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Photogrammetry and Stadia Surveying Formulas

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List of 28 Photogrammetry and Stadia Surveying Formulas

Photogrammetry and Stadia Surveying

1) Fore Bearing in Whole Circle Bearing System

Open Calculator

fx $$FB = \left(BB - \left(180 \cdot \frac{\pi}{180}\right)\right)$$

ex $$50.85841\text{rad} = \left(54\text{rad} - \left(180 \cdot \frac{\pi}{180}\right)\right)$$

2) Included Angle from Two Lines

Open Calculator

fx $$\theta = \alpha - \beta$$

ex $$60^\circ = 90^\circ - 30^\circ$$

3) Included Angle when Bearings are Measured in Opposite Side of Common Meridian

Open Calculator

fx $$\theta = \beta + \alpha$$

ex $$120^\circ = 30^\circ + 90^\circ$$

4) Included Angle when Bearings are Measured in Same Side of Different Meridian

Open Calculator

$$\theta = \left(180 \cdot \frac{\pi}{180}\right) - (\alpha + \beta)$$

$$60^\circ = \left(180 \cdot \frac{\pi}{180}\right) - (90^\circ + 30^\circ)$$

5) Magnetic Bearing given True Bearing with East Declination

Open Calculator

$$MB = TB - MD$$

$$55^\circ = 60^\circ - 5^\circ$$

6) Magnetic Bearing given True Bearing with West Declination

Open Calculator

$$MB = TB + MD$$

$$65^\circ = 60^\circ + 5^\circ$$

7) Magnetic Declination to East

Open Calculator

$$MD = TB - MB$$

$$5^\circ = 60^\circ - 55^\circ$$

8) Magnetic Declination to West

Open Calculator

$$MD = MB - TB$$

$$-5^\circ = 55^\circ - 60^\circ$$

9) Magnetic Declination to West for Compass Surveying

Open Calculator

fx $$MD = MB - TB$$

ex $$-5^\circ = 55^\circ - 60^\circ$$

10) True Bearing if Declination is in East

Open Calculator

fx $$TB = MB + MD$$

ex $$60^\circ = 55^\circ + 5^\circ$$

11) True Bearing if Declination is in West

Open Calculator

fx $$TB = MB - MD$$

ex $$50^\circ = 55^\circ - 5^\circ$$

Photogrammetry

12) Elevation of Point, Line or Area

Open Calculator

fx $$h_1 = \left(H - \left(\frac{f_{len}}{P}\right)\right)$$

ex $$9m = \left(11m - \left(\frac{4.2m}{2.1}\right)\right)$$

13) Flying Height of Airplane above Datum

Open Calculator

fx $$H = \left(\left(\frac{f_{len}}{P}\right) + h_1\right)$$

ex $$11\text{m} = \left(\left(\frac{4.2\text{m}}{2.1}\right) + 9\text{m}\right)$$

14) Focal Length of Lens given Photo Scale

Open Calculator

fx $$f_{len} = (P \cdot (H - h_1))$$

ex $$4.2\text{m} = (2.1 \cdot (11\text{m} - 9\text{m}))$$

15) Photo Scale given Focal Length

Open Calculator

fx $$P = \left(\frac{f_{len}}{H - h_1}\right)$$

ex $$2.1 = \left(\frac{4.2\text{m}}{11\text{m} - 9\text{m}}\right)$$

Stadia Surveying

16) Additive Constant or Stadia Constant

Open Calculator

fx $$C = (f + D_c)$$

ex $$10\text{m} = (2\text{m} + 8\text{m})$$

17) Distance Equation given Index Error

Open Calculator

$$D = \left(K_M \cdot \frac{s_i}{m - e}\right) + C_{add}$$

$$35.5\text{m} = \left(12 \cdot \frac{3\text{m}}{3.1 - 1.5}\right) + 13$$

18) Horizontal Distance between Center of Transit and Rod

Open Calculator

$$H_{Horizontal} = \left(K \cdot R_i \cdot (\cos(a))^2\right) + (fc \cdot \cos(a))$$

$$26.90396\text{m} = \left(11.1 \cdot 3.2\text{m} \cdot (\cos(30^\circ))^2\right) + (0.3048\text{m} \cdot \cos(30^\circ))$$

19) Horizontal Distance using Gradienter

Open Calculator

$$D = s_i \cdot \frac{100 \cdot \cos(x)^2 \cdot 0.5 \cdot \sin(2 \cdot x)}{m \cdot c}$$

$$10.98572\text{m} = 3\text{m} \cdot \frac{100 \cdot \cos(20^\circ)^2 \cdot 0.5 \cdot \sin(2 \cdot 20^\circ)}{3.1 \cdot 2.5\text{m}}$$

20) Intercept on Rod between Two Sighting Wires

Open Calculator

fx $$R = \frac{D_s}{\left(\frac{f}{R_i}\right) + C}$$

ex $$6.023529\text{m} = \frac{64\text{m}}{\left(\frac{2\text{m}}{3.2\text{m}}\right) + 10\text{m}}$$

21) Stadia Distance from Instrument Spindle to Rod

Open Calculator

fx $$D_s = R \cdot \left(\left(\frac{f}{R_i}\right) + C\right)$$

ex $$63.75\text{m} = 6\text{m} \cdot \left(\left(\frac{2\text{m}}{3.2\text{m}}\right) + 10\text{m}\right)$$

22) Stadia Interval

Open Calculator

fx $$S_i = m \cdot P_{screw}$$

ex $$15.5\text{m} = 3.1 \cdot 5\text{m}$$

23) Staff Intercept

Open Calculator

fx $$s_i = D \cdot (\tan(\theta_1) - \tan(\theta_2))$$

ex $$3.982713\text{m} = 35.5\text{m} \cdot (\tan(25^\circ) - \tan(19.5^\circ))$$

24) Staff Intercept in Gradienter given Horizontal Distance

Open Calculator

fx $$s_i = \frac{D}{\frac{100 \cdot \cos(x)^2 \cdot 0.5 \cdot \sin(2 \cdot x)}{m \cdot c}}$$

ex $$9.6944\text{m} = \frac{35.5\text{m}}{\frac{100 \cdot \cos(20^\circ)^2 \cdot 0.5 \cdot \sin(2 \cdot 20^\circ)}{3.1 \cdot 2.5\text{m}}}$$

25) Staff Intercept in Gradienter given Vertical Distance

Open Calculator

fx $$s_i = \frac{V}{\frac{100 \cdot \sin(2 \cdot x) \cdot 0.5 \cdot \sin(x)^2}{m \cdot c}}$$

ex $$8.245573\text{m} = \frac{4\text{m}}{\frac{100 \cdot \sin(2 \cdot 20^\circ) \cdot 0.5 \cdot \sin(20^\circ)^2}{3.1 \cdot 2.5\text{m}}}$$

26) Vertical Distance between Center of Transit and Rod Intersected by Middle Horizontal Crosshair

Open Calculator

fx $$V = \frac{1}{2 \cdot ((K \cdot R_i \cdot \sin(2 \cdot a)) + (fc \cdot \sin(a)))}$$

ex $$0.016174\text{m} = \frac{1}{2 \cdot ((11.1 \cdot 3.2\text{m} \cdot \sin(2 \cdot 30^\circ)) + (0.3048\text{m} \cdot \sin(30^\circ)))}$$

27) Vertical Distance between Instrument Axis and Lower Vane

Open Calculator

fx $$V = D \cdot \tan(\theta_2)$$

ex $$12.57121\text{m} = 35.5\text{m} \cdot \tan(19.5^\circ)$$

28) Vertical Distance using Gradienter

Open Calculator

fx $$V = s_i \cdot \frac{100 \cdot \sin(2 \cdot x) \cdot 0.5 \cdot \sin(x)^2}{m \cdot c}$$

ex $$1.455326\text{m} = 3\text{m} \cdot \frac{100 \cdot \sin(2 \cdot 20^\circ) \cdot 0.5 \cdot \sin(20^\circ)^2}{3.1 \cdot 2.5\text{m}}$$

Variables Used

- **a** Vertical Inclination of Line of Sight *(Degree)*
- **BB** Back Bearing *(Radian)*
- **c** Distance in One Turn *(Meter)*
- **C** Stadia Constant *(Meter)*
- C_{add} Additive Constant
- **D** Distance between Two Points *(Meter)*
- D_c Distance from Center *(Meter)*
- D_s Stadia Distance *(Meter)*
- **e** Index Error
- **f** Focal Length of Telescope *(Meter)*
- f_{len} Focal Length of Lens *(Meter)*
- **FB** Fore Bearing *(Radian)*
- **fc** Instrument Constant *(Meter)*
- **H** Flying Height of Airplane *(Meter)*
- h_1 Elevation of Point *(Meter)*
- $H_{Horizontal}$ Horizontal Distance *(Meter)*
- **K** Stadia Factor
- K_M Multiplying Constant
- **m** Revolution of Screw
- **MB** Magnetic Bearing *(Degree)*
- **MD** Magnetic Declination *(Degree)*
- **P** Photo Scale
- P_{screw} Pitch Screw *(Meter)*

- **R** Intercept on Rod *(Meter)*
- $\mathbf{R_i}$ Rod Intercept *(Meter)*
- $\mathbf{s_i}$ Staff Intercept *(Meter)*
- $\mathbf{S_i}$ Stadia Interval *(Meter)*
- **TB** True Bearing *(Degree)*
- **V** Vertical Distance *(Meter)*
- **x** Vertical Angle *(Degree)*
- **α** Fore Bearing of Previous Line *(Degree)*
- **β** Back Bearing of Previous Line *(Degree)*
- **θ** Included Angle *(Degree)*
- $\mathbf{\theta_1}$ Vertical Angle to Upper Vane *(Degree)*
- $\mathbf{\theta_2}$ Vertical Angle to Lower Vane *(Degree)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- Function: **sin**, sin(Angle)
  Trigonometric sine function
- Function: **tan**, tan(Angle)
  Trigonometric tangent function
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Angle** in Radian (rad), Degree (°)
  Angle Unit Conversion

Check other formula lists

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