	9	26.1856	138	16	47.6908	198	23	69.1961
19	3	7.6464	79	9	26.1996	139	16	47.7048	199	23	69.2101
20	3	7.6604	80	9	26.2136	140	16	47.7188	200	23	69.2241
21	3	7.6744	81	10	29.1797	141	16	47.7328	201	23	69.2381
22	3	7.6885	82	10	29.1937	142	16	47.7468	202	23	69.2521
23	3	7.7025	83	10	29.2077	143	16	47.7608	203	23	69.2661
24	3	7.7165	84	10	29.2217	144	17	50.7270	204	23	69.2801
25	3	7.7305	85	10	29.2357	145	17	50.7410	205	23	69.2941
26	3	7.7445	86	10	29.2497	146	17	50.7550	206	23	69.3081
27	4	10.7106	87	10	29.2637	147	17	50.7690	207	24	72.2742
28	4	10.7246	88	10	29.2777	148	17	50.7830	208	24	72.2882
29	4	10.7386	89	10	29.2917	149	17	50.7970	209	24	72.3022
30	4	10.7526	90	11	32.2579	150	17	50.8110	210	24	72.3163
31	4	10.7666	91	11	32.2719	151	17	50.8250	211	24	72.3303
32	4	10.7806	92	11	32.2859	152	17	50.8390	212	24	72.3443
33	4	10.7946	93	11	32.2999	153	18	53.8051	213	24	72.3583
34	4	10.8086	94	11	32.3139	154	18	53.8192	214	24	72.3723
35	4	10.8227	95	11	32.3279	155	18	53.8332	215	24	72.3863
36	5	13.7888	96	11	32.3419	156	18	53.8472	216	25	75.3524
37	5	13.8028	97	11	32.3559	157	18	53.8612	217	25	75.3664
38	5	13.8168	98	11	32.3699	158	18	53.8752	218	25	75.3804
39	5	13.8308	99	12	35.3361	159	18	53.8892	219	25	75.3944
40	5	13.8448	100	12	35.3501	160	18	53.9032	220	25	75.4084
41	5	13.8588	101	12	35.3641	161	18	53.9172	221	25	75.4224
42	5	13.8728	102	12	35.3781	162	19	56.8833	222	25	75.4364
43	5	13.8868	103	12	35.3921	163	19	56.8973	223	25	75.4505
44	5	13.9008	104	12	35.4061	164	19	56.9113	224	25	75.4645
45	6	16.8670	105	12	35.4201	165	19	56.9253	225	26	78.4306
46	6	16.8810	106	12	35.4341	166	19	56.9394	226	26	78.4446
47	6	16.8950	107	12	35.4481	167	19	56.9534	227	26	78.4586
48	6	16.9090	108	13	38.4142	168	19	56.9674	228	26	78.4726
49	6	16.9230	109	13	38.4282	169	19	56.9814	229	26	78.4866
50	6	16.9370	110	13	38.4423	170	19	56.9954	230	26	78.5006
51	6	16.9510	111	13	38.4563	171	20	59.9615	231	26	78.5146
52	6	16.9650	112	13	38.4703	172	20	59.9755	232	26	78.5286
53	6	16.9790	113	13	38.4843	173	20	59.9895	233	26	78.5426
54	7	19.9452	114	13	38.4983	174	20	60.0035	234	27	81.5088
55	7	19.9592	115	13	38.5123	175	20	60.0175	235	27	81.5228
56	7	19.9732	116	13	38.5263	176	20	60.0315	236	27	81.5368
57	7	19.9872	117	14	41.4924	177	20	60.0455	237	27	81.5508
58	7	20.0012	118	14	41.5064	178	20	60.0596	238	27	81.5648
59	7	20.0152	119	14	41.5204	179	20	60.0736	239	27	81.5788
60	7	20.0292	120	14	41.5344	180	21	63.0397	240	27	81.5928

$$m = 1 \quad (\alpha = 20°)$$

z	k	W	z	k	W	z	k	W	z	k	W
241	27	81.6068	301	34	103.1120	361	41	124.6170	421	47	143.1700
242	27	81.6208	302	34	103.1260	362	41	124.6310	422	47	143.1840
243	28	84.5870	303	34	103.1400	363	41	124.6450	423	48	146.1510
244	28	84.6010	304	34	103.1540	364	41	124.6590	424	48	146.1650
245	28	84.6150	305	34	103.1680	365	41	124.6730	425	48	146.1790
246	28	84.6290	306	35	106.1340	366	41	124.6870	426	48	146.1930
247	28	84.6430	307	35	106.1480	367	41	124.7010	427	48	146.2070
248	28	84.6570	308	35	106.1620	368	41	124.7150	428	48	146.2210
249	28	84.6710	309	35	106.1760	369	42	127.6810	429	48	146.2350
250	28	84.6850	310	35	106.1900	370	42	127.6960	430	48	146.2490
251	28	84.6990	311	35	106.2040	371	42	127.7100	431	48	146.2630
252	29	87.6651	312	35	106.2180	372	42	127.7240	432	49	149.2290
253	29	87.6791	313	35	106.2320	373	42	127.7380	433	49	149.2430
254	29	87.6932	314	35	106.2460	374	42	127.7520	434	49	149.2570
255	29	87.7072	315	36	109.2120	375	42	127.7660	435	49	149.2710
256	29	87.7212	316	36	109.2260	376	42	127.7800	436	49	149.2850
257	29	87.7352	317	36	109.2400	377	42	127.7940	437	49	149.2990
258	29	87.7492	318	36	109.2540	378	43	130.7600	438	49	149.3130
259	29	87.7632	319	36	109.2680	379	43	130.7740	439	49	149.3270
260	29	87.7772	320	36	109.2820	380	43	130.7880	440	49	149.3410
261	30	90.7433	321	36	109.2960	381	43	130.8020	441	50	152.3070
262	30	90.7573	322	36	109.3100	382	43	130.8160	442	50	152.3210
263	30	90.7713	323	36	109.3240	383	43	130.8300	443	50	152.3350
264	30	90.7853	324	37	112.2910	384	43	130.8440	444	50	152.3490
265	30	90.7993	325	37	112.3050	385	43	130.8580	445	50	152.3630
266	30	90.8133	326	37	112.3190	386	43	130.8720	446	50	152.3770
267	30	90.8274	327	37	112.3330	387	44	133.8380	447	50	152.3910
268	30	90.8414	328	37	112.3470	388	44	133.8520	448	50	152.4050
269	30	90.8554	329	37	112.3610	389	44	133.8660	449	50	152.4190
270	31	93.8215	330	37	112.3750	390	44	133.8800	450	51	155.3850
271	31	93.8355	331	37	112.3890	391	44	133.8940	451	51	155.3990
272	31	93.8495	332	37	112.4030	392	44	133.9080	452	51	155.4130
273	31	93.8635	333	38	115.3690	393	44	133.9220	453	51	155.4270
274	31	93.8775	334	38	115.3830	394	44	133.9360	454	51	155.4410
275	31	93.8915	335	38	115.3970	395	44	133.9500	455	51	155.4550
276	31	93.9055	336	38	115.4110	396	45	136.9160	456	51	155.4690
277	31	93.9195	337	38	115.4250	397	45	136.9300	457	51	155.4830
278	31	93.9335	338	38	115.4390	398	45	136.9440	458	51	155.4970
279	32	96.8997	339	38	115.4530	399	45	136.9580	459	52	158.4630
280	32	96.9137	340	38	115.4670	400	45	136.9720	460	52	158.4770
281	32	96.9277	341	38	115.4810	401	45	136.9860	461	52	158.4910
282	32	96.9417	342	39	118.4470	402	45	137.0000	462	52	158.5050
283	32	96.9557	343	39	118.4610	403	45	137.0140	463	52	158.5190
284	32	96.9697	344	39	118.4750	404	45	137.0280	464	52	158.5330
285	32	96.9837	345	39	118.4890	405	46	139.9940	465	52	158.5470
286	32	96.9977	346	39	118.5030	406	46	140.0080	466	52	158.5610
287	32	97.0117	347	39	118.5170	407	46	140.0220	467	52	158.5750
288	33	99.9779	348	39	118.5310	408	46	140.0360	468	53	161.5420
289	33	99.9919	349	39	118.5450	409	46	140.0500	469	53	161.5560
290	33	100.0060	350	39	118.5590	410	46	140.0640	470	53	161.5700
291	33	100.0200	351	40	121.5250	411	46	140.0780	471	53	161.5840
292	33	100.0340	352	40	121.5390	412	46	140.0920	472	53	161.5980
293	33	100.0480	353	40	121.5530	413	46	140.1060	473	53	161.6120
294	33	100.0620	354	40	121.5670	414	47	143.0720	474	53	161.6260
295	33	100.0760	355	40	121.5810	415	47	143.0860	475	53	161.6400
296	33	100.0900	356	40	121.5950	416	47	143.1000	476	53	161.6540
297	34	103.0560	357	40	121.6090	417	47	143.1140	477	54	164.6200
298	34	103.0700	358	40	121.6230	418	47	143.1280	478	54	164.6340
299	34	103.0840	359	40	121.6370	419	47	143.1420	479	54	164.6480
300	34	103.0980	360	41	124.6030	420	47	143.1560	480	54	164.6620

4 Span Measurement Over *k* Teeth of Standard Spur Gear $W(x=0)$ $m=1$ ($\alpha=14.5°$)

z	k	W	z	k	W	z	k	W	z	k	W
			61	5	14.0143	121	10	29.5440	181	15	45.0738
			62	5	14.0197	122	10	29.5494	182	15	45.0791
			63	6	17.0666	123	10	29.5548	183	15	45.0845
			64	6	17.0720	124	10	29.5602	184	15	45.0899
			65	6	17.0773	125	11	32.6070	185	15	45.0952
			66	6	17.0827	126	11	32.6124	186	15	45.1006
7	2	4.5999	67	6	17.0881	127	11	32.6178	187	16	48.1475
8	2	4.6052	68	6	17.0934	128	11	32.6232	188	16	48.1529
9	2	4.6106	69	6	17.0988	129	11	32.6285	189	16	48.1582
10	2	4.6160	70	6	17.1042	130	11	32.6339	190	16	48.1636
11	2	4.6213	71	6	17.1095	131	11	32.6393	191	16	48.1690
12	2	4.6267	72	6	17.1149	132	11	32.6446	192	16	48.1743
13	2	4.6321	73	6	17.1203	133	11	32.6500	193	16	48.1797
14	2	4.6374	74	6	17.1256	134	11	32.6554	194	16	48.1851
15	2	4.6428	75	7	20.1725	135	11	32.6607	195	16	48.1905
16	2	4.6482	76	7	20.1779	136	11	32.6661	196	16	48.1958
17	2	4.6536	77	7	20.1833	137	12	35.7130	197	16	48.2012
18	2	4.6589	78	7	20.1886	138	12	35.7184	198	16	48.2066
19	2	4.6643	79	7	20.1940	139	12	35.7237	199	17	51.2534
20	2	4.6697	80	7	20.1994	140	12	35.7291	200	17	51.2588
21	2	4.6750	81	7	20.2047	141	12	35.7345	201	17	51.2642
22	2	4.6804	82	7	20.2101	142	12	35.7398	202	17	51.2696
23	2	4.6858	83	7	20.2155	143	12	35.7452	203	17	51.2749
24	2	4.6911	84	7	20.2208	144	12	35.7506	204	17	51.2803
25	3	7.7380	85	7	20.2262	145	12	35.7559	205	17	51.2857
26	3	7.7434	86	7	20.2316	146	12	35.7613	206	17	51.2910
27	3	7.7488	87	8	23.2785	147	12	35.7667	207	17	51.2964
28	3	7.7541	88	8	23.2838	148	12	35.7720	208	17	51.3018
29	3	7.7595	89	8	23.2892	149	13	38.8189	209	17	51.3071
30	3	7.7649	90	8	23.2946	150	13	38.8243	210	17	51.3125
31	3	7.7702	91	8	23.3000	151	13	38.8297	211	17	51.3179
32	3	7.7756	92	8	23.3053	152	13	38.8350	212	18	54.3648
33	3	7.7810	93	8	23.3107	153	13	38.8404	213	18	54.3701
34	3	7.7863	94	8	23.3161	154	13	38.8458	214	18	54.3755
35	3	7.7917	95	8	23.3214	155	13	38.8511	215	18	54.3809
36	3	7.7971	96	8	23.3268	156	13	38.8565	216	18	54.3862
37	3	7.8024	97	8	23.3322	157	13	38.8619	217	18	54.3916
38	4	10.8493	98	8	23.3375	158	13	38.8672	218	18	54.3970
39	4	10.8547	99	8	23.3429	159	13	38.8726	219	18	54.4023
40	4	10.8601	100	9	26.3898	160	13	38.8780	220	18	54.4077
41	4	10.8654	101	9	26.3952	161	13	38.8834	221	18	54.4131
42	4	10.8708	102	9	26.4005	162	14	41.9302	222	18	54.4184
43	4	10.8762	103	9	26.4059	163	14	14.9356	223	18	54.4238
44	4	10.8815	104	9	26.4113	164	14	41.9410	224	19	57.4707
45	4	10.8869	105	9	26.4166	165	14	41.9464	225	19	57.4761
46	4	10.8923	106	9	26.4220	166	14	41.9517	226	19	57.4814
47	4	10.8976	107	9	26.4274	167	14	41.9571	227	19	57.4868
48	4	10.9030	108	9	26.4327	168	14	41.9625	228	19	57.4922
49	4	10.9084	109	9	26.4381	169	14	41.9678	229	19	57.4975
50	5	13.9553	110	9	26.4435	170	14	41.9732	230	19	57.5029
51	5	13.9606	111	9	26.4488	171	14	41.9786	231	19	57.5083
52	5	13.9660	112	10	29.4957	172	14	41.9839	232	19	57.5137
53	5	13.9714	113	10	29.5011	173	14	41.9893	233	19	57.5190
54	5	13.9767	114	10	29.5065	174	15	45.0362	234	19	57.5244
55	5	13.9821	115	10	29.5118	175	15	45.0416	235	19	57.5298
56	5	13.9875	116	10	29.5172	176	15	45.0469	236	20	60.5766
57	5	13.9929	117	10	29.5226	177	15	45.0523	237	20	60.5820
58	5	13.9982	118	10	29.5279	178	15	45.0577	238	20	60.5874
59	5	14.0036	119	10	29.5333	179	15	45.0630	239	20	60.5928
60	5	14.0090	120	10	29.5387	180	15	45.0684	240	20	60.5981

$m = 1$ ($\alpha = 14.5°$)

z	k	W	z	k	W	z	k	W	z	k	W
241	20	60.6035	301	25	76.1332	361	30	91.6629	421	34	104.1510
242	20	60.6089	302	25	76.1386	362	30	91.6683	422	34	104.1560
243	20	60.6142	303	25	76.1440	363	30	91.6737	423	35	107.2030
244	20	60.6196	304	25	76.1493	364	30	91.6790	424	35	107.2090
245	20	60.6250	305	25	76.1547	365	30	91.6844	425	35	107.2140
246	20	60.6303	306	25	76.1601	366	30	91.6898	426	35	107.2190
247	20	60.6357	307	25	76.1654	367	30	91.6951	427	35	107.2250
248	20	60.6411	308	25	76.1708	368	30	91.7005	428	35	107.2300
249	21	63.6880	309	25	76.1762	369	30	91.7059	429	35	107.2360
250	21	63.6933	310	25	76.1815	370	30	91.7113	430	35	107.2410
251	21	63.6987	311	26	79.2284	371	30	91.7166	431	35	107.2460
252	21	63.7041	312	26	79.2338	372	30	91.7220	432	35	107.2520
253	21	63.7094	313	26	79.2392	373	31	94.7689	433	35	107.2570
254	21	63.7148	314	26	79.2445	374	31	94.7742	434	35	107.2620
255	21	63.7202	315	26	79.2499	375	31	94.7796	435	36	110.3090
256	21	63.7255	316	26	79.2553	376	31	94.7850	436	36	110.3150
257	21	63.7309	317	26	79.2606	377	31	94.7904	437	36	110.3200
258	21	63.7363	338	26	79.2660	378	31	94.7957	438	36	110.3250
259	21	63.7416	319	26	79.2714	379	31	94.8011	439	36	110.3310
260	21	63.7470	320	26	79.2767	380	31	94.8065	440	36	110.3360
261	22	66.7939	321	26	79.2821	381	31	94.8118	441	36	110.3420
262	22	66.7993	322	26	79.2875	382	31	94.8172	442	36	110.3470
263	22	66.8046	323	27	82.3344	383	31	94.8226	443	36	110.3520
264	22	66.8100	324	27	82.3397	384	31	94.8279	444	36	110.3580
265	22	66.8154	325	27	82.3451	385	32	97.8748	445	36	110.3630
266	22	66.8207	326	27	82.3505	386	32	97.8802	446	36	110.3680
267	22	66.8261	327	27	82.3558	387	32	97.8856	447	37	113.4150
268	22	66.8315	328	27	82.3612	388	32	97.8909	448	37	113.4210
269	22	66.8369	329	27	82.3666	389	32	97.8963	449	37	113.4260
270	22	66.8422	330	27	82.3719	390	32	97.9017	450	37	113.4310
271	22	66.8476	331	27	82.3773	391	32	97.9070	451	37	113.4370
272	22	66.8530	332	27	82.3827	392	32	97.9124	452	37	113.4420
273	22	66.8583	333	27	82.3880	393	32	97.9178	453	37	113.4470
274	23	69.9052	334	27	82.3934	394	32	97.9231	454	37	113.4530
275	23	69.9106	335	27	82.3988	395	32	97.9285	455	37	113.4580
276	23	69.9160	336	28	85.4457	396	32	97.9339	456	37	113.4640
277	23	69.9213	337	28	85.4510	397	32	97.9392	457	37	113.4690
278	23	69.9267	338	28	85.4564	398	33	100.9860	458	37	113.4740
279	23	69.9321	339	28	85.4618	399	33	100.9920	459	37	113.4800
280	23	69.9374	340	28	85.4671	400	33	100.9970	460	38	116.5270
281	23	69.9428	341	28	85.4725	401	33	101.0020	461	38	116.5320
282	23	69.9482	342	28	85.4779	402	33	101.0080	462	38	116.5370
283	23	69.9535	343	28	85.4833	403	33	101.0130	463	38	116.5430
284	23	69.9589	344	28	85.4886	404	33	101.0180	464	38	116.5480
285	23	69.9643	345	28	85.4940	405	33	101.0240	465	38	116.5530
286	24	73.0112	346	28	85.4994	406	33	101.0290	466	38	116.5590
287	24	73.0165	347	28	85.5047	407	33	101.0340	467	38	116.5640
288	24	73.0219	348	29	88.5516	408	33	101.0400	468	38	116.5700
289	24	73.0273	349	29	88.5570	409	33	101.0450	469	38	116.5750
290	24	73.0326	350	29	88.5624	410	34	104.0920	470	38	116.5800
291	24	73.0380	351	29	88.5677	411	34	104.0970	471	38	116.5860
292	24	73.0434	352	29	88.5731	412	34	104.1030	472	39	119.6330
293	24	73.0487	353	29	88.5785	413	34	104.1080	473	39	119.6380
294	24	73.0541	354	29	88.5838	414	34	104.1140	474	39	119.6430
295	24	73.0595	355	29	88.5892	415	34	104.1190	475	39	119.6490
296	24	73.0649	356	29	88.5946	416	34	104.1240	476	39	119.6540
297	24	73.0702	357	29	88.5999	417	34	104.1300	477	39	119.6590
298	25	76.1171	358	29	88.6053	418	34	104.1350	478	39	119.6650
299	25	76.1225	359	29	88.6107	419	34	104.1400	479	39	119.6700
300	25	76.1278	360	30	91.6576	420	34	104.1460	480	39	119.6750

5 **Charts Indicating Spanned Number of Teeth of Spur and Helical Gears** (Maag's data)
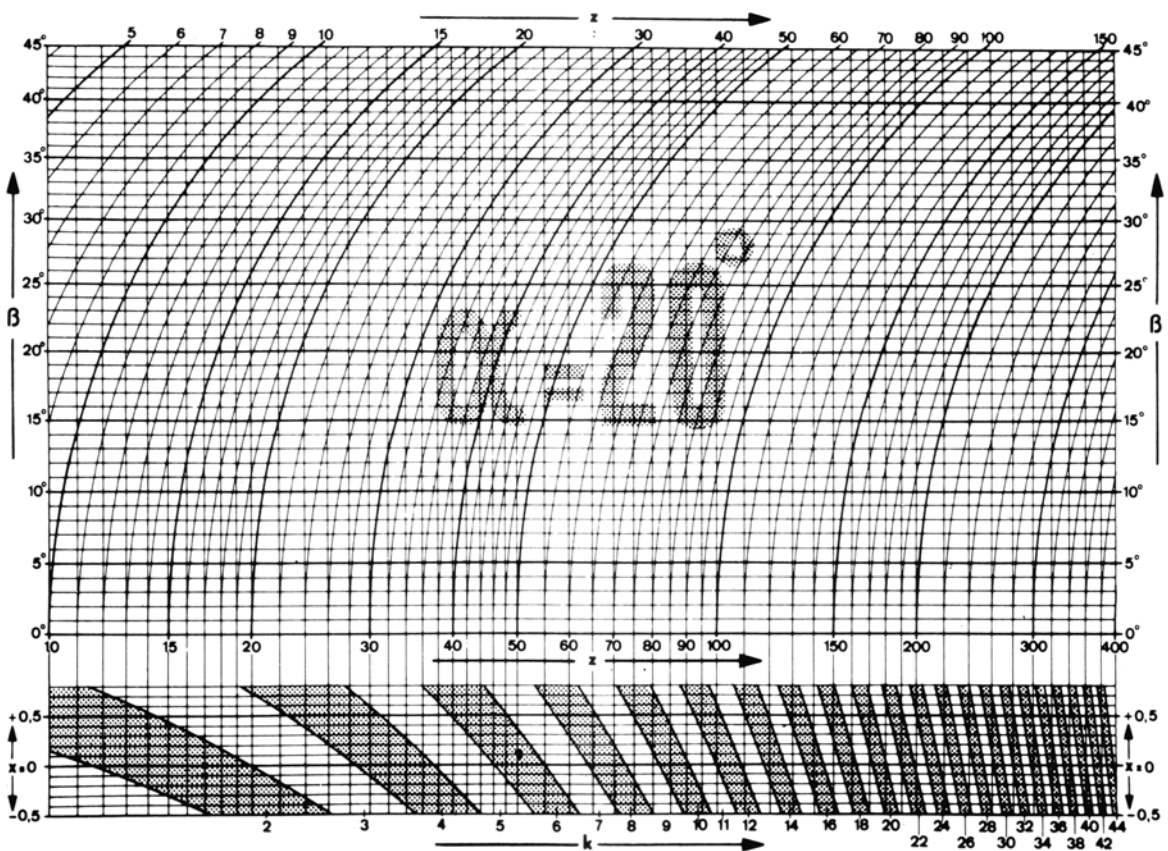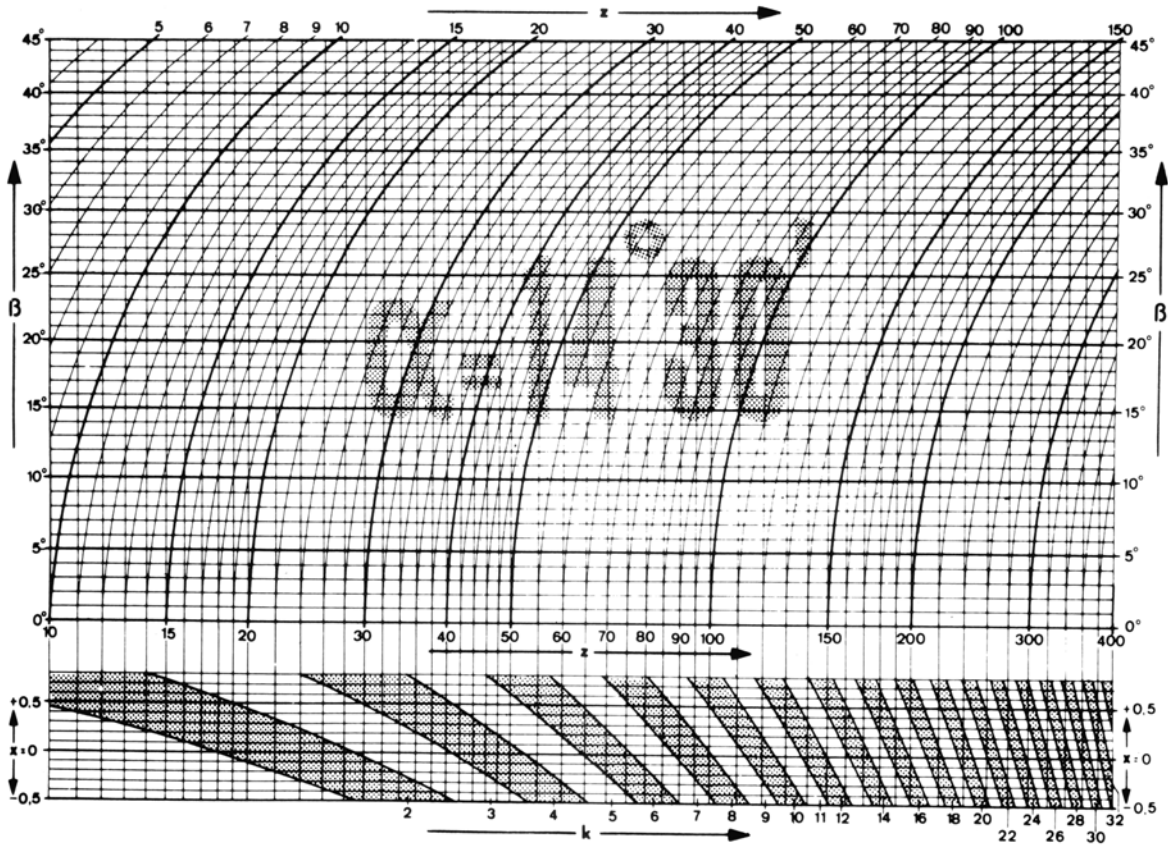
6 Involute Function Table

$\text{inv } \alpha = \tan \alpha - \alpha$

	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°
0	0.00001418	0.00004790	0.0001136	0.0002222	0.0003845	0.0006115	0.0009145	0.001305	0.001794	0.002394
1	0.00001454	0.00004871	0.0001151	0.0002244	0.0003877	0.0006159	0.0009203	0.001312	0.001803	0.002405
2	0.00001491	0.00004952	0.0001165	0.0002267	0.0003909	0.0006203	0.0009260	0.001319	0.001812	0.002416
3	0.00001528	0.00005034	0.0001180	0.0002289	0.0003942	0.0006248	0.0009318	0.001327	0.001821	0.002427
4	0.00001565	0.00005117	0.0001194	0.0002312	0.0003975	0.0006292	0.0009377	0.001334	0.001830	0.002438
5	0.00001603	0.00005201	0.0001209	0.0002335	0.0004008	0.0006337	0.0009435	0.001342	0.001840	0.002449
6	0.00001642	0.00005286	0.0001224	0.0002358	0.0004041	0.0006382	0.0009494	0.001349	0.001849	0.002461
7	0.00001682	0.00005372	0.0001239	0.0002382	0.0004074	0.0006427	0.0009553	0.001357	0.001858	0.002472
8	0.00001722	0.00005458	0.0001254	0.0002405	0.0004108	0.0006473	0.0009612	0.001364	0.001867	0.002483
9	0.00001762	0.00005546	0.0001269	0.0002429	0.0004141	0.0006518	0.0009672	0.001372	0.001877	0.002494
10	0.00001804	0.00005634	0.0001285	0.0002452	0.0004175	0.0006564	0.0009732	0.001379	0.001886	0.002506
11	0.00001846	0.00005724	0.0001300	0.0002476	0.0004209	0.0006610	0.0009792	0.001387	0.001895	0.002517
12	0.00001888	0.00005814	0.0001316	0.0002500	0.0004244	0.0006657	0.0009852	0.001394	0.001905	0.002528
13	0.00001931	0.00005906	0.0001332	0.0002524	0.0004278	0.0006703	0.0009913	0.001402	0.001914	0.002540
14	0.00001975	0.00005998	0.0001347	0.0002549	0.0004313	0.0006750	0.0009973	0.001410	0.001924	0.002551
15	0.00002020	0.00006091	0.0001363	0.0002573	0.0004347	0.0006797	0.0010034	0.001417	0.001933	0.002563
16	0.00002065	0.00006186	0.0001380	0.0002598	0.0004382	0.0006844	0.0010096	0.001425	0.001943	0.002574
17	0.00002111	0.00006281	0.0001396	0.0002622	0.0004417	0.0006892	0.0010157	0.001433	0.001952	0.002586
18	0.00002158	0.00006377	0.0001412	0.0002647	0.0004453	0.0006939	0.0010219	0.001441	0.001962	0.002598
19	0.00002205	0.00006474	0.0001429	0.0002673	0.0004488	0.0006987	0.0010281	0.001448	0.001972	0.002609
20	0.00002253	0.00006573	0.0001445	0.0002698	0.0004524	0.0007035	0.0010343	0.001456	0.001981	0.002621
21	0.00002301	0.00006672	0.0001462	0.0002723	0.0004560	0.0007083	0.0010406	0.001464	0.001991	0.002633
22	0.00002351	0.00006772	0.0001479	0.0002749	0.0004596	0.0007132	0.0010469	0.001472	0.002001	0.002644
23	0.00002401	0.00006873	0.0001496	0.0002775	0.0004632	0.0007181	0.0010532	0.001480	0.002010	0.002656
24	0.00002452	0.00006975	0.0001513	0.0002801	0.0004669	0.0007230	0.0010595	0.001488	0.002020	0.002668
25	0.00002503	0.00007078	0.0001530	0.0002827	0.0004706	0.0007279	0.0010659	0.001496	0.002030	0.002680
26	0.00002555	0.00007183	0.0001548	0.0002853	0.0004743	0.0007328	0.0010722	0.001504	0.002040	0.002692
27	0.00002608	0.00007288	0.0001565	0.0002879	0.0004780	0.0007378	0.0010786	0.001512	0.002050	0.002703
28	0.00002662	0.00007394	0.0001583	0.0002906	0.0004817	0.0007428	0.0010851	0.001520	0.002060	0.002715
29	0.00002716	0.00007501	0.0001601	0.0002933	0.0004854	0.0007478	0.0010915	0.001528	0.002069	0.002727
30	0.00002771	0.00007610	0.0001619	0.0002959	0.0004892	0.0007528	0.0010980	0.001536	0.002079	0.002739
31	0.00002827	0.00007719	0.0001637	0.0002986	0.0004930	0.0007579	0.0011045	0.001544	0.002089	0.002751
32	0.00002884	0.00007829	0.0001655	0.0003014	0.0004968	0.0007629	0.0011111	0.001553	0.002100	0.002764
33	0.00002941	0.00007941	0.0001674	0.0003041	0.0005006	0.0007680	0.0011176	0.001561	0.002110	0.002776
34	0.00002999	0.00008053	0.0001692	0.0003069	0.0005045	0.0007732	0.0011242	0.001569	0.002120	0.002788
35	0.00003058	0.00008167	0.0001711	0.0003096	0.0005083	0.0007783	0.0011308	0.001577	0.002130	0.002800
36	0.00003117	0.00008281	0.0001729	0.0003124	0.0005122	0.0007835	0.0011375	0.001586	0.002140	0.002812
37	0.00003178	0.00008397	0.0001748	0.0003152	0.0005161	0.0007887	0.0011441	0.001594	0.002150	0.002825
38	0.00003239	0.00008514	0.0001767	0.0003180	0.0005200	0.0007939	0.0011508	0.001602	0.002160	0.002837
39	0.00003301	0.00008632	0.0001787	0.0003209	0.0005240	0.0007991	0.0011575	0.001611	0.002171	0.002849
40	0.00003364	0.00008751	0.0001806	0.0003237	0.0005280	0.0008044	0.0011643	0.001619	0.002181	0.002862
41	0.00003427	0.00008871	0.0001825	0.0003266	0.0005319	0.0008096	0.0011711	0.001628	0.002191	0.002874
42	0.00003491	0.00008992	0.0001845	0.0003295	0.0005359	0.0008693	0.0011779	0.001636	0.002202	0.002887
43	0.00003556	0.00009114	0.0001865	0.0003324	0.0005400	0.0008203	0.0011847	0.001645	0.002212	0.002899
44	0.00003622	0.00009237	0.0001885	0.0003353	0.0005440	0.0008256	0.0011915	0.001653	0.002223	0.002912
45	0.00003689	0.00009362	0.0001905	0.0003383	0.0005481	0.0008310	0.0011984	0.001662	0.002233	0.002924
46	0.00003757	0.00009487	0.0001925	0.0003412	0.0005522	0.0008364	0.0012053	0.001670	0.002244	0.002937
47	0.00003825	0.00009614	0.0001945	0.0003442	0.0005563	0.0008418	0.0012122	0.001679	0.002254	0.002949
48	0.00003894	0.00009742	0.0001965	0.0003472	0.0005604	0.0008473	0.0012192	0.001688	0.002265	0.002962
49	0.00003964	0.00009870	0.0001986	0.0003502	0.0005645	0.0008527	0.0012262	0.001696	0.002275	0.002975
50	0.00004035	0.00010000	0.0002007	0.0003532	0.0005687	0.0008582	0.0012332	0.001705	0.002286	0.002987
51	0.00004107	0.00010132	0.0002028	0.0003563	0.0005729	0.0008638	0.0012402	0.001714	0.002297	0.003000
52	0.00004179	0.00010264	0.0002049	0.0003593	0.0005771	0.0008693	0.0012473	0.001723	0.002307	0.003013
53	0.00004252	0.00010397	0.0002070	0.0003624	0.0005813	0.0008749	0.0012544	0.001731	0.002318	0.003026
54	0.00004327	0.00010532	0.0002091	0.0003655	0.0005856	0.0008805	0.0012615	0.001740	0.002329	0.003039
55	0.00004402	0.00010668	0.0002113	0.0003686	0.0005898	0.0008861	0.0012687	0.001749	0.002340	0.003052
56	0.00004478	0.00010805	0.0002134	0.0003718	0.0005941	0.0008917	0.0012758	0.001758	0.002350	0.003065
57	0.00004554	0.00010943	0.0002156	0.0003749	0.0005985	0.0008974	0.0012830	0.001767	0.002361	0.003078
58	0.00004632	0.00011082	0.0002178	0.0003781	0.0006028	0.0009031	0.0012903	0.001776	0.002372	0.003091
59	0.00004711	0.00011223	0.0002200	0.0003813	0.0006071	0.0009088	0.0012975	0.001785	0.002383	0.003104
60	0.00004790	0.00011364	0.0002222	0.0003845	0.0006115	0.0009145	0.0013048	0.001794	0.002394	0.003117

Involute Function Table

inv $\alpha = \tan \alpha - \alpha$

	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°
0	0.003117	0.003975	0.004982	0.006150	0.007493	0.009025	0.010760	0.012715	0.014904	0.017345
1	0.003130	0.003991	0.005000	0.006171	0.007517	0.009052	0.010791	0.012750	0.014943	0.017388
2	0.003143	0.004006	0.005018	0.006192	0.007541	0.009079	0.010822	0.012784	0.014982	0.017431
3	0.003157	0.004022	0.005036	0.006213	0.007565	0.009107	0.010853	0.012819	0.015020	0.017474
4	0.003170	0.004038	0.005055	0.006234	0.007589	0.009134	0.010884	0.012854	0.015059	0.017517
5	0.003183	0.004053	0.005073	0.006255	0.007613	0.009161	0.010915	0.012888	0.015098	0.017560
6	0.003197	0.004069	0.005091	0.006276	0.007637	0.009189	0.010946	0.012923	0.015137	0.017603
7	0.003210	0.004085	0.005110	0.006297	0.007661	0.009216	0.010977	0.012958	0.015176	0.017647
8	0.003223	0.004101	0.005128	0.006318	0.007686	0.009244	0.011008	0.012993	0.015215	0.017690
9	0.003237	0.004117	0.005146	0.006340	0.007710	0.009272	0.011039	0.013028	0.015254	0.017734
10	0.003250	0.004133	0.005165	0.006361	0.007735	0.009299	0.011071	0.013063	0.015293	0.017777
11	0.003264	0.004148	0.005184	0.006382	0.007759	0.009327	0.011102	0.013098	0.015333	0.017821
12	0.003277	0.004164	0.005202	0.006404	0.007784	0.009355	0.011133	0.013134	0.015372	0.017865
13	0.003291	0.004180	0.005221	0.006425	0.007808	0.009383	0.011165	0.013169	0.015411	0.017908
14	0.003305	0.004197	0.005239	0.006447	0.007833	0.009411	0.011196	0.013204	0.015451	0.017952
15	0.003318	0.004213	0.005258	0.006469	0.007857	0.009439	0.011228	0.013240	0.015490	0.017996
16	0.003332	0.004229	0.005277	0.006490	0.007882	0.009467	0.011260	0.013275	0.015530	0.018040
17	0.003346	0.004245	0.005296	0.006512	0.007907	0.009495	0.011291	0.013311	0.015570	0.018084
18	0.003360	0.004261	0.005315	0.006534	0.007932	0.009523	0.011323	0.013346	0.015609	0.018129
19	0.003374	0.004277	0.005334	0.006555	0.007957	0.009552	0.011355	0.013382	0.015649	0.018173
20	0.003387	0.004294	0.005353	0.006577	0.007982	0.009580	0.011387	0.013418	0.015689	0.018217
21	0.003401	0.004310	0.005372	0.006599	0.008007	0.009608	0.011419	0.013454	0.015729	0.018262
22	0.003415	0.004327	0.005391	0.006621	0.008032	0.009637	0.011451	0.013490	0.015769	0.018306
23	0.003429	0.004343	0.005410	0.006643	0.008057	0.009665	0.011483	0.013526	0.015809	0.018351
24	0.003443	0.004359	0.005429	0.006665	0.008082	0.009694	0.011515	0.013562	0.015849	0.018395
25	0.003458	0.004376	0.005448	0.006687	0.008107	0.009722	0.011547	0.013598	0.015890	0.018440
26	0.003472	0.004393	0.005467	0.006709	0.008133	0.009751	0.011580	0.013634	0.015930	0.018485
27	0.003486	0.004409	0.005487	0.006732	0.008158	0.009780	0.011612	0.013670	0.015971	0.018530
28	0.003500	0.004426	0.005506	0.006754	0.008183	0.009808	0.011644	0.013707	0.016011	0.018575
29	0.003514	0.004443	0.005525	0.006776	0.008209	0.009837	0.011677	0.013743	0.016052	0.018620
30	0.003529	0.004459	0.005545	0.006799	0.008234	0.009866	0.011709	0.013779	0.016092	0.018665
31	0.003543	0.004476	0.005564	0.006821	0.008260	0.009895	0.011742	0.013816	0.016133	0.018710
32	0.003557	0.004493	0.005584	0.006843	0.008285	0.009924	0.011775	0.013852	0.016174	0.018755
33	0.003572	0.004510	0.005603	0.006866	0.008311	0.009953	0.011807	0.013889	0.016214	0.018800
34	0.003586	0.004527	0.005623	0.006888	0.008337	0.009982	0.011840	0.013926	0.016255	0.018846
35	0.003600	0.004544	0.005643	0.006911	0.008362	0.010011	0.011873	0.013963	0.016296	0.018891
36	0.003615	0.004561	0.005662	0.006934	0.008388	0.010041	0.011906	0.013999	0.016337	0.018937
37	0.003630	0.004578	0.005682	0.006956	0.008414	0.010070	0.011939	0.014036	0.016379	0.018983
38	0.003644	0.004595	0.005702	0.006979	0.008440	0.010099	0.011972	0.014073	0.016420	0.019028
39	0.003659	0.004612	0.005722	0.007002	0.008466	0.010129	0.012005	0.014110	0.016461	0.019074
40	0.003673	0.004629	0.005742	0.007025	0.008492	0.010158	0.012038	0.014148	0.016502	0.019120
41	0.003688	0.004646	0.005762	0.007048	0.008518	0.010188	0.012071	0.014185	0.016544	0.019166
42	0.003703	0.004664	0.005782	0.007071	0.008544	0.010217	0.012105	0.014222	0.016585	0.019212
43	0.003718	0.004681	0.005802	0.007094	0.008571	0.010247	0.012138	0.014259	0.016627	0.019258
44	0.003733	0.004698	0.005822	0.007117	0.008597	0.010277	0.012172	0.014297	0.016669	0.019304
45	0.003747	0.004716	0.005842	0.007140	0.008623	0.010307	0.012205	0.014334	0.016710	0.019350
46	0.003762	0.004733	0.005862	0.007163	0.008650	0.010336	0.012239	0.014372	0.016752	0.019397
47	0.003777	0.004751	0.005882	0.007186	0.008676	0.010366	0.012272	0.014409	0.016794	0.019443
48	0.003792	0.004768	0.005903	0.007209	0.008702	0.010396	0.012306	0.014447	0.016836	0.019490
49	0.003807	0.004786	0.005923	0.007233	0.008729	0.010426	0.012340	0.014485	0.016878	0.019536
50	0.003822	0.004803	0.005943	0.007256	0.008756	0.010456	0.012373	0.014523	0.016920	0.019583
51	0.003838	0.004821	0.005964	0.007280	0.008782	0.010486	0.012407	0.014560	0.016962	0.019630
52	0.003853	0.004839	0.005984	0.007303	0.008809	0.010517	0.012441	0.014598	0.017004	0.019676
53	0.003868	0.004856	0.006005	0.007327	0.008836	0.010547	0.012475	0.014636	0.017047	0.019723
54	0.003883	0.004874	0.006025	0.007350	0.008863	0.010577	0.012509	0.014674	0.017089	0.019770
55	0.003898	0.004892	0.006046	0.007374	0.008889	0.010608	0.012543	0.014713	0.017132	0.019817
56	0.003914	0.004910	0.006067	0.007397	0.008916	0.010638	0.012578	0.014751	0.017174	0.019864
57	0.003929	0.004928	0.006087	0.007421	0.008943	0.010669	0.012612	0.014789	0.017217	0.019912
58	0.003944	0.004946	0.006108	0.007445	0.008970	0.010699	0.012646	0.014827	0.017259	0.019959
59	0.003960	0.004964	0.006129	0.007469	0.008998	0.010730	0.012681	0.014866	0.017302	0.020006
60	0.003975	0.004982	0.006150	0.007493	0.009025	0.010760	0.012715	0.014904	0.017345	0.020054

Involute Function Table

$$\text{inv } \alpha = \tan \alpha - \alpha$$

	22°	23°	24°	25°	26°	27°	28°	29°	30°	31°
0	0.020054	0.023049	0.026350	0.029975	0.033947	0.038287	0.043017	0.048164	0.053751	0.059809
1	0.020101	0.023102	0.026407	0.030039	0.034016	0.038362	0.043100	0.048253	0.053849	0.059914
2	0.020149	0.023154	0.026465	0.030102	0.034086	0.038438	0.043182	0.048343	0.053946	0.060019
3	0.020197	0.023207	0.026523	0.030166	0.034155	0.038514	0.043264	0.048432	0.054043	0.060124
4	0.020244	0.023259	0.026581	0.030229	0.034225	0.038590	0.043347	0.048522	0.054140	0.060230
5	0.020292	0.023312	0.026639	0.030293	0.034294	0.038666	0.043430	0.048612	0.054238	0.060335
6	0.020340	0.023365	0.026697	0.030357	0.034364	0.038742	0.043513	0.048702	0.054336	0.060441
7	0.020388	0.023418	0.026756	0.030420	0.034434	0.038818	0.043596	0.048792	0.054433	0.060547
8	0.020436	0.023471	0.026814	0.030484	0.034504	0.038894	0.043679	0.048883	0.054531	0.060653
9	0.020484	0.023524	0.026872	0.030549	0.034574	0.038971	0.043762	0.048973	0.054629	0.060759
10	0.020533	0.023577	0.026931	0.030613	0.034644	0.039047	0.043845	0.049063	0.054728	0.060866
11	0.020581	0.023631	0.026989	0.030677	0.034714	0.039124	0.043929	0.049154	0.054826	0.060972
12	0.020629	0.023684	0.027048	0.030741	0.034785	0.039201	0.044012	0.049245	0.054924	0.061079
13	0.020678	0.023738	0.027107	0.030806	0.034855	0.039278	0.044096	0.049336	0.055023	0.061186
14	0.020726	0.023791	0.027166	0.030870	0.034926	0.039355	0.044180	0.049427	0.055122	0.061292
15	0.020775	0.023845	0.027225	0.030935	0.034996	0.039432	0.044264	0.049518	0.055221	0.061400
16	0.020824	0.023899	0.027284	0.031000	0.035067	0.039509	0.044348	0.049609	0.055320	0.061507
17	0.020873	0.023952	0.027343	0.031065	0.035138	0.039586	0.044432	0.049701	0.055419	0.061614
18	0.020921	0.024006	0.027402	0.031130	0.035209	0.039664	0.044516	0.049792	0.055518	0.061721
19	0.020970	0.024060	0.027462	0.031195	0.035280	0.039741	0.044601	0.049884	0.055617	0.061829
20	0.021019	0.024114	0.027521	0.031260	0.035352	0.039819	0.044685	0.049976	0.055717	0.061937
21	0.021069	0.024169	0.027581	0.031325	0.035423	0.039897	0.044770	0.050068	0.055817	0.062045
22	0.021118	0.024223	0.027640	0.031390	0.035494	0.039974	0.044855	0.050160	0.055916	0.062153
23	0.021167	0.024277	0.027700	0.031456	0.035566	0.040052	0.044939	0.050252	0.056016	0.062261
24	0.021217	0.024332	0.027760	0.031521	0.035637	0.040131	0.045024	0.050344	0.056116	0.062369
25	0.021266	0.024386	0.027820	0.031587	0.035709	0.040209	0.045110	0.050437	0.056217	0.062478
26	0.021315	0.024441	0.027880	0.031653	0.035781	0.040287	0.045195	0.050529	0.056317	0.062586
27	0.021365	0.024495	0.027940	0.031718	0.035853	0.040366	0.045280	0.050622	0.056417	0.062695
28	0.021415	0.024550	0.028000	0.031784	0.035925	0.040444	0.045366	0.050715	0.056518	0.062804
29	0.021465	0.024605	0.028060	0.031850	0.035997	0.040523	0.045451	0.050808	0.056619	0.062913
30	0.021514	0.024660	0.028121	0.031917	0.036069	0.040602	0.045537	0.050901	0.056720	0.063022
31	0.021564	0.024715	0.028181	0.031983	0.036142	0.040680	0.045623	0.050994	0.056821	0.063131
32	0.021614	0.024770	0.028242	0.032049	0.036214	0.040759	0.045709	0.051087	0.056922	0.063241
33	0.021665	0.024825	0.028302	0.032116	0.036287	0.040838	0.045795	0.051181	0.057023	0.063350
34	0.021715	0.024881	0.028363	0.032182	0.036359	0.040918	0.045881	0.051274	0.057124	0.063460
35	0.021765	0.024936	0.028424	0.032249	0.036432	0.040997	0.045967	0.051368	0.057226	0.063570
36	0.021815	0.024992	0.028485	0.032315	0.036505	0.041076	0.046054	0.051462	0.057328	0.063680
37	0.021866	0.025047	0.028546	0.032382	0.036578	0.041156	0.046140	0.051556	0.057429	0.063790
38	0.021916	0.025103	0.028607	0.032449	0.036651	0.041236	0.046227	0.051650	0.057531	0.063901
39	0.021967	0.025159	0.028668	0.032516	0.036724	0.041316	0.046313	0.051744	0.057633	0.064011
40	0.022018	0.025214	0.028729	0.032583	0.036798	0.041395	0.046400	0.051838	0.057736	0.064122
41	0.022068	0.025270	0.028791	0.032651	0.036871	0.041475	0.046487	0.051933	0.057838	0.064232
42	0.022119	0.025326	0.028852	0.032718	0.036945	0.041556	0.046575	0.052027	0.057940	0.064343
43	0.022170	0.025382	0.028914	0.032785	0.037018	0.041636	0.046662	0.052122	0.058043	0.064454
44	0.022221	0.025439	0.028976	0.032853	0.037092	0.041716	0.046749	0.052217	0.058146	0.064565
45	0.022272	0.025495	0.029037	0.032920	0.037166	0.041797	0.046837	0.052312	0.058249	0.064677
46	0.022324	0.025551	0.029099	0.032988	0.037240	0.041877	0.046924	0.052407	0.058352	0.064788
47	0.022375	0.025608	0.029161	0.033056	0.037314	0.041958	0.047012	0.052502	0.058455	0.064900
48	0.022426	0.025664	0.029223	0.033124	0.037388	0.042039	0.047100	0.052597	0.058558	0.065012
49	0.022478	0.025721	0.029285	0.033192	0.037462	0.042120	0.047188	0.052693	0.058662	0.065123
50	0.022529	0.025778	0.029348	0.033260	0.037537	0.042201	0.047276	0.052788	0.058765	0.065236
51	0.022581	0.025834	0.029410	0.033328	0.037611	0.042282	0.047364	0.052884	0.058869	0.065348
52	0.022632	0.025891	0.029472	0.033397	0.037686	0.042363	0.047452	0.052980	0.058973	0.065460
53	0.022684	0.025948	0.029535	0.033465	0.037761	0.042444	0.047541	0.053076	0.059077	0.065573
54	0.022736	0.026005	0.029598	0.033534	0.037835	0.042526	0.047630	0.053172	0.059181	0.065685
55	0.022788	0.026062	0.029660	0.033602	0.037910	0.042607	0.047718	0.053268	0.059285	0.065798
56	0.022840	0.026120	0.029723	0.033671	0.037985	0.042689	0.047807	0.053365	0.059390	0.065911
57	0.022892	0.026177	0.029786	0.033740	0.038060	0.042771	0.047896	0.053461	0.059494	0.066024
58	0.022944	0.026235	0.029849	0.033809	0.038136	0.042853	0.047985	0.053558	0.059599	0.066137
59	0.022997	0.026292	0.029912	0.033878	0.038211	0.042935	0.048074	0.053655	0.059704	0.066250
60	0.023049	0.026350	0.029975	0.033947	0.038287	0.043017	0.048164	0.053751	0.059809	0.066364

Involute Function Table

inv $\alpha = \tan \alpha - \alpha$

	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°
0	0.066364	0.073449	0.081097	0.089342	0.098224	0.107782	0.118061	0.129106	0.140968	0.15370
1	0.066478	0.073572	0.081229	0.089485	0.098378	0.107948	0.118238	0.129296	0.141173	0.15392
2	0.066591	0.073695	0.081362	0.089628	0.098531	0.108113	0.118416	0.129488	0.141378	0.15414
3	0.066705	0.073818	0.081494	0.089771	0.098685	0.108279	0.118594	0.129679	0.141583	0.15436
4	0.066819	0.073941	0.081627	0.089914	0.098840	0.108445	0.118772	0.129870	0.141789	0.15458
5	0.066934	0.074064	0.081760	0.090058	0.098994	0.108611	0.118951	0.130062	0.141995	0.15480
6	0.067048	0.074188	0.081894	0.090201	0.099149	0.108777	0.119130	0.130254	0.142201	0.15503
7	0.067163	0.074311	0.082027	0.090345	0.099303	0.108943	0.119309	0.130446	0.142408	0.15525
8	0.067277	0.074435	0.082161	0.090489	0.099458	0.109110	0.119488	0.130639	0.142614	0.15547
9	0.067392	0.074559	0.082294	0.090633	0.099614	0.109277	0.119667	0.130832	0.142821	015569
10	0.067507	0.074684	0.082428	0.090777	0.099769	0.109444	0.119847	0.131025	0.143028	0.15591
11	0.067622	0.074808	0.082562	0.090922	0.099924	0.109611	0.120027	0.131218	0.143236	0.15614
12	0.067738	0.074932	0.082697	0.091067	0.100080	0.109779	0.120207	0.131411	0.143443	0.15636
13	0.067853	0.075057	0.082831	0.091211	0.100236	0.109947	0.120387	0.131605	0.143651	0.15658
14	0.067969	0.075182	0.082966	0.091356	0.100392	0.110114	0.120567	0.131798	0.143859	0.15680
15	0.068084	0.075307	0.083100	0.091502	0.100548	0.110283	0.120748	0.131993	0.144067	0.15703
16	0.068200	0.075432	0.083235	0.091647	0.100705	0.110451	0.120929	0.132187	0.144276	0.15725
17	0.068316	0.075557	0.083371	0.091792	0.100862	0.110619	0.121110	0.132381	0.144485	0.15748
18	0.068432	0.075683	0.083506	0.091938	0.101019	0.110788	0.121291	0.132576	0.144694	0.15770
19	0.068549	0.075808	0.083641	0.092084	0.101176	0.110957	0.121473	0.132771	0.144903	0.15793
20	0.068665	0.075934	0.083777	0.092230	0.101333	0.111126	0.121655	0.132966	0.145113	0.15815
21	0.068782	0.076060	0.083913	0.092377	0.101490	0.111295	0.121837	0.133162	0.145323	0.15838
22	0.068899	0.076186	0.084049	0.092523	0.101648	0.111465	0.122019	0.133357	0.145533	0.15860
23	0.069016	0.076312	0.084185	0.092670	0.101806	0.111635	0.122201	0.133553	0.145743	0.15883
24	0.069133	0.076439	0.084321	0.092816	0.101964	0.111805	0.122384	0.133750	0.145954	0.15905
25	0.069250	0.076565	0.084458	0.092963	0.102122	0.111975	0.122567	0.133946	0.146165	0.15928
26	0.069367	0.076692	0.084594	0.093111	0.102280	0.112145	0.122750	0.134143	0.146376	0.15951
27	0.069485	0.076819	0.084731	0.093258	0.102439	0.112316	0.122933	0.134339	0.146587	0.15973
28	0.069602	0.076946	0.084868	0.093406	0.102598	0.112486	0.123116	0.134536	0.146798	0.15996
29	0.069720	0.077073	0.085005	0.093533	0.102757	0.112657	0.123300	0.134734	0.147010	0.16019
30	0.069838	0.077200	0.085142	0.093701	0.102916	0.112829	0.123484	0.134931	0.147222	0.16041
31	0.069956	0.077328	0.085280	0.093849	0.103075	0.113000	0.123668	0.135129	0.147435	0.16064
32	0.070075	0.077455	0.085418	0.093998	0.103235	0.113171	0.123853	0.135327	0.147647	0.16087
33	0.070193	0.077583	0.085555	0.094146	0.103395	0.113343	0.124037	0.135525	0.147860	0.16110
34	0.070312	0.077711	0.085693	0.094295	0.103555	0.113515	0.124222	0.135724	0.148073	0.16133
35	0.070430	0.077839	0.085832	0.094443	0.103715	0.113687	0.124407	0.135923	0.148286	0.16156
36	0.070549	0.077968	0.085970	0.094592	0.103875	0.113860	0.124592	0.136122	0.148500	0.16178
37	0.070668	0.078096	0.086108	0.094742	0.104036	0.114032	0.124778	0.136321	0.148714	0.16201
38	0.070788	0.078225	0.083247	0.094891	0.104196	0.114205	0.124964	0.136520	0.148928	0.16224
39	0.070907	0.078354	0.086386	0.095041	0.104357	0.114378	0.125150	0.136720	0.149142	0.16247
40	0.071026	0.078483	0.086525	0.095190	0.104518	0.114552	0.125336	0.136920	0.149357	0.16270
41	0.071146	0.078612	0.086664	0.095340	0.104680	0.114725	0.125522	0.137120	0.149572	0.16293
42	0.071266	0.078741	0.086804	0.095490	0.104841	0.114899	0.125709	0.137320	0.149787	0.16317
43	0.071386	0.078871	0.086943	0.095641	0.105003	0.115073	0.125895	0.137521	0.150002	0.16340
44	0.071506	0.079000	0.087083	0.095791	0.105165	0.115247	0.126083	0.137722	0.150218	0.16363
45	0.071626	0.079130	0.087223	0.095942	0.105327	0.115421	0.126270	0.137923	0.150433	0.16386
46	0.071747	0.079260	0.087363	0.096093	0.105489	0.115595	0.126457	0.138124	0.150650	0.16409
47	0.071867	0.079390	0.087503	0.096244	0.105652	0.115770	0.126645	0.138326	0.150866	0.16432
48	0.071988	0.079520	0.087644	0.096395	0.105814	0.115945	0.126833	0.138528	0.151083	0.16456
49	0.072109	0.079651	0.087784	0.096546	0.105977	0.116120	0.127021	0.138730	0.151299	0.16479
50	0.072230	0.079781	0.087925	0.096698	0.106140	0.116296	0.127209	0.138932	0.151516	0.16502
51	0.072351	0.079912	0.088066	0.096850	0.106304	0.116471	0.127398	0.139134	0.151734	0.16625
52	0.072473	0.080043	0.088207	0.097002	0.106467	0.116647	0.127587	0.139337	0.151951	0.16549
53	0.072594	0.080174	0.088348	0.097154	0.106631	0.116823	0.127776	0.139540	0.152169	0.16572
54	0.072716	0.080306	0.088490	0.097306	0.106795	0.116999	0.127965	0.139743	0.152388	0.16596
55	0.072838	0.080437	0.088631	0.097459	0.106959	0.117175	0.128155	0.139947	0.152606	0.16619
56	0.072959	0.080569	0.088773	0.097611	0.107123	0.117352	0.128344	0.140151	0.152825	0.16642
57	0.073082	0.080700	0.088915	0.097764	0.107288	0.117529	0.128534	0.140355	0.153043	0.16666
58	0.073204	0.080832	0.089057	0.097917	0.107452	0.117706	0.128725	0.140559	0.153263	0.16689
59	0.073326	0.080964	0.089200	0.098071	0.107617	0.117883	0.128915	0.140763	0.153482	0.16713
60	0.073449	0.081097	0.089342	0.098224	0.107782	0.118061	0.129106	0.140968	0.153702	0.16737

Involute Function Table

$\text{inv } \alpha = \tan \alpha - \alpha$

	42°	43°	44°	45°	46°	47°	48°	49°	50°	51°
0	0.16737	0.18202	0.19774	0.21460	0.23268	0.25206	0.27285	0.29516	0.31909	0.34478
1	0.16760	0.18228	0.19802	0.21489	0.23299	0.25240	0.27321	0.29554	0.31950	0.34522
2	0.16784	0.18253	0.19829	0.21518	0.23330	0.25273	0.27357	0.29593	0.31992	0.34567
3	0.16807	0.18278	0.19856	0.21548	0.23362	0.25307	0.27393	0.29631	0.32033	0.34611
4	0.16831	0.18304	0.19883	0.21577	0.23393	0.25341	0.27429	0.29670	0.32075	0.34656
5	0.16855	0.18329	0.19910	0.21606	0.23424	0.25374	0.27465	0.29709	0.32116	0.34700
6	0.16879	0.18355	0.19938	0.21635	0.23456	0.25408	0.27501	0.29747	0.32158	0.34745
7	0.16902	0.18380	0.19965	0.21665	0.23487	0.25442	0.27538	0.29786	0.32199	0.34790
8	0.16926	0.18406	0.19992	0.21694	0.23519	0.25475	0.27574	0.29825	0.32241	0.34834
9	0.16950	0.18431	0.20020	0.21723	0.23550	0.25509	0.27610	0.29864	0.32283	0.34879
10	0.16974	0.18457	0.20047	0.21753	0.23582	0.25543	0.27646	0.29903	0.32324	0.34924
11	0.16998	0.18482	0.20075	0.21782	0.23613	0.25577	0.27683	0.29942	0.32366	0.34969
12	0.17022	0.18508	0.20102	0.21812	0.23645	0.25611	0.27719	0.29981	0.32408	0.35014
13	0.17045	0.18534	0.20130	0.21841	0.23676	0.25645	0.27755	0.30020	0.32450	0.35059
14	0.17069	0.18559	0.20157	0.21871	0.23708	0.25679	0.27792	0.30059	0.32492	0.35104
15	0.17093	0.18585	0.20185	0.21900	0.23740	0.25713	0.27828	0.30098	0.32534	0.35149
16	0.17117	0.18611	0.20212	0.21930	0.23772	0.25747	0.27865	0.30137	0.32576	0.35194
17	0.17142	0.18637	0.20240	0.21960	0.23803	0.25781	0.27902	0.30177	0.32618	0.35240
18	0.17166	0.18662	0.20268	0.21989	0.23835	0.25815	0.27938	0.30216	0.32661	0.35285
19	0.17190	0.18688	0.20296	0.22019	0.23867	0.25849	0.27975	0.30255	0.32703	0.35330
20	0.17214	0.18714	0.20323	0.22049	0.23899	0.25883	0.28012	0.30295	0.32745	0.35376
21	0.17238	0.18740	0.20351	0.22079	0.23931	0.25918	0.28048	0.30334	0.32787	0.35421
22	0.17262	0.18766	0.20379	0.22108	0.23963	0.25952	0.28085	0.30374	0.32830	0.35467
23	0.17286	0.18792	0.20407	0.22138	0.23995	0.25986	0.28122	0.30413	0.32872	0.35512
24	0.17311	0.18818	0.20435	0.22168	0.24027	0.26021	0.28159	0.30453	0.32915	0.35558
25	0.17335	0.18844	0.20463	0.22198	0.24059	0.26055	0.28196	0.30492	0.32957	0.35604
26	0.17359	0.18870	0.20490	0.22228	0.24091	0.26089	0.28233	0.30532	0.33000	0.35649
27	0.17383	0.18896	0.20518	0.22258	0.24123	0.26124	0.28270	0.30572	0.33042	0.35695
28	0.17408	0.18922	0.20546	0.22288	0.24156	0.26159	0.28307	0.30611	0.33085	0.35741
29	0.17432	0.18948	0.20575	0.22318	0.24188	0.26193	0.28344	0.30651	0.33128	0.35787
30	0.17457	0.18975	0.20603	0.22348	0.24220	0.26228	0.28381	0.30691	0.33171	0.35833
31	0.17481	0.19001	0.20631	0.22378	0.24253	0.26262	0.28418	0.30731	0.33213	0.35879
32	0.17506	0.19027	0.20659	0.22409	0.24285	0.26297	0.28455	0.30771	0.33256	0.35925
33	0.17530	0.19053	0.20687	0.22439	0.24317	0.26332	0.28493	0.30811	0.33299	0.35971
34	0.17555	0.19080	0.20715	0.22469	0.24350	0.26367	0.28530	0.30851	0.33342	0.36017
35	0.17579	0.19106	0.20743	0.22499	0.24382	0.26401	0.28567	0.30891	0.33385	0.36063
36	0.17604	0.19132	0.20772	0.22530	0.24415	0.26436	0.28605	0.30931	0.33428	0.36110
37	0.17628	0.19159	0.20800	0.22560	0.24447	0.26471	0.28642	0.30971	0.33471	0.36156
38	0.17653	0.19185	0.20828	0.22590	0.24480	0.26506	0.28680	0.31012	0.33515	0.36202
39	0.17678	0.19212	0.20857	0.22621	0.24512	0.26541	0.28717	0.31052	0.33558	0.36249
40	0.17702	0.19238	0.20885	0.22651	0.24545	0.26576	0.28755	0.31092	0.33601	0.36295
41	0.17727	0.19265	0.20914	0.22682	0.24578	0.26611	0.28792	0.31133	0.33645	0.36342
42	0.17752	0.19291	0.20942	0.22712	0.24611	0.26646	0.28830	0.31173	0.33688	0.36388
43	0.17777	0.19318	0.20971	0.22743	0.24643	0.26682	0.28868	0.31214	0.33731	0.36435
44	0.17801	0.19344	0.20999	0.22773	0.24676	0.26717	0.28906	0.31254	0.33775	0.36482
45	0.17826	0.19371	0.21028	0.22804	0.24709	0.26752	0.28943	0.31295	0.33818	0.36529
46	0.17851	0.19398	0.21056	0.22835	0.24742	0.26787	0.28981	0.31335	0.33862	0.36575
47	0.17876	0.19424	0.21085	0.22865	0.24775	0.26823	0.29019	0.31376	0.33906	0.36622
48	0.17901	0.19451	0.21114	0.22896	0.24808	0.26858	0.29057	0.31417	0.33949	0.36669
49	0.17926	0.19478	0.21142	0.22927	0.24841	0.26893	0.29095	0.31457	0.33993	0.36716
50	0.17951	0.19505	0.21171	0.22958	0.24874	0.26929	0.29133	0.31498	0.34037	0.36763
51	0.17976	0.19532	0.21200	0.22989	0.24907	0.26964	0.29171	0.31539	0.34081	0.36810
52	0.18001	0.19558	0.21229	0.23020	0.24940	0.27000	0.29209	0.31580	0.34125	0.36858
53	0.18026	0.19585	0.21257	0.23050	0.24973	0.27035	0.29247	0.31621	0.34169	0.36905
54	0.18051	0.19612	0.21286	0.23081	0.25006	0.27071	0.29286	0.31662	0.34213	0.36952
55	0.18076	0.19639	0.21315	0.23112	0.25040	0.27107	0.29324	0.31703	0.34257	0.36999
56	0.18101	0.19666	0.21344	0.23143	0.25073	0.27142	0.29362	0.31744	0.34301	0.37047
57	0.18127	0.19693	0.21373	0.23174	0.25106	0.27178	0.29400	0.31785	0.34345	0.37094
58	0.18152	0.19720	0.21402	0.23206	0.25140	0.27214	0.29439	0.31826	0.34389	0.37142
59	0.18177	0.19747	0.21431	0.23237	0.25173	0.27250	0.29477	0.31868	0.34434	0.37189
60	0.18202	0.19774	0.21460	0.23268	0.25206	0.27285	0.29516	0.31909	0.34478	0.37237

Involute Function Table

$\text{inv } \alpha = \tan \alpha - \alpha$

	52°	53°	54°	55°	56°	57°	58°	59°	60°	61°
0	0.37237	0.40202	0.43390	0.46822	0.50518	0.54503	0.58804	0.63454	0.68485	0.73940
1	0.37285	0.40253	0.43446	0.46881	0.50582	0.54572	0.58879	0.63534	0.68573	0.74034
2	0.37332	0.40305	0.43501	0.46940	0.50646	0.54641	0.58954	0.63615	0.68660	0.74129
3	0.37380	0.40356	0.43556	0.47000	0.50710	0.54710	0.59028	0.63696	0.68748	0.74224
4	0.37428	0.40407	0.43611	0.47060	0.50774	0.54779	0.59103	0.63777	0.68835	0.74319
5	0.37476	0.40459	0.43667	0.47119	0.50838	0.54849	0.59178	0.63858	0.68923	0.74415
6	0.37524	0.40511	0.43722	0.47179	0.50903	0.54918	0.59253	0.63939	0.69011	0.74510
7	0.37572	0.40562	0.43778	0.47239	0.50967	0.54988	0.59328	0.64020	0.69099	0.74606
8	0.37620	0.40614	0.43833	0.47299	0.51032	0.55057	0.59403	0.64102	0.69187	0.74701
9	0.37668	0.40666	0.43889	0.47359	0.51096	0.55127	0.59479	0.64183	0.69276	0.74797
10	0.37716	0.40717	0.43945	0.47419	0.51161	0.55197	0.59554	0.64265	0.69364	0.74893
11	0.37765	0.40769	0.44001	0.47479	0.51226	0.55267	0.59630	0.64346	0.69452	0.74989
12	0.37813	0.40821	0.44057	0.47539	0.51291	0.55337	0.59705	0.64428	0.69541	0.75085
13	0.37861	0.40873	0.44113	0.47599	0.51356	0.55407	0.59781	0.64510	0.69630	0.75181
14	0.37910	0.40925	0.44169	0.47660	0.51421	0.55477	0.59857	0.64592	0.69719	0.75278
15	0.37958	0.40977	0.44225	0.47720	0.51486	0.55547	0.59933	0.64674	0.69808	0.75375
16	0.38007	0.41030	0.44281	0.47780	0.51551	0.55618	0.60009	0.64756	0.69897	0.75471
17	0.38055	0.41082	0.44337	0.47841	0.51616	0.55688	0.60085	0.64839	0.69986	0.75568
18	0.38104	0.41134	0.44393	0.47902	0.51682	0.55759	0.60161	0.64921	0.70075	0.75665
19	0.38153	0.41187	0.44450	0.47962	0.51747	0.55829	0.60237	0.65004	0.70165	0.75762
20	0.38202	0.41239	0.44506	0.48023	0.51813	0.55900	0.60314	0.65086	0.70254	0.75859
21	0.38251	0.41292	0.44563	0.48084	0.51878	0.55971	0.60390	0.65169	0.70344	0.75957
22	0.38299	0.41344	0.44619	0.48145	0.51944	0.56042	0.60467	0.65252	0.70434	0.76054
23	0.38348	0.41397	0.44676	0.48206	0.52010	0.56113	0.60544	0.65335	0.70524	0.76152
24	0.38397	0.41450	0.44733	0.48267	0.52076	0.56184	0.60620	0.65418	0.70614	0.76250
25	0.38446	0.41502	0.44789	0.48328	0.52141	0.56255	0.60697	0.65501	0.70704	0.76348
26	0.38496	0.41555	0.44846	0.48389	0.52207	0.56326	0.60774	0.65585	0.70794	0.76446
27	0.38545	0.41608	0.44903	0.48451	0.52274	0.56398	0.60851	0.65668	0.70885	0.76544
28	0.38594	0.41661	0.44960	0.48512	0.52340	0.56469	0.60929	0.65752	0.70975	0.76642
29	0.38643	0.41714	0.45017	0.48574	0.52406	0.56541	0.61006	0.65835	0.71066	0.76741
30	0.38693	0.41767	0.45074	0.48635	0.52472	0.56612	0.61083	0.65919	0.71157	0.76839
31	0.38742	0.41820	0.45132	0.48697	0.52539	0.56684	0.61161	0.66003	0.71248	0.76938
32	0.38792	0.41874	0.45189	0.48758	0.52605	0.56756	0.61239	0.66087	0.71339	0.77037
33	0.38841	0.41927	0.45246	0.48820	0.52672	0.56828	0.61316	0.66171	0.71430	0.77136
34	0.38891	0.41980	0.45304	0.48882	0.52739	0.56900	0.61394	0.66255	0.71521	0.77235
35	0.38941	0.42034	0.45361	0.48944	0.52805	0.56972	0.61472	0.66340	0.71613	0.77334
36	0.38990	0.42087	0.45419	0.49006	0.52872	0.57044	0.61550	0.66424	0.71704	0.77434
37	0.39040	0.42141	0.45476	0.49068	0.52939	0.57116	0.61628	0.66509	0.71796	0.77533
38	0.39090	0.42194	0.45534	0.49130	0.53006	0.57188	0.61706	0.66594	0.71888	0.77633
39	0.39140	0.42248	0.45592	0.49193	0.53073	0.57261	0.61785	0.66678	0.71980	0.77733
40	0.39190	0.42302	0.45650	0.49255	0.53141	0.57333	0.61863	0.66763	0.72072	0.77833
41	0.39240	0.42355	0.45708	0.49317	0.53208	0.57406	0.61942	0.66848	0.72164	0.77933
42	0.39290	0.42409	0.45766	0.49380	0.53275	0.57479	0.62020	0.66933	0.72256	0.78033
43	0.39340	0.42463	0.45824	0.49442	0.53343	0.57552	0.62099	0.67019	0.72349	0.78134
44	0.39390	0.42517	0.45882	0.49505	0.53410	0.57625	0.62178	0.67104	0.72441	0.78234
45	0.39441	0.42571	0.45940	0.49568	0.53478	0.57698	0.62257	0.67189	0.72534	0.78335
46	0.39491	0.42625	0.45998	0.49630	0.53546	0.57771	0.62336	0.67275	0.72627	0.78436
47	0.39541	0.42680	0.46057	0.49693	0.53613	0.57844	0.62415	0.67361	0.72720	0.78537
48	0.39592	0.42734	0.46115	0.49756	0.53681	0.57917	0.62494	0.67447	0.72813	0.78638
49	0.39642	0.42788	0.46173	0.49819	0.53749	0.57991	0.62574	0.67532	0.72906	0.78739
50	0.39693	0.42843	0.46232	0.49882	0.53817	0.58064	0.62653	0.67618	0.72999	0.78840
51	0.39743	0.42897	0.46291	0.49945	0.53885	0.58138	0.62733	0.67705	0.73093	0.78942
52	0.39794	0.42952	0.46349	0.50009	0.53954	0.58211	0.62812	0.67791	0.73186	0.79044
53	0.39845	0.43006	0.46408	0.50072	0.54022	0.58285	0.62892	0.67877	0.73280	0.79146
54	0.39896	0.43061	0.46467	0.50135	0.54090	0.58359	0.62972	0.67964	0.73374	0.79247
55	0.39947	0.43116	0.46526	0.50199	0.54159	0.58433	0.63052	0.68050	0.73468	0.79350
56	0.39998	0.43171	0.46585	0.50263	0.54228	0.58507	0.63132	0.68137	0.73562	0.79452
57	0.40049	0.43225	0.46644	0.50326	0.54296	0.58581	0.63212	0.68224	0.73656	0.79554
58	0.40100	0.43280	0.46703	0.50390	0.54365	0.58656	0.63293	0.68311	0.73751	0.79657
59	0.40151	0.43335	0.46762	0.50454	0.54434	0.58730	0.63373	0.68398	0.73845	0.79759
60	0.40202	0.43390	0.46822	0.50518	0.54503	0.58804	0.63454	0.68485	0.73940	0.79862

Involute Function Table

inv $\alpha = \tan \alpha - \alpha$

	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°
0	0.79862	0.86305	0.93329	1.01004	1.09412	1.18648	1.28826	1.40081	1.52575	1.66503
1	0.79965	0.86417	0.93452	1.01138	1.09559	1.18810	1.29005	1.40279	1.52794	1.66748
2	0.80068	0.86530	0.93574	1.01272	1.09706	1.18972	1.29183	1.40477	1.53015	1.66994
3	0.80172	0.86642	0.93697	1.01407	1.09853	1.19134	1.29362	1.40675	1.53235	1.67241
4	0.80275	0.86755	0.93820	1.01541	1.10001	1.19296	1.29541	1.40874	1.53456	1.67488
5	0.80378	0.86868	0.93943	1.01676	1.10149	1.19459	1.29721	1.41073	1.53678	1.67735
6	0.80482	0.86980	0.94066	1.01811	1.10297	1.19622	1.29901	1.41272	1.53899	1.67983
7	0.80586	0.87094	0.94190	1.01946	1.10445	1.19785	1.30081	1.41472	1.54122	1.68232
8	0.80690	0.87207	0.94313	1.02081	1.10593	1.19948	1.30262	1.41672	1.54344	1.68480
9	0.80794	0.87320	0.94437	1.02217	1.10742	1.20112	1.30442	1.41872	1.54567	1.68730
10	0.80898	0.87434	0.94561	1.02352	1.10891	1.20276	1.30623	1.42073	1.54791	1.68980
11	0.81003	0.87548	0.94685	1.02488	1.11040	1.20440	1.30805	1.42274	1.55014	1.69230
12	0.81107	0.87662	0.94810	1.02624	1.11190	1.20604	1.30986	1.42475	1.55239	1.69481
13	0.81212	0.87776	0.94934	1.02761	1.11339	1.20769	1.31168	1.42677	1.55463	1.69732
14	0.81317	0.87890	0.95059	1.02897	1.11489	1.20934	1.31351	1.42879	1.55688	1.69984
15	0.81422	0.88004	0.95184	1.03034	1.11639	1.21100	1.31533	1.43081	1.55914	1.70236
16	0.81527	0.88119	0.95309	1.03171	1.11790	1.21265	1.31716	1.43284	1.56140	1.70488
17	0.81632	0.88234	0.95434	1.03308	1.11940	1.21431	1.31899	1.43487	1.56366	1.70742
18	0.81738	0.88349	0.95560	1.03446	1.12091	1.21597	1.32083	1.43691	1.56593	1.70995
19	0.81844	0.88464	0.95686	1.03583	1.12242	1.21763	1.32267	1.43895	1.56820	1.71249
20	0.81949	0.88579	0.95812	1.03721	1.12393	1.21930	1.32451	1.44099	1.57047	1.71504
21	0.82055	0.88694	0.95938	1.03859	1.12545	1.22097	1.32635	1.44304	1.57275	1.71759
22	0.82161	0.88810	0.96064	1.03997	1.12697	1.22264	1.32820	1.44509	1.57503	1.72015
23	0.82267	0.88926	0.96190	1.04136	1.12849	1.22432	1.33005	1.44714	1.57732	1.72271
24	0.82374	0.89042	0.96317	1.04274	1.13001	1.22599	1.33191	1.44920	1.57961	1.72527
25	0.82480	0.89158	0.96444	1.04413	1.13154	1.22767	1.33376	1.45126	1.58191	1.72785
26	0.82587	0.89274	0.96571	1.04552	1.13306	1.22936	1.33562	1.45332	1.58421	1.73042
27	0.82694	0.89390	0.96698	1.04692	1.13459	1.23104	1.33749	1.45539	1.58652	1.73300
28	0.82801	0.89507	0.96825	1.04831	1.13613	1.23273	1.33935	1.45746	1.58882	1.73559
29	0.82908	0.89624	0.96953	1.04971	1.13766	1.23442	1.34122	1.45954	1.59114	1.73818
30	0.83015	0.89741	0.97081	1.05111	1.13920	1.23612	1.34310	1.46162	1.59346	1.74077
31	0.83123	0.89858	0.97209	1.05251	1.14074	1.23781	1.34497	1.46370	1.59578	1.74338
32	0.83230	0.89975	0.97337	1.05391	1.14228	1.23951	1.34685	1.46579	1.59810	1.74598
33	0.83338	0.90092	0.97465	1.05532	1.14383	1.24122	1.34874	1.46788	1.60043	1.74859
34	0.83446	0.90210	0.97594	1.05673	1.14537	1.24292	1.35062	1.46997	1.60277	1.75121
35	0.83554	0.90328	0.97722	1.05814	1.14692	1.24463	1.35251	1.47207	1.60511	1.75383
36	0.83662	0.90446	0.97851	1.05955	1.14847	1.24634	1.35440	1.47417	1.60745	1.75646
37	0.83770	0.90564	0.97980	1.06097	1.15003	1.24805	1.35630	1.47627	1.60980	1.75909
38	0.83879	0.90682	0.98110	1.06238	1.15159	1.24977	1.35820	1.47838	1.61215	1.76172
39	0.83987	0.90801	0.98239	1.06380	1.15315	1.25149	1.36010	1.48050	1.61451	1.76436
40	0.84096	0.90919	0.98369	1.06522	1.15471	1.25321	1.36201	1.48261	1.61687	1.76701
41	0.84205	0.91038	0.98499	1.06665	1.15627	1.25494	1.36391	1.48473	1.61923	1.76966
42	0.84314	0.91157	0.98629	1.06807	1.15784	1.25666	1.36583	1.48686	1.62160	1.77232
43	0.84424	0.91276	0.98759	1.06950	1.15941	1.25839	1.36774	1.48898	1.62398	1.77498
44	0.84533	0.91396	0.98890	1.07093	1.16098	1.26013	1.36966	1.49112	1.62636	1.77765
45	0.84643	0.91515	0.99020	1.07236	1.16256	1.26187	1.37158	1.49325	1.62874	1.78032
46	0.84752	0.91635	0.99151	1.07380	1.16413	1.26360	1.37351	1.49539	1.63113	1.78300
47	0.84862	0.91755	0.99282	1.07524	1.16571	1.26435	1.37544	1.49753	1.63352	1.78568
48	0.84972	0.91875	0.99414	1.07667	1.16729	1.26709	1.37737	1.49968	1.63592	1.78837
49	0.85082	0.91995	0.99545	1.07812	1.16888	1.26884	1.37930	1.50183	1.63832	1.79106
50	0.85193	0.92115	0.99677	1.07956	1.17047	1.27059	1.38124	1.50399	1.64072	1.79376
51	0.85303	0.92236	0.99808	1.08100	1.17206	1.27235	1.38318	1.50614	1.64313	1.79647
52	0.85414	0.92357	0.99941	1.08245	1.17365	1.27410	1.38513	1.50831	1.64555	1.79918
53	0.85525	0.92478	1.00073	1.08390	1.17524	1.27586	1.38708	1.51047	1.64797	1.80189
54	0.85636	0.92599	1.00205	1.08536	1.17684	1.27762	1.38903	1.51264	1.65039	1.80461
55	0.85747	0.92720	1.00338	1.08681	1.17844	1.27936	1.39098	1.51482	1.65282	1.80734
56	0.85858	0.92842	1.00471	1.08827	1.18004	1.28116	1.39294	1.51700	1.65525	1.81007
57	0.85970	0.92963	1.00604	1.08973	1.18165	1.28293	1.39490	1.51918	1.65769	1.81280
58	0.86082	0.93085	1.00737	1.09119	1.18326	1.28470	1.39687	1.52136	1.66013	1.81555
59	0.86193	0.93207	1.00871	1.09265	1.18487	1.28648	1.39884	1.52355	1.66258	1.81829
60	0.86305	0.93329	1.01004	1.09412	1.18648	1.28826	1.40081	1.52575	1.66503	1.82105

Involute Function Table

$inv\ \alpha = \tan \alpha - \alpha$

	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°
0	1.82105	1.99676	2.19587	2.42305	2.68433	2.98757	3.34327	3.76574	4.27502	4.90003
1	1.82380	1.99988	2.19941	2.42711	2.68902	2.99304	3.34972	3.77345	4.28439	4.91165
2	1.82657	2.00300	2.20296	2.43118	2.69371	2.99852	3.35619	3.78119	4.29379	4.92331
3	1.82934	2.00613	2.20652	2.43525	2.69842	3.00401	3.36267	3.78895	4.30323	4.93502
4	1.83211	2.00926	2.21008	2.43934	2.70314	3.00952	3.36918	3.79673	4.31270	4.94677
5	1.83489	2.01240	2.21366	2.44343	2.70787	3.01504	3.37570	3.80454	4.32220	4.95856
6	1.83768	2.01555	2.21724	2.44753	2.71262	3.02058	3.38224	3.81237	4.33173	4.97040
7	1.84047	2.01871	2.22083	2.45165	2.71737	3.02613	3.38880	3.83023	4.34130	4.98229
8	1.84326	2.02187	2.33442	2.45577	2.72214	3.03170	3.39538	3.82811	4.35090	4.99422
9	1.84607	2.02504	2.22803	2.45990	2.72692	3.03728	3.40197	3.83601	4.36053	5.00620
10	1.84888	2.02821	2.23164	2.46405	2.73171	3.04288	3.40859	3.84395	4.37020	5.01822
11	1.85169	2.03139	2.23526	2.46820	2.73651	3.04849	3.41523	3.85190	4.37990	5.03029
12	1.85451	2.03458	2.23889	2.47236	2.74133	3.05412	3.42188	3.85988	4.38963	5.04240
13	1.85733	2.03777	2.24253	2.47653	2.74616	3.05977	3.42856	3.86789	4.39940	5.05456
14	1.86016	2.04097	2.24617	2.48071	2.75100	3.06542	3.43525	3.87592	4.40920	5.06677
15	1.86300	2.04418	2.24983	2.48491	2.75585	3.07110	3.44197	3.88398	4.41903	5.07902
16	1.86584	2.04740	2.25349	2.48911	2.76071	3.07679	3.44870	3.89206	4.42890	5.09133
17	1.86869	2.05062	2.25716	2.49332	2.76559	3.08249	3.45545	3.90017	4.43880	5.10368
18	1.87154	2.05385	2.26083	2.49754	2.77048	3.08821	3.46222	3.90830	4.44874	5.11608
19	1.87440	1.05708	2.26452	2.50177	2.77538	3.09395	3.46902	3.91646	4.45871	5.12852
20	1.87726	2.06032	2.26821	2.50601	2.78029	3.09970	3.47583	3.92465	4.46872	5.14102
21	1.88014	2.06357	2.27192	2.51027	2.78522	3.10546	3.48266	3.93286	4.47877	5.15356
22	1.88301	2.06683	2.27563	2.51453	2.79016	3.11125	3.48952	3.94110	4.48885	5.16616
23	1.88589	2.07009	2.27935	2.51880	2.79511	3.11704	3.49639	3.94937	4.49896	5.17880
24	1.88878	2.07336	2.28307	2.52308	2.80007	3.12286	3.50328	3.95766	4.50911	5.19149
25	1.89167	2.07664	2.28681	2.52737	2.80505	3.12869	3.51020	3.96598	4.51930	5.20424
26	1.89457	2.07992	2.29055	2.53168	2.81004	3.13453	3.51713	3.97433	4.52952	5.21703
27	1.89748	2.08321	2.29430	2.53599	2.81504	3.14040	3.52408	3.98270	4.53978	5.22987
28	1.90039	2.08651	2.29807	2.54031	2.82006	3.14627	3.53106	3.99110	4.55007	5.24277
29	1.90331	2.08981	2.30184	2.54465	2.82508	3.15217	3.53806	3.99953	4.56041	5.25572
30	1.90623	2.09313	2.30561	2.54899	2.83012	3.15808	3.54507	4.00798	4.57077	5.26871
31	1.90916	2.09645	2.30940	2.55334	2.83518	3.16401	3.55211	4.01646	4.58118	5.28176
32	1.91210	2.09977	2.31319	2.55771	2.84024	3.16995	3.55917	4.02497	4.59162	5.29486
33	1.91504	2.10310	2.31700	2.56208	2.84532	3.17591	3.56625	4.03351	4.60210	5.30802
34	1.91798	2.10644	2.32081	2.56647	2.85041	3.18188	3.57335	4.04207	4.61262	5.32122
35	1.92094	2.10979	2.32463	2.57087	2.85552	3.18788	3.58047	4.05067	4.62318	5.33448
36	1.92389	2.11315	2.32846	2.57527	2.86064	3.19389	3.58762	4.05929	4.63377	5.34780
37	1.92686	2.11651	2.33230	2.57969	2.86577	3.19991	3.59478	4.06794	4.64441	5.36117
38	1.92983	2.11988	2.33615	2.58412	2.87092	3.20595	3.60197	4.07662	4.65508	5.37459
39	1.93281	2.12325	2.34000	2.58856	2.87607	3.21201	3.60918	4.08532	4.66579	5.38806
40	1.93579	2.12664	2.34387	2.59301	2.88125	3.21809	3.61641	4.09406	4.67654	5.40159
41	1.93878	2.13003	2.34774	2.59747	2.88643	3.22418	3.62366	4.10282	4.68733	5.41518
42	1.94178	2.13343	2.35162	2.60194	2.89163	3.23029	3.63094	4.11162	4.69816	5.42882
43	1.94478	2.13683	2.35551	2.60642	2.89684	3.23642	3.63823	4.12044	4.70902	5.44251
44	1.94779	2.14024	2.35941	2.61092	2.90207	3.24257	3.64555	4.12929	4.71993	5.45626
45	1.95080	2.14366	2.36332	2.61542	2.90731	3.24873	3.65289	4.13817	4.73088	5.47007
46	1.95382	2.14709	2.36724	2.61994	2.91256	3.25491	3.66026	4.14708	4.74186	5.48394
47	1.95685	2.15053	2.37117	2.62446	2.91783	3.26110	3.66764	4.15602	4.75289	5.49786
48	1.95988	2.15397	2.37511	2.62900	2.92311	3.26732	3.67505	1.16499	4.76396	5.51184
49	1.96292	2.15742	2.37905	2.63355	2.92840	3.27355	3.68248	4.17399	4.77507	5.52588
50	1.96596	2.16088	2.38300	2.63811	2.93371	3.27980	3.68993	4.18302	4.78622	5.53997
51	1.96901	2.16434	2.38697	2.64268	2.93903	3.28606	3.69741	4.19208	4.79741	5.55413
52	1.97207	2.16781	2.39094	2.64726	2.94437	3.29235	3.70491	4.20118	4.80865	5.56834
53	1.97514	2.17130	2.39492	2.65186	2.94972	3.29865	3.71243	4.21030	4.81992	5.58261
54	1.97821	2.17478	2.39891	2.65646	2.95509	3.30497	3.71998	4.21945	4.83124	5.59694
55	1.98128	2.17828	2.40291	2.66108	2.96046	3.31131	3.72755	4.22863	4.84260	5.61133
56	1.98437	2.18178	2.40692	2.66571	2.96586	3.31767	3.73514	4.23785	4.85400	5.62578
57	1.98746	2.18529	2.41194	2.67034	2.97126	3.32404	3.74275	4.24709	4.86544	5.64030
58	1.99055	2.18881	2.41497	2.67500	2.97669	3.33043	3.75039	4.25637	4.87693	5.65487
59	1.99365	2.19234	2.41901	2.67966	2.98212	3.33684	3.75806	4.26568	4.88846	5.66950
60	1.99676	2.19587	2.42305	2.68433	2.98757	3.34327	3.76574	4.27502	4.90003	5.68420