FIELD BOOK

KEUFFEL & ESSER CO.


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Since 1867 K&E equipment and materials have been partners of the draftsman, the engineer, the surveyor and the scientist in shaping the modern world.

Whatever your needs, whether drawing instruments, papers, cloths, slide rules, surveying equipment, measuring tapes—in fact anything for the drafting room, for reproduction or for work in the field—think first of K&E.
9/17/71 Sheep Mtn
Top jointed 55 ft - N75W
38° NE
0 to 20 - Green Shaley 55 ft/
20 to 51 - Yellow to cream
Yielded 55 ft 97% w/2% Glencore
51 to 56 - Yellow heavy
carbonate rock (summit height)
then in line material
bed to 3 1/2
56 to line slope 60° up
Bottom of dolite
20° slope 60°
0 to 20' red shale etc.
0.5° 20°
20' to 100' covered
100' to 116' covered
116' yellow brown carbonate
CURVE FORMULAS

\[
\begin{align*}
T &= R \tan \frac{1}{I} \\
T &= \frac{50 \tan \frac{1}{I}}{\sin \frac{1}{D}} \\
\sin \frac{1}{D} &= \frac{50}{R} \\
\sin \frac{1}{D} &= \frac{50 \tan \frac{1}{I}}{T}
\end{align*}
\]

\[
\begin{align*}
R &= T \cot \frac{1}{I} \\
R &= \frac{50}{\sin \frac{1}{D}} \\
E &= R \cos \sec \frac{1}{I} \\
E &= T \tan \frac{1}{I}
\end{align*}
\]

Chord def. = \( \frac{\text{chord}^2}{R} \)

No. chords = \( \frac{1}{D} \)

Tan. def. = \( \frac{1}{1} \) chord def.

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

To find angle for a given distance and deflection.

Rule 1. Multiply the given distance by .01745 (def. for \( \frac{1}{100} \) for 1 ft.) and divide given deflection by the product.

Rule 2. Multiply given distance 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 \( \div 200 = 0.5 \), 100 + 0.5 = 100.5 hyp.

Given Hyp. 100, Alt. 25.25 \( \div 200 = 1.25 \), 100 + 1.25 = 101.25 hyp.

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

To find tons of rail in one mile of track: multiply weight per yard by 14, 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, \( \frac{\pi d^2}{2} \). 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 \( \Sigma d^2 \) is the sum of the squares of these differences and \( n \) is the number of observations, then the probable error of the mean = 

\[
\pm \frac{0.6745 \sqrt{\Sigma d^2}}{\sqrt{n(n-1)}}
\]

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' | .9000 |
| 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

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TRIGONOMETRIC FORMULAS

Solution of Right Triangles

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

Given \( a, b \) Required \( A, B, c \)

\[ \tan A = \frac{a}{b} = \cot B, c = \sqrt{a^2 + b^2} = \sqrt{1 + \frac{b^2}{a^2}} \]

Solution of Oblique Triangles

Given \( A, B, a \) Required \( c, B, A \)

\[ \sin A = \frac{a}{c} = \cos B, b = \sqrt{(c-a)(c-a)} = c \sqrt{1 - \frac{a^2}{c^2}} \]

Area \( \frac{1}{2} \sin A \cdot \sin B \cdot \sin C = \frac{1}{2} \sin \frac{A-B}{2} \sin \frac{A+B}{2} \)

Area \( \frac{1}{2} \sin A \cdot \sin B \cdot \sin C = \frac{1}{2} \sin \frac{A-B}{2} \sin \frac{A+B}{2} \)

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 \( \cos 5° 10' = .9999 \), horizontal distance = 319.4 \( \times .9999 = 318.09 \) 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 = \( \frac{302.6 - 14 \times 14}{2 \times 302.6} = 302.6 - 0.32 = 302.28 \) ft.