43

Keuffel & Esser Company

GRUMMAN
NAVY

82 0022

Field Book

50% rag paper
32 pages

4 5/8" x 7 1/4"

NYSDEC 065410

CURVE FORMULAS

$T = R \tan \frac{1}{2} I$	$R = T \cot. \frac{1}{2} I$	Chord def. $= \frac{\text{chord}^2}{R}$
$T = \frac{50 \tan \frac{1}{2} I}{\text{Sin. } \frac{1}{2} D}$	$R = \frac{50}{\text{Sin. } \frac{1}{2} D}$	No. chords $= \frac{I}{D}$
$\text{Sin. } \frac{1}{2} D = \frac{50}{R}$	$E = R \text{ ex. sec } \frac{1}{2} I$	
$\text{Sin. } \frac{1}{2} D = \frac{50 \tan \frac{1}{2} I}{T}$	$E = T \tan \frac{1}{4} I$	Tan. def. $= \frac{1}{2}$ chord def.

The square of any distance, divided by twice the radius, will equal the distance from tangent to curve, very nearly.

To find angle for a given distance and deflection.

Rule 1. Multiply the given distance by .01745 (def. for 1° for 1 ft.) and divide given deflection by the product.

Rule 2. Multiply given deflection by 57.3, and divide the product by the given distance.

To find deflection for a given angle and distance. Multiply the angle by .01745, and the product by the distance.

GENERAL DATA

RIGHT ANGLE TRIANGLES. Square the altitude, divide by twice the base. Add quotient to base for hypotenuse.

Given Base 100, Alt. $10.10^2 \div 200 = .5$. $100 + .5 = 100.5$ hyp.

Given Hyp. 100, Alt. $25.25^2 \div 200 = 3.125$. $100 - 3.125 = 96.875 =$ Base.

Error in first example, .002; in last, .045.

To find Tons of Rail in one mile of track: multiply weight per yard by 11, and divide by 7.

LEVELING. The correction for curvature and refraction, in feet and decimals of feet is equal to $0.574\,d^2$, where d is the distance in miles. The correction for curvature alone is closely, $\frac{2}{3}d^2$. The combined correction is negative.

PROBABLE ERROR. If d_1, d_2, d_3, etc. are the discrepancies of various results from the mean, and if Σd^2 = the sum of the squares of these differences and n = the number of observations, then the probable error of the mean $= \pm 0.6745 \sqrt{\frac{\Sigma d^2}{n(n-1)}}$

MINUTES IN DECIMALS OF A DEGREE

1′	.0167	11′	.1833	21′	.3500	31′	.5167	41′	.6833	51′	.8500
2	.0333	12	.2000	22	.3667	32	.5333	42	.7000	52	.8667
3	.0500	13	.2167	23	.3833	33	.5500	43	.7167	53	.8833
4	.0667	14	.2333	24	.4000	34	.5667	44	.7333	54	.9000
5	.0833	15	.2500	25	.4167	35	.5833	45	.7500	55	.9167
6	.1000	16	.2667	26	.4333	36	.6000	46	.7667	56	.9333
7	.1167	17	.2833	27	.4500	37	.6167	47	.7833	57	.9500
8	.1333	18	.3000	28	.4667	38	.6333	48	.8000	58	.9667
9	.1500	19	.3167	29	.4833	39	.6500	49	.8167	59	.9833
10	.1667	20	.3333	30	.5000	40	.6667	50	.8333	60	1.0000

INCHES IN DECIMALS OF A FOOT

1-16	3-32	1/8	3-16	1/4	5-16	3/8	7/16	1/2	9/16	5/8	11/16
.0052	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625	.0729	
1	2	3	4	5	6	7	8	9	10	11	
.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167	

NYSDEC 065411

12/3 Chris M

3:37 I went looking for the drillers that were supposed to be installing the temporary wells on the "Number Straits" to the E of the plant site, N. of the RR tracks. I didn't see them or any evidence of well installation

12/4/92 [illegible signature]

9:05 Signed in at Main Gate

Fred Ramsey - Halliburton
Kevin K. Imarti - Halliburton

9:30 Fred told me two piezometers have been installed (#1 + #2) screened at water table 51 to 61 piezometer #2 was installed yesterday

Fred said that the Delta rig that is going to be putting in the products well will not be running today and that there was a problem getting permission from the town to put the temp. wells in the "Number Streets" area

9:35 leave grumman plant auto

1/13/92 [illegible signature]

Z 10:20 ARRIVE AT GRUMMAN SECURITY OFFICE TO SIGN IN

10:40 Arrive at drilling site between plant 3 and the RR tracks to the south.

Denis Lubrano - helper }
Mike Polyzman - driller } [illegible]

Kevin Killmartin - Hollister

THE 10-12' of HN 24-I Z
Sample collected 1X 8oz bottle
1X 16oz bottle [illegible]
head space

20-22 7-18-14-19
1 ft recovery
Tan MedC sand some well rounded gravel (mostly quartz), dry
bottles filled, same as 10-12

1/13/92 CM

Weather

lt rain

Wind from East ≈ 5 mph

≈ 35°F

11:28 ~~35'~~ 36 DARK BROWN SAND

COMING UP IN CUTTINGS

30-32 11:36

24 26 21 24

1ft recovery

Tan to med Brown M+C sand

w/ some well rounded gravel, dry.

gravel is mostly quartz

Bottles filled sell 10-12

11:49 I asked Kevin to do a

headspace on some of

the cuttings in a baggie

(to keep the HNU out of the

rain) he agreed to this.

1/13/92 cm

12:00

40-42 12-50-$\frac{100}{5''}$

± 8" Recovery

Tan M to C sand w/ some well rounded gravel, dry. Gravel is mostly quartz

12:12 Drillers break for lunch. I am going to check on GM-35D2

Weather - Drizzel, 36°

12:30 ⇒ 100 at GM-35D2

±1:00 Return to Grumman Security Booth to make ~~toll~~ telephone calls

±2:00 Return to site HN-24 I2. Work is in progress. The work being done today is a test boring w/ 3 1/4 ID Auger

NYSDEC 065416

11/13/92 CM

the auger and do 100' and a spoon is being driven. Kevin said he did the headspace for the samples from 10 to 42' BG and that the 10 to 12' sample showed 3 ppm w/ an HNU. All the other samples gave no reponse ~~The 10 to 12' samples~~ ~~were~~ retained. The 8oz both from the 10 to 12' sample was retained for Lab analysis

2:33

100-102

1 foot recovery

Top 6" Log

3" ~~Red~~ Red VF to M sand w/ mica flakes, 1/8" streaks of pink clay

Bottom 3" Orangish Tan VF to M sand w/ mica flakes, 1/8" of orange clay

Saturated. 1 X 16oz head space jar filled.

6/13/92 cm

2:35 Drilling terminated off. Mike P makes phone calls

3:18 Per Kevin the bentonite on the 100 to 102 sample was non-detect.

There is about 2' of heave in the auger at 110'. Mike Pellegrino bailed it out w/ a sand bailer.

3:43 110-112 (bottles filled see 100-102)

± 1.5 feet recovery

± Top 7" Tan and orange VF to M sand laminated with tannish gray plastic clay laminations on ± 1/8 to 1/16" thick

± 1" Tannish gray plastic clay

± bottom 4" Tan VF to M sand laminated w/ Orange VF to M sand. Laminations ± 1/8 to 1/16" thick

1/13/92 CM

4:21 120-122' Interbedded
Red, tan, orange and gray
~~clay~~ VF to F sand
some silt, trace clay. Not
plastic, Not Dilatent. beds
from 1" to 1/16" thick. Saturated
Driller says formation is
tight
- bottles filled see 100 to 102 -

4:47 Mike has done the 130 to 132'
spoon. There is heave
in the augers and Mike
is ~~stopping~~ having a hard
time getting it back (sand
locks)

5:08 130 to 132
8" Rec.
Top 4" ~~F~~ Orange F to C
sand, trace pebbles, well

1/13/92 OMM

rounded, quartz and sandstone ?

Bottom 4" lt gray VF sand w/ trace clay

Bottle filled 1 X 8OZ JAR
1 X 16OZ Headspace

Drillers + Kevin are packing up for the night. Kevin will be shipping the Lab sample from the 10 to 12' spoon tonight along w/ a trip blank + rinsate blank. I asked him about him holding the 130 to 132 sample overnight + he said that if he ships it off site within 48 hours of sampling, it will meet QAQC standards as long as it is kept on ice

5:20 I'm leaving, the borehole is secure (Auger attached to top drive of F-10)

				1/13/92
	5:22	110-112	}	HNU HEADSPACE
		120-122	}	NO RESPONCE
		130-132	}	FOR ALL

1/14/92 Chm M

7:50 Signed in at the security booth

8:07 Arrive at the site of HN 24 I2. The drillers are not here.

Weather - ≈30°F. There was freezing rain earlier this morning and driving is treacherous. It is currently cloudy and the wind is from the north at ≈3 to 5 MPH.

AN NUS EMPLOYEE WAS HERE WHEN I ARRIVED (STAN CONTI)

8:50 KEVIN KILLMARTIN - HALLIBURTON NUS
STAN CONTI - " "
STILL NO DRILLERS

9:04 Drillers Arrive
Mike Pellegreno - Driller } Delta
Denis Lubrano - Helper }
A truck from Henrich Equipment Co. Delivers screens + casing

NYSDEC 065422

1/14/92 cm

9:30 Rig is Runny
Drilling begins

HN-24I2

10:24
140-142
2 9" RECOVERY
Top 3" Reddish Tan UF Sand
3" Lt. Grey UF Sand
Bottom 3" Orang F sand.
Bottles filled 1X 8OZ JAR
1X16 OZ HEADSPACE JAR

11:27 150-152
2 1/4 Recovery
Top 3/4" Pinkish Tan Clay
Bottom 1 1/4" Tan and Orange
UF to F sand.
Bottles filled 3X 8OZ JAR
1X 16OZ HEADSPACE JAR
THE HEADSPACE JAR WAS FILLED FROM THE "WASH" PORTION OF THE SPOON (ABOVE THE CLAY) BECAUSE THE 3 LARGER 8 OZ BOTTLES REQUIRED ALL THE VOLUME OF UNDISTURBED

1/14/92 cm

FORMATION IN THE SPOON

11:40 KEVIN AND STAN COLLECT A RINSE WATER BLANK FROM THE [redacted] DECONED SAMPLING EQUIPMENT

Mike told Kevin that the auger "hooped up" [redacted] after 150' and got out of whatever caused it by 158

12:42
160-162 1 foot Recovery [redacted]
Tan VF-to F sand, slight [redacted] mottling with red VF-to F sand.

12:54 Added 5' Auger

1:16 "CHRIS" FROM DELTA IS LOGGING THE ISOTE-MOLE. THE BAKA LOGGING RIG CONSISTS OF A SONTICATION METER ON A CABLE THAT HAS 2½ foot

1/14/92 cm

INCREMENTS MARKED ON IT.
THE ~~METER~~ SOND IS POSITIONED
BY HAND AND THE METER
MEASURES HOW LONG IT TAKES
FOR 100 COUNTS. THIS DATA IS
graphed by hand.

1:20 leave site to get lunch
1:40 return to site
1:54 Gamma logging completed

2:40 The gamma log doesn't show much clay (unlike HAN-24-I)
There is a peak at ±70'BG, ±150'BG
~~[redacted]~~ a small one at
±160'BG. Kevin wants to
screen at 150 to 160'. This
is consistent w/ HAN-24-I and
is within a sandy zone.

The drillers are beginning to
pull up the 3¼ ID augers.

3:00 I leave to make phone calls

1/14/93 CM

3:38 THE LEAD AUGER IS OUT. THE MAX DEPTH WAS 165'6" SOME OF THE FLYTES ON THE LEAD AUGER HAD A LIGHT GREY CLAY ON THEM. THIS IS CONSISTENT W/ THE GAMMA LOG THAT SHOW ~~WERE~~ A HIGH COUNT AT THE BOTTOM OF THE CORE

4:15 Kevin says that the Headspace HNU readings for 140-142 and 150-152 were Non ~~detect~~ detect and for 160 to 162 it was 30 ppm. Kevin wants to get this interval in the screen zone, I agree

4:20 leaving site.

1/15/92 [illegible]

Arrive at site ≈ 8125 sign in
Arrive at recharge basin 838
Kevin Killmartin } Halliburton NUS
Sten Conti

Kevin + Sten are taking water level measurements in prep for step drawdown test.

Depth to water.

53.76 HN-26 I

52.6? HN-26 S

9140 Data logger set up at HN 26 S and I
The shallow well is almost dry. IT has 0.04' water column according to the M-Scope ~ 0.09' water column according to the transducer

NYSDEC 065427

9:50 1/5/92 CM

PW-1 (Pump Well-1) & HN27I2

W.L. = 56.95' Below the top of the mouse trap (hole holding up the pump

HN-27I ~~[illegible]~~

WL = 56.50' BTOC (inner casing)

HN-27-5

WL = 53.94' BTOC

Rich - Delete (pump apparatus)

10:34

Well by WL = 53.75 BTOC

Center of ~~[illegible]~~ Monument yard (P1)

Pump started at 10:46 (10:45 NYS TIME)

1/15/92 cm

10:50 Rich checked a riser at the discharge to a storm sewer for the pumping rate and the water column so he increased the pump rate

10:55 rate measured at 393 gpm (10' column)

~~5'~~ 5 1/8" at 11:01
(Pump was throttled back

10:51 P-1 53.83

12:02 NAMOMETER MEASURED AT 5" BY STAN
(288 gpm

1/15/92 cm

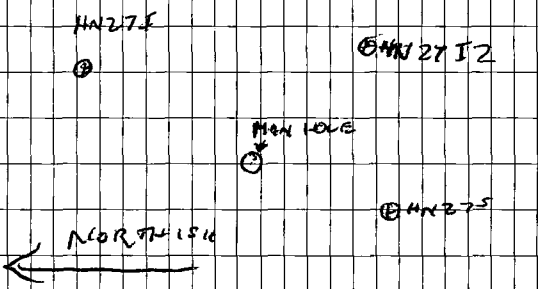
12:35 pumping rate increased
Nanometer = 8 1/8"
(8" = 350 gpm)

1:03 54.10

DTW of P-1 = 54.10 BTOC

1:15 Nanometer reads 8 1/4"

1:42 THERE IS AN ABANDONED
(FILLED ?) MANHOLE ABOUT
1/2 WAY BETWEEN HN 27S
AND HN 27-I



1/15/92 cm

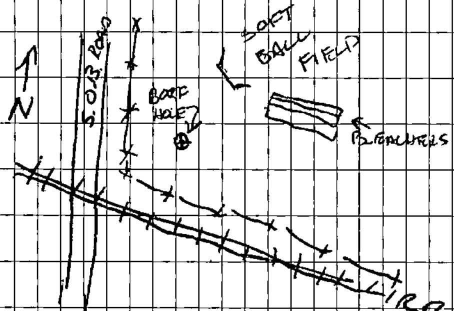
THE MAN HOLE IS A STEEL RING CEMENTED INTO THE GROUND. THERE IS NO COVER

2:40 LEFT SITE

5/5/95

Arrived at Bellpage 7:30
Signed in. Told by Guard that
my "contact" will be Tammy Roy.

8:00 Rig set up inside of fence at the North east corner
of South oyster bay road and
and the LIRR Tracks



~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ||| - Small Auger
≈ 3¼" ID = 33 flights

MARK MENGAL - NUS
BOB DEVINA JR } Delta
JOEY

5/5 cont

HHH HHH HHH HHH HHH HHH III large
Auger x 6 3/4" = 33 flights

8:30 Drill rig running

8:49 after fooling w/
the UNU (no power to probe for
some reason) and fixing it
Mike began setting
borehole

9:13 Drillers have left to get
coffee. B is at 49'
~ 9:30 Driller return. Turn on water

9:45 Water is coming from a
hydrant on the N.W. corner of
the intersection of S. Oyster Bay
road + the LIRR.

Drillers are preparing to take
sample from 49' to 51' BG

5/5 cm

Samples will be taken w/ 2" split spoon & a down hole hammer (it slides like cable tool jars) on a cable.

10:08 There was a rock in the end of the spoon. Joe will drill down to 50' and try again.

* ALL HNU READINGS FROM SPOONS ARE HEADSPACE

50-52 - 10:20?
3-4-12-35-58 1' Rec
Lt Orange Tan and LT Grey VF to F Sand trace silt + mica flakes (muscovite) - DRY HNU = PEAK 8ppm, STEADY 5ppm
MAGOTHY FORMATION
10:23

10:30 Mike took HNU of auger 1ppm

10:35 57' TO H_2O

55-61 11-15-18-43 10:37
Lt TANISH ORANGE, LT PINK + LT GREY
INTERBEDDED VF TO F SAND
1' RECOVERY WET

NYSDEC 065434

5/5 cm

69-71 10:52

14-10 8-3

3' RECOVERY

T. 1.5' TAN FROM SAND TRACE SILT

B. 1.5' ORANGEISH TAN MED C SAND TRACE SILT & VC SAND, ROUNDED

1 foot of "wash" on top of spoon

11:00 Mike takes BKG of auger = 1ppm

11:02 59-61 BKG = 5ppm

79-81 8-16-27-29 11:10

18" Recovery Interlayered LT Grey and Tan VF Sandy Silt & Silty VF Sand w/ some laminations of grey sandy clay

5/5 cm

89-91 10-12-5-0

11:20 HNU = 0ppm on Hole

89-91 11:23

1" RECOVERY

TOP 9.5" Greyish Tan

UF + FSand trace silt

Bottom 2.5" Greyish tan +

Lt pink UF sandy clay

11:27 69-71 minus 2ppm

11:42 ~~[illegible]~~ -0- HNU

99-101 11-14-29-48 -WASH

11:42 79-81 HNU = Negative reading

11:56 2nd Try to get a sample at 99 to 101 11-14-19-17

NYSDEC 065436

5/5 cm

94-101 12:02
1' Recovery VF to F Tan silt & Gray Sand w/ minor interbedded sandy clay some streaks of red.

89 to 91 ANU - Negative reading at 12:08

12:10 Tested ANU w/ sharpie and it only responded 2 or 3 ppm in spite of pegging the meter.

12:23 Mike is having trouble w/ the ANU. The plug from the probe seems to be damaged and does not fit well on the main body of the meter.

94-100 Negative reading on ANU at 12:26

NYSDEC 065437

5/5 cm

105 - 111

15-21-25-41 12:33

LT Gry VF to F Sand, 1.5' Recovery
all the spoons wash.

HNU

14:04 110 - 112 - 0 ppm
120 - 122 - 0 ppm
130 - 132 - 0 ppm
135 - 137 - 0 ppm
140 - 142 - 1 ppm

120' LT Brn Sand w/ Mica Recovery
Sand (med Sand) (14.00 hrs)
poor recovery 0.3'

130' 0.5' Recovery LT Brn F Sand w/
mica & trace silt (14:25 hrs

135' (14.55 hrs)

140' same (15:15 hrs)

Note: after the drillers broke for lunch
(12:30) I called the office and

explained the trouble w/ the NUS HNU. I then called the Regional office in Stonybrook and arranged to pick up an HNU from them. I drove to Stony Brook and picked up the instrument (3PD) and then drove back to grumman (arrived @ 11:00) Mike + I did headspace on soil samples that had been saved in the shade (no ice) (see preceding pages) Mike had a flat on his rental car so I had helped him by it to a gas station earlier in the afternoon, and after w/ boarded his equipment back to his storage area and then the State Truck I dropped him off at the gas station to pick up his car.

5/7/95 [illegible signature]

Arrived at plant 7:45 + signed in at security booth

8:00 Arrived at site of borehole

1.45→147' LT BRN SAND (7:45am) (Per Mike)

150-152 10-12-20-23 8:26 am

1.5' Recov
T 1.2' Wash
B 0.3' Tan + LT Gry VF-F Sand w/ Trace silt + mica flakes wet

8:54

HNU	NUS INST	DEC INST
145→147	5 ppm	0 ppm
150→152	5 ppm	0 ppm

NYSDEC 065440

5/7 am

155-157 16-14-20-17
2' Recovery
T. 1.0' Wash
B 1.0' LT Tanish
Gray VF to F sand

9:18 HNU Taken at top of augers
0 - ppm

10:00
160-162 VF to F Orangeish Brn Sand
Trace Silt & M sand

The sand has been heaving in the borehole the driller says that he saw some clay blobs in the stuff from the sand bailer

HNU - 2nd Try on the DEC inst
145→147 0 ppm 10:08 AM
150→152 0 ppm " "
HNU — NUS — DEC —
155→157 - ppm | 0 ppm 10:11

5/7 cm

Note: All the HNU readings taken today w/ the DEC instrument have been taken after the NUS instrument had been used & had pierced the tin foil covering the headspace jars. This may be an explanation of why the NUS meter & DEC meter do not agree.

10:23 called story book office from Security Bldg & got permission to keep the HNU for the rest of the day

10:30 Returned call to [illegible] of DOH

10:50 Return to Borehole

11:00 HNU 160-162 0.1 ppm

11:10 Drillers having problem w/ the cable that the sand bailer is attached to. They [illegible] stop to

5/7 am

repair

12:25 Repair of cable is coming to an end. Joe (the diver) is complaining of a piece of debris in his eye. We tried to wash it out w/ saline solution but it didn't work. I told him to go get it looked at not to leave it in. Then he said "Yeah, I know."

12:35 Rig is running again. Sand blasting in area

Vicki "Chi" from DEC showed up at the site ≈ 11:45 to do the gamma log. The borehole was not yet complete

1:20 A split spoon has been driven but the spoon & w.i. the hammer are sand locked. Joe is getting frustrated.

5/7 cm

1:23 rig shut off. Joe calls his "people" on radio for instructions

1:28 rig started again

2:05 still stuck rig off. I suggested to Joe that a dummie be put down next to the spoon & water cranked down next to it & the spoon pulled but he said that there wasnt ~~enough~~ enough room.

250 Spoon is still stuck. Rig is shut off. I'm leaving to bring Region 1's HNU back to Stony Brook. I asked Mike to fax a copy of the Gamma log to Central OFFICE and to have Dave Brayack call John Barns at the end of the day today.

5/7 am

5:20 Drive past site of borehole on S. Oyster Bay Road. Nobody is there so I'm going home.

3/27/96

10:00 John Barnes & Dan Evans arrive at Plant 16

10:30 We are escorted to Site 2 by Al Tarantino.

Excavating preceding - 4 trucks (25 yds) ⇒ hauling loads to Farmingdale rail yd ⇒ then to Utah

11:05 - A truck was just loaded w/ soil. As it turned around a big cloud of dust was created which blew east. It advised Al and Craig (Foster-Wheeler) that dust suppression actions must be taken. The loading area will be dampened.

3/27/96
Lynn Miles - F/W -

± 150 septic pits
composite lower ten feet
TCLP + RCRA
bottom two feet + two feet of
native material: field tested

J Barnes given tour of field test
lab set-up.

11:45 Return to Site 2 -
Workers on lunch.

12:15 - 12:45 lunch.
I gave Dan a tour of area.
(Grumman - from outside of plant)

1:05 - Additional water
being poured on soil in
truck loading zone

NYSDEC 065447

3/27/96

There is a question of whether decon system hooked to municipal or grumman. Navy to look into this. I am concerned that F/W could be deconning trucks w/contaminated water.

J Barnes to call Al Taormino tomorrow regarding above issue.

2:10 J Barnes and D. Evans leave site

John Barnes

Rejection Refined in Hunt RI
WP Frank Schaff July 17, 1989

914-427-2957
Bill Schmick

GB 450 → 530
715 → 1030
13 + 1625

13 BN 8.00

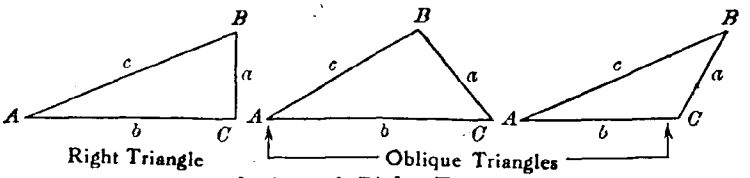
John Ulm
7:45

56-757 4078

Bch 444-0385
Bch 444-0388

Nanette Gray 458.6343

TRIGONOMETRIC FORMULAS



Solution of Right Triangles

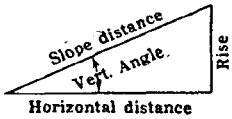
For Angle A. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\operatorname{cosec} = \frac{c}{a}$

Given	Required	
a, b	A, B, c	$\tan A = \frac{a}{b} = \cot B,\ c = \sqrt{a^2 + b^2} = a\sqrt{1 + \frac{b^2}{a^2}}$
a, c	A, B, b	$\sin A = \frac{a}{c} = \cos B,\ b = \sqrt{(c+a)(c-a)} = c\sqrt{1 - \frac{a^2}{c^2}}$
A, a	B, b, c	$B = 90° - A,\ b = a \cot A,\ c = \frac{a}{\sin A}$
A, b	B, a, c	$B = 90° - A,\ a = b \tan A,\ c = \frac{b}{\cos A}$
A, c	B, a, b	$B = 90° - A,\ a = c \sin A,\ b = c \cos A$

Solution of Oblique Triangles

Given	Required	
A, B, a	b, c, C	$b = \frac{a \sin B}{\sin A},\ C = 180° - (A + B),\ c = \frac{a \sin C}{\sin A}$
A, a, b	B, c, C	$\sin B = \frac{b \sin A}{a},\ C = 180° - (A + B),\ c = \frac{a \sin C}{\sin A}$
a, b, C	A, B, c	$A + B = 180° - C,\ \tan \frac{1}{2}(A - B) = \frac{(a-b)\tan \frac{1}{2}(A+B)}{a+b},\ c = \frac{a \sin C}{\sin A}$
a, b, c	A, B, C	$s = \frac{a+b+c}{2},\ \sin \frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{bc}},\ \sin \frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{ac}},\ C = 180° - (A+B)$
a, b, c	Area	$s = \frac{a+b+c}{2},\ \text{area} = \sqrt{s(s-a)(s-b)(s-c)}$
A, b, c	Area	$\text{area} = \frac{bc \sin A}{2}$
A, B, C, a	Area	$\text{area} = \frac{a^2 \sin B \sin C}{2 \sin A}$

REDUCTION TO HORIZONTAL



Horizontal distance = Slope distance multiplied by the cosine of the vertical angle. Thus: slope distance = 319.4 ft. Vert. angle = 5° 10′. Since cos 5° 10′ = .9959, horizontal distance = 319.4 × .9959 = 318.09 ft.

Horizontal distance also = Slope distance minus slope distance times (1 − cosine of vertical angle). With the same figures as in the preceding example, the following result is obtained. Cosine 5° 10′ = .9959. 1 − .9959 = .0041. 319.4 × .0041 = 1.31. 319.4 − 1.31 = 318.09 ft.

When the rise is known, the horizontal distance is approximately the slope distance less the square of the rise divided by twice the slope distance. Thus: rise = 14 ft., slope distance = 302.6 ft. Horizontal distance = $302.6 - \frac{14 \times 14}{2 \times 302.6} = 302.6 - 0.32 = 302.28$ ft.

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