

Gr. 164
Rose Canyon.

PAST

FIELD BOOK

No. 335

Our Leather Bound Engineers Note Books are carried in the following rulings:

- No. 380 LEVEL BOOK. Left and Right Hand Page the same as Left Hand Page of this Book.
- No. 382 FIELD BOOK. Left Hand Page as in this Book, Right Hand Page 4 x 4 to the inch, Center Line Red.
- No. 384 MINING TRANSIT BOOK. Left Hand Page as in this Book, Right Hand Page 8x8 to the inch, Center Line Red.
- No. 385 FIELD BOOK. Left Hand Page as in this Book, Right Hand Page 8 vertical and 4 horizontal lines to the inch, Center Line Red.

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THE FREDERICK POST CO.
ENGINEERING and DRAFTING SUPPLIES
IRVING PARK STATION
CHICAGO, ILL.

MICROFILMED

APR 9 1965

INDEX

Cross Sections Slides

Page

10-11

10-11

05 plates

Had left

104 down instead of the

STA.	+	H.I.	-
262+00			
T.P.	12.27	333.15	1.55 320.88
+50			
261+00			
+50			
260+00			
+77.80 259+75.50 = B.C.L.			
T.P.	5.68	322.43	1.73 316.75
259+50			
	2.53	318.48	315.95

Temp B.M.
Nail in
Exc. Tree
75' H. 261+70

B.M. # 21
87' Lt.
Sta. 258+63

5.0%

-0.6 25.9	-2.7 14.36 318.79	-74 35.9 8-30-23
	333.15	
-2.8 29.0	-4.3 6.14 316.29	-78 36.5
-2.5 28.5	-5.0 8.64 313.79	-93 38.7
-0.2 28.1	-5.8 11.14 311.29	-110 42.2
+0.5 25.2	-7.3 13.64 308.79	-115 42.0
+1.1 25.5	-5.1 14.87 307.56	-127 43.8
+1.7 25.8	-3.1 16.14 306.29	-80 36.8
	322.43	

Walker
MS/High
Lecke
176 Hoon
8-30-23

continues to E.C.
lower than
0.5
Note: this side of curve is 0.5 lower than
0.5
Special: This curve has
not been instead of this

Sta.	+	H.F.	-	
265+50				
T.P.	12.78	355.21	0.69	342.43
265+00				
+50				
T.P.	12.02	343.12	2.05	331.10
264+00				
+50				
263+00				
262+50				

333.15

L.

+13.0
31.5

+11.7
30.8

+8.5
29.2

+4.9
27.4

+5.0
27.5

+4.1
27.0

+2.1
26.0

L

+7.9
18.92
336.29

+7.3
9.33
333.79

+5.4
11.83
331.29

+3.3
4.36
328.79

+1.0
6.86
324.29

-0.8
9.36
323.79

-1.3
11.86
321.29

333.15

H.

+3.6
26.2

+2.8
26.2

+0.7
25.1

+0.5
25.0

-0.4
25.4

-1.3
26.7

-3.9
30.6

Sta. + H.I. -
+30.60
269+28.30 = F.C.

269+00

+50

268+00

8.33 363.25

354.92 = B.M.

T.P. on B.M. #22, 103' L.H. sta 267+00 0.24

354.97
0.05 = diff.

+50

267+00

+50

266+00

355.21

L.A.

+6.1
28.0

+4.9
27.4

+5.3
27.6

+5.9
27.9

+6.9
28.4

+8.9
29.4

+9.6
29.8

S

cut

+4.2
3.46
353.79

+3.0
11.96
351.29

+3.8
14.46
348.79
363.25

+4.7
8.92
346.29

+5.8
11.42
343.79

+6.8
13.92
341.29

+7.9
16.42
338.79

355.21

B.F.

3

+1.6
25.6

+2.3
25.9

+2.2
25.9

+2.6
26.1

+4.2
26.9

+2.4
26.0

+3.3
26.4

STR. + H.I. -

272+50

$\frac{+6.1}{28.0}$

$\frac{+6.1}{17.28}$
370.45

$\frac{+6.8}{27.8}$

272+00

$\frac{+6.7}{28.4}$

$\frac{+6.0}{19.41}$
368.32

$\frac{+5.1}{27.3}$

T.P. 12.12 387.73 0.08 375.81

387.73

+50

$\frac{+6.6}{28.3}$

$\frac{+6.4}{9.61}$
366.08

$\frac{+5.5}{27.6}$

271+00

$\frac{+6.3}{29.6}$

$\frac{+6.3}{11.95}$
363.74

$\frac{+6.7}{28.2}$

+50 = P.V.C

$\frac{+10.0}{30.0}$

$\frac{+5.8}{14.40}$
361.29

$\frac{+6.2}{27.9}$

270+00

$\frac{+10.5}{30.3}$

$\frac{+9.1}{16.90}$
358.79

$\frac{+4.8}{27.2}$

T.P. 12.58 375.69 0.14 363.11

375.69

269+50

$\frac{+8.5}{29.2}$

$\frac{+4.6}{6.96}$
350.29

$\frac{+3.3}{26.6}$

363.25

363.25

600' V.C.

5:00%

STR. + H.I. -

276+00

+0.8
25.4

+0.1
6.52
382.49

-0.2
5
25.1

+50

+1.4
25.7

+0.1
7.93
381.08

-0.6
25.7

275+00

+2.3
26.1

+1.2
9.44
379.57

+0.5
25.0

T.P. 6.43 389.01 5.15 382.58

389.01

T.I.

+50

+4.4
27.2

+3.8
9.78
377.95

+3.6
26.6

274+00

+7.4
28.7

+8.3
11.49
376.24

+9.5
29.6

+50

+10.0
30.0

+11.9
13.31
374.42

+5.5
27.5

273+00

+6.6
28.6

+8.0
15.24
372.49

+8.9
29.2

387.73

387.73

606 V.C.

STA.	+	H.I.	-
279+50			
279+00			
+50			
T.P.	10.97	396.58	340 385.61
278+00			
+50			
277+00			
276+50=EXC		389.01	

LT.	R.	BT.
$\frac{-3.4}{30.1}$	$\frac{-3.8}{5.29}$ 391.29	$\frac{6}{-2.5}$ 28.6
$\frac{-4.1}{31.1}$	$\frac{-4.1}{4.54}$ 390.04	$\frac{-2.8}{29.0}$
$\frac{-3.7}{30.5}$	$\frac{-3.8}{7.79}$ 389.79	$\frac{-4.4}{31.6}$
	396.58	
$\frac{-2.5}{28.7}$	$\frac{-3.7}{1.47}$ 387.57	$\frac{-4.1}{30.9}$
$\frac{-1.4}{27.1}$	$\frac{-2.9}{2.72}$ 386.29	$\frac{-4.1}{30.9}$
$\frac{-0.6}{25.9}$	$\frac{-1.4}{3.57}$ 385.04	$\frac{-2.4}{28.4}$
$\frac{+0.4}{25.2}$	$\frac{+0.1}{5.22}$ 383.79	$\frac{-1.0}{26.3}$
	389.01	

2.50%

600 Y.C.

STA. + H.I. -

282+50

282+00

+50

6.79 401.77

chk. on BM #23 not in cubert

6.79 394.97

T.P. C.07 401.76

0.89 395.69

281+00 = Bkt.

+86.98

280+84 = B.C. Rt.

+50

280+00

396.58

+33
28.9

+20
26.0

+0.9
25.5

+1.1
25.5

2.50 o/p

-0.9
26.4

-3.0
29.5

+37
4.46
397.31

+2.5
5.23
396.54

+1.4
6.0
395.77

401.77

+1.6
1.54
395.04

-1.3
2.79
393.79

-2.9
4.04
392.54

396.58

7
14.2
26.9

+2.0
26.3

+2.2
25.9

+2.3
26.0

-0.4
25.4

-2.6
28.7

Note: Left side not higher than 2
right side
at corner
Rt.

5TA. + H.I.

286+00

285+50

285+00

+50

284+00

+50

TP 6.30 408.00 0.07 401.70

283+00

401.77

- 0.2
5.29
402.71

8
0.0
24.8

011.80

+ 0.4
6.07
401.93

+ 0.4
25.0

+ 1.3
25.7

+ 0.6
6.84
401.16

+ 1.6
25.6

+ 1.4
25.7

+ 2.0
7.41
400.39

+ 2.6
26.1

+ 2.6
26.3

+ 3.4
8.38
399.62

+ 3.7
26.7

+ 3.7
26.5

+ 4.3
9.15
398.85

+ 4.8
27.2

+ 3.7
26.5

+ 4.3
9.92
398.08

+ 4.8
27.2

408.00
Σ

STN.

+

H.F.

-

£

9

+52.96
288+51.92 = E.C.

288+00

+50

287+00

286+50

408.00

11.3
409.33

on Pay
10.32
407.68

on Pay
1.99
406.01

on Pay
3.66
404.34

on Paying

+0.4
4.76
403.24
408.00

+5.1
27.4

+2.5
26.1

+1.7
25.7

+1.2
25.4

+0.5
25.1

Walker.
Bliss
Muller.
Stearns 5-10-30

Cross Section of Slide
Set. Sta. 30+50. And 31+23
Sections on Radial 4172

Station 30+50 original (see P. 10)

Station	Transit H.I.	Vert A	Slope dist.	Horiz. dist.	Elev Ground
					38.37
30+69.22	50.5	+37°44'	62	49'	88.5
" " "	50.5	+29°30'	54'	47'	77.2
" " "	50.5	0°0'	28'	29'	50.5
30+80	50.8	0°0'	29	29'	50.8
" " "	50.8	+18°36'	46'	43.6	65.5
" " "	50.8	+30°55'	59'	50.6	81.1
" " "	50.8	+33°42'	70.7	59	90.3
" " "	50.8	+38°09'	81.2	63.7	100.8
30+88	50.7	+38°07'	84.0	66	102.7
" " "	50.7	+33°58'	74.2	61.3	91.7
" " "	50.7	+30°00'	63.0	54.5	82.2
" " "	50.7	+26°10'	58.0	52	76.2
" " "	50.7	+19°50'	44.3	41.4	65.7
" " "	50.7	0°0'		38'	50.7
31+00	50.6	0°0'		28'	50.6
" " "	50.6	+22°48'	49.7	46	70.1
" " "	50.6	+25°42'	57.3	51.4	75.6
" " "	50.6	+30°31'	65.6	57	84.1
" " "	50.6	+33°24'	74.0	62	91.3
" " "	50.6	+38°43'	85.4	66.3	103.6
31+09	50.5	+38°25'	74.4	58	96.5
" " "	50.5	+26°23'	51.3	45.7	73.0
" " "	50.5	+21°08'	48.0	44.8	67.5

Temp.
S.V. Frank
in file
5/4 31+00

Station	H.I. Transit	Vert A	Slope dist.	Horiz.	10 Elev.
31+09	50.5	0°0'		38.7	50.5
31+20	50.8	0°0'		28.8	50.8
" " "	50.8	+17°38'	40.4	38	62.8
" " "	50.8	+33°02'	50.4	42	77.8
" " "	50.8	+40°06'	62.8	48	91.3
31+28	51.0	+40°11'	61.2	46.6	96.0
" " "	51.0	0°0'		28	51.0
30+50	50.5	+36°58'	56.8	45.4	84.7 ✓
" " "	50.5	0°0'		29'	50.5

Walker
Blair
Metcalf
Osborne, 11.30

CROSS SECTION SLIDE

bet Sta. 229+56 and Sta. 230+55

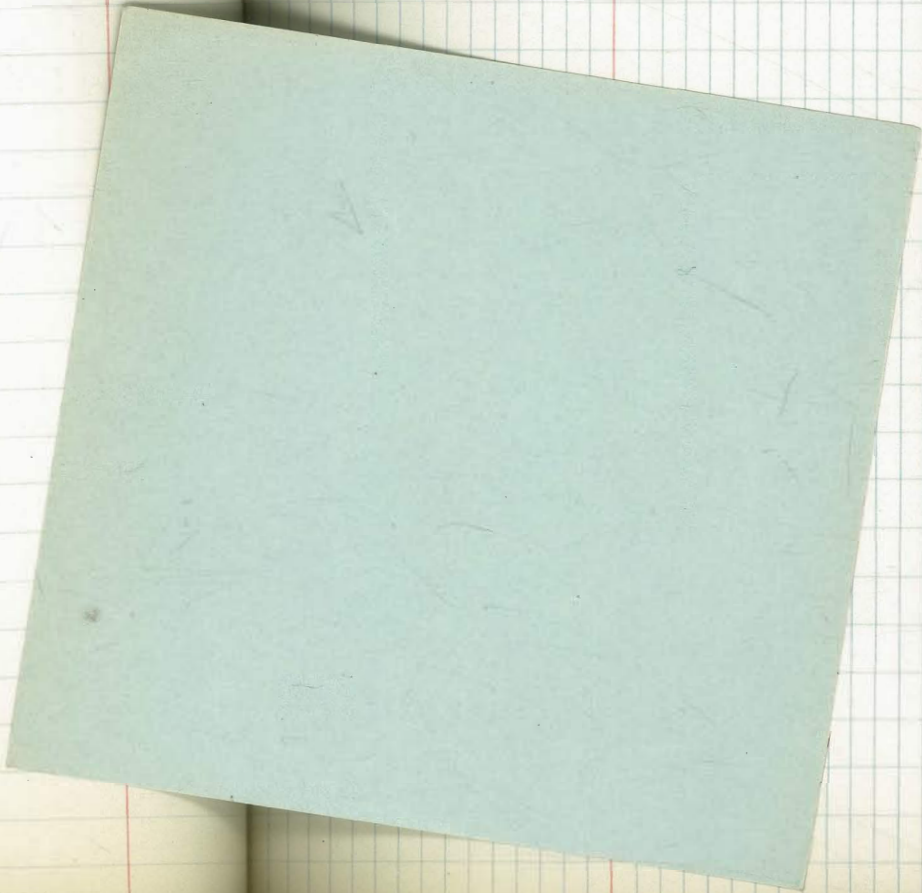
Sections on radial line

Station	TRANSIT	Vert A	Slope	Horiz.	Elev. Ground
229+56	238.5	+45° 28'	82.6	58'	97.3
" "	238.5	0° 00'		28'	238.5
229+92	238.6	+45° 03'	79.8	56.5	95.1
" "	238.6	+30° 53'	56.0	48.0	67.3
" "	238.6	+25° 22'	45.0	40.5	58.1
" "	238.6	0° 0'		29.0	238.6
229+86	238.7	0° 0'		33.0	238.7
" "	238.7	+16° 56'	46.3	44.0	52.2
" "	238.7	+23° 10'	56.3	51.5	60.7
" "	238.7	+43° 12'	78.0	58.0	91.2
229+98	238.8	+39° 06'	74.0	57.4	85.8
" "	238.8	+24° 11'	60.4	55	63.3
" "	238.8	0° 0'		32.0	238.8
230+03	238.7	0° 0'		32.0	238.7
" "	238.7	+19° 4'	49.5	47	55.2
" "	238.7	+26° 03'	62.0	56	65.7
" "	238.7	+30° 12'	71.0	61.5	74.1
" "	238.7	+36° 51'	79.0	63	86.2
" "	238.7	+37° 10'	85.0	69	90.2
230+16	238.7	+37° 49'	83.0	65.5	89.7
" "	238.7	+30° 27'	69.0	59.5	73.7
" "	238.7	+37° 49'	59.5	53	66.7
" "	238.7	+18° 07'	46'	44	52.7
" "	238.7	+12° 54'	36.8	36	47.0
" "	238.7	0° 0'		30'	238.7

11 Ground Elev.

Station	Transit	Vert A	Slope	Horiz.	Ground Elev.
230+28	238.8	0° 0'		29.5	238.8
" "	238.8	+7° 32'	38'	34.5	43.8
" "	238.8	+20° 17'	53'	50.0	57.3
" "	238.8	+37° 22'	67'	53	77.3
" "	238.8	+37° 39'	79'	63	86.8
230+43	238.7	+39° 24'	65'	50	79.7
" "	238.7	+13° 51'	41.8	41	48.7
" "	238.7	0° 0'		29.0	238.7
230+52	238.7	0° 0'		29.0	238.7
" "		+39° 58'	63.5	48.7	79.5

238.8
53
238.5



67

DIRECTIONS FOR USE OF TABLES

TABLE No. 1.

Distance of slope stake from side or shoulder stake for any width roadway, slope $1\frac{1}{2}$ to 1. If ground is nearly level, the cut or fill at side stake is located by the double entry method in left column and top row. The number in body

of table in same row and column gives distance from side stake to slope stake. If ground is not

IMPROVED TABLES

AND

INFORMATION

TABLE No. 2.

To find Tangent and External for curve of any other degree, divide by degree of curve and add correction found in column of corrections.

Degree of curve with a given L may be found by dividing tangent (or external), opposite L by given tangent (or external).

The distance from a point on the tangent to the curve is very nearly the square of the tangent length divided by twice the radius.

TABLE II—Continued
TRIGONOMETRIC FORMULAE (continued)

In any triangle:

Given a, b, C; to find c, B, A.

Use Law of Tangents.

Given A, B, c; to find a, b, C.

Use Law of Sines.

Given a, b, c; to find A, B, C.

$$\text{Let } \frac{a+b+c}{2} = s, \sqrt{\frac{(s-a)(s-b)(s-c)}{s}} = r$$

$$\cos \frac{1}{2} A = \sqrt{\frac{s(s-a)}{bc}}$$

$$\tan \frac{1}{2} A = \frac{r}{s-a}$$

$$\tan \frac{1}{2} B = \frac{r}{s-b}$$

$$\tan \frac{1}{2} C = \frac{r}{s-c}$$

Area of a triangle:

$$\text{Area} = \frac{1}{2} ab \sin C$$

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

PRISMOIDAL FORMULA.

$$\text{Vol} = \frac{h}{6} (E + b + 4M)$$

h = altitude; b, B = bases; M = midsection

TABLE III
INCHES AND FRACTIONS OF AN INCH IN DECIMALS OF A FOOT

	0	1	2	3	4	5	6	7	8	9	10	11
$\frac{1}{16}$	.0052	.0885	.1719	.2552	.3385	.4219	.5052	.5885	.6719	.7552	.8385	.9219
$\frac{1}{8}$	.0104	.0938	.1771	.2604	.3438	.4271	.5104	.5938	.6771	.7604	.8438	.9271
$\frac{3}{16}$	.0156	.0990	.1823	.2656	.3490	.4323	.5156	.5990	.6823	.7656	.8490	.9323
$\frac{1}{4}$	.0208	.1042	.1875	.2708	.3542	.4375	.5208	.6042	.6875	.7708	.8542	.9375
$\frac{5}{16}$	.0260	.1094	.1927	.2760	.3594	.4427	.5260	.6094	.6927	.7760	.8594	.9427
$\frac{3}{8}$	.0313	.1146	.1979	.2813	.3646	.4479	.5313	.6146	.6979	.7813	.8646	.9479
$\frac{7}{16}$	.0365	.1198	.2031	.2865	.3698	.4531	.5365	.6198	.7031	.7865	.8698	.9531
$\frac{1}{2}$	.0417	.1250	.2083	.2917	.3750	.4583	.5417	.6250	.7083	.7917	.8750	.9583
$\frac{9}{16}$	.0469	.1302	.2135	.2969	.3803	.4635	.5469	.6302	.7135	.7969	.8802	.9635
$\frac{5}{8}$	.0521	.1354	.2188	.3021	.3854	.4688	.5521	.6354	.7188	.8021	.8854	.9688
$\frac{11}{16}$	.0573	.1406	.2240	.3073	.3906	.4740	.5573	.6406	.7240	.8073	.8906	.9740
$\frac{3}{4}$	.0625	.1458	.2292	.3125	.3958	.4792	.5625	.6458	.7292	.8125	.8958	.9792
$\frac{13}{16}$	.0677	.1510	.2344	.3177	.4010	.4844	.5677	.6510	.7344	.8177	.9010	.9844
$\frac{7}{8}$	.0729	.1563	.2396	.3229	.4063	.4896	.5729	.6563	.7396	.8229	.9063	.9896
$\frac{15}{16}$	.0781	.1615	.2448	.3281	.4115	.4948	.5781	.6615	.7448	.8281	.9115	.9948
1	.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167	1.000
	0	1	2	3	4	5	6	7	8	9	10	11

TABLE IV
USEFUL RELATIONS

Lineal feet	×.00019	= miles
Lineal yards	×.0006	= miles
Square inches	×.007	= square feet
Square feet	×.111	= square yards
Square yards	×.0002067	= acres
Acres	×4840	= square yards
Cubic inches	×.00058	= cubic feet
Cubic feet	×.03704	= cubic yards
Links	×.22	= yards
Links	×.66	= feet
Feet	×1.5	= links
360° = 21600' = 1296000"		
Radius = arc of 57.2957790°		
Arc of 1° (radius = 1) = .017453292		
Arc of 1' (radius = 1) = .000290888		
Arc of 1" (radius = 1) = .000004848		

$$\pi = 3.141592654 \quad \sqrt{\frac{1}{4}} = 0.564190$$

$$\frac{\pi}{4} = 0.785398163 \quad \sqrt[3]{\frac{6}{\pi}} = 1.240700982$$

$$\frac{\pi}{6} = 0.523598776 \quad \pi^2 = 9.869604401$$

$$\sqrt{\frac{4}{\pi}} = 1.128379167 \quad \frac{1}{\pi^2} = 0.101321184$$

$$\frac{\pi}{6} = 0.523598776 \quad \sqrt{\pi} = 1.772453851$$

$$\frac{4\pi}{3} = 4.188790205 \quad \frac{1}{\pi} = 0.3183099$$

Curvature of Earth's surface = about 0.7 feet in 1 mile

Curvature in feet = 0.667 (Dist. in miles)²

Difference between arc and chord length, 0.05 feet in 11½ miles

$$\text{Probable error of a single observation} = 0.6754 \sqrt{\frac{Mv^2}{n-1}}$$

Error in chaining of 0.01 feet in 100 feet:

Due to—

1. Length of tape error of 0.01 feet
2. Alignment. One end 1.4 feet out of line
3. Sag of tape at centre of 0.61 feet.
4. Temperature difference of 15°
5. Difference of pull of 15 lbs.

STADIA REDUCTION FORMULAE.

Horizontal Distance = R - R sin² a + C cos a

Vertical Distance = R ½ sin 2 a + C sin a

R = Reading × $\frac{\text{distance from Object glass to cross hairs}}{\text{distance between cross hairs}}$

C = distance from Object glass to cross hairs + distance from Object

glass to center of instrument.

a = angle of elevation for mid Reading

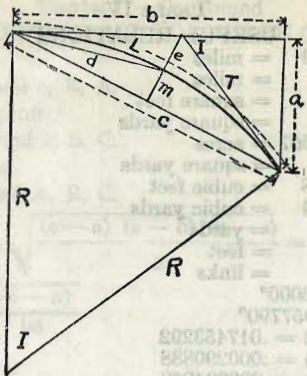


TABLE V
 CURVE FORMULAE FOR SIMPLE CURVES

COMPILED BY J. CALVIN LOCKE, C.E.

- (1) $c = \sqrt{2Ra}$ (2) $c = \sqrt{a^2 + b^2}$
- (3) $c = \sqrt{2R(R - \sqrt{(R+b)(R-b)})} = \sqrt{2R(R - \sqrt{R^2 - b^2})}$
- (4) $c = 2\sqrt{m(2R - m)}$
- (5) $c = 2R \sin \frac{1}{2} I$ (6) $c = 2T \cos \frac{1}{2} I$
- (7) $e = R \text{ exsec } \frac{1}{2} I$
- (8) $e = R \tan \frac{1}{2} I \tan \frac{1}{4} I$ (9) $e = T \tan \frac{1}{4} I$
- (10) $b = \sqrt{a(2R - a)}$
- (11) $b = \sqrt{\left(c + \frac{c^2}{2R}\right)\left(c - \frac{c^2}{2R}\right)} = \sqrt{c^2 - \frac{c^4}{4R^2}}$
- (12) $b = R \sin I$ (13) $b = a \cot \frac{1}{2} I$
- (14) $R = \frac{a^2 + b^2}{2a} = \frac{c^2}{2a}$ (15) $R = \frac{d^2}{2m} = \frac{c^2 + 4m^2}{8m}$
- (16) $d = \sqrt{R(2R - \sqrt{(2R+c)(2R-c)})} = \sqrt{R(2R - \sqrt{4R^2 - c^2})}$
- (17) $d = \sqrt{2Rm}$ (18) $d = 2R \sin \frac{1}{4} I$ (19) $m = \frac{d^2}{2R}$
- (20) $m = R \mp \sqrt{\left(R + \frac{c}{2}\right)\left(R - \frac{c}{2}\right)} = R \mp \sqrt{R^2 - \frac{c^2}{4}}$
- (21) $m = R \text{ vers } \frac{1}{2} I$ (22) $m = R \sin \frac{1}{2} I \tan \frac{1}{4} I$ (23) $m = \frac{1}{2} c \tan \frac{1}{4} I$
- (24) $a = \frac{c^2}{2R}$ (25) $a = R - \sqrt{(R+b)(R-b)} = R - \sqrt{R^2 - b^2}$
- (26) $a = 2R(\sin^2 \frac{1}{2} I)$ (27) $a = R \text{ vers } I$ (28) $a = R \sin I \tan \frac{1}{2} I$
- (29) $a = b \tan \frac{1}{2} I$ (30) $a = T \sin I$ (31) $T = R \tan \frac{1}{2} I$
- (32) $I = \frac{L}{R} \times 57.295780$ (33) $R = \frac{L}{I} \times 57.295780$
- (34) $L = IR \times 0.01745329$ (35) $L = \frac{8d - c}{3}$
- (36) Area Seg. = $\frac{LR - R^2 \sin I}{2} = \frac{LR - Rb}{2}$

TABLE VI
 SINES, COSINES, TANGENTS, COTANGENTS

deg.	sin 0'	tan 0'	sin 10'	tan 10'	sin 20'	tan 20'	sin 30'	tan 30'	sin 40'	tan 40'	sin 50'	tan 50'	sin 60'	tan 60'
0	0000	0000	0029	0029	0058	0058	0087	0087	0116	0116	0145	0145	0175	0175
1	175	0175	0204	0204	0233	0233	0262	0262	0291	0291	0320	0320	0349	0349
2	349	349	378	378	407	407	436	437	465	466	494	495	523	523
3	523	524	552	553	581	582	610	612	640	641	669	670	706	706
4	698	699	727	729	756	758	785	787	814	816	843	845	885	885
5	872	875	901	904	929	934	958	963	987	992	1016	1022	1064	1064
6	1045	1051	1074	1080	1103	1110	1132	1139	1161	1169	1190	1198	1245	1245
7	219	228	248	257	279	287	305	317	334	346	363	376	402	402
8	392	405	421	435	449	465	478	495	507	524	536	554	588	588
9	564	584	593	614	622	644	650	673	679	703	708	733	780	780
10	736	763	765	793	794	823	822	853	851	883	880	914	979	979
11	908	944	937	974	965	2004	994	2035	2022	2065	2051	2095	2258	2258
12	2079	2126	2108	2156	2136	186	2164	217	193	247	221	278	317	317
13	250	309	278	339	306	370	334	401	363	432	391	462	520	520
14	419	493	447	524	476	555	504	586	532	617	560	648	722	722
15	588	679	616	711	644	742	672	773	700	805	728	836	957	957
16	756	867	784	899	812	931	840	962	868	994	896	3026	73	73
17	924	3057	952	3089	939	3121	3007	3153	3035	3185	3062	217	72	72
18	3090	249	3118	281	3145	314	173	346	201	378	228	411	71	71
19	256	443	283	476	311	508	338	541	365	574	393	607	70	70
20	420	640	448	673	475	706	502	739	529	772	557	805	69	69
21	584	839	611	872	638	906	665	939	692	973	719	4006	68	68
22	746	4040	773	4074	800	4108	827	4142	854	4176	881	210	67	67
23	907	245	934	279	961	314	987	348	4014	383	4041	417	66	66
24	4067	452	4094	487	4120	522	4147	557	173	592	200	628	65	65
25	226	663	253	699	279	734	305	770	331	806	358	841	64	64
26	384	877	410	913	436	950	462	986	488	5022	514	5059	63	63
27	540	5095	563	5132	592	5169	617	5206	643	243	669	280	62	62
28	695	317	720	354	746	392	772	430	797	467	823	505	61	61
29	848	543	874	581	899	619	924	658	950	696	975	735	60	60
30	5000	774	5025	5812	5050	851	5075	890	5100	930	5125	969	59	59
31	150	6009	175	6048	200	6088	225	6128	250	6168	275	6208	58	58
32	299	249	324	289	348	330	5373	371	398	412	422	453	57	57
33	446	494	471	536	495	577	519	619	544	661	568	703	56	56
34	592	745	616	787	640	830	664	873	688	916	712	959	55	55
35	736	7002	760	7046	783	7089	807	7133	831	7177	854	7221	54	54
36	878	265	901	310	925	355	948	400	972	445	995	490	53	53
37	6018	536	6041	581	6065	627	6088	673	6111	720	6134	766	52	52
38	157	813	180	860	202	907	225	954	248	8002	271	8050	51	51
39	293	8098	316	8146	338	8195	361	8243	383	292	406	342	50	50
40	428	391	450	441	472	491	494	541	517	591	539	642	49	49
41	561	693	583	744	604	796	626	847	648	899	670	952	48	48
42	691	9004	713	9057	734	9110	756	9163	777	9217	799	9271	47	47
43	820	325	841	380	862	435	884	490	905	545	926	601	46	46
44	947	657	967	713	988	770	7009	827	7030	884	7050	942	45	45
45	7071	1.0000	7092	1.0058	7112	1.0117	133	1.0176	153	1.0235	173	1.0295	44	44
deg.	60'	60'	50'	50'	40'	40'	30'	30'	20'	20'	10'	10'	cos	cot

Sta	Rel	Elev.
30780	50	455
188	50	455
31400	50	455
19	51	454
120	49	456
118	48	457

22746 3

510
57
459

1274
874

DATE
PER
PER

NEE