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Levelling Formulas

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List of 23 Levelling Formulas

Levelling

1) Angle of Dip for Compass Surveying

Open Calculator

fx $$\theta = \frac{D}{R} \cdot \left(\frac{180}{\pi}\right)$$

ex $$18.29507^\circ = \frac{35.5\text{m}}{6370} \cdot \left(\frac{180}{\pi}\right)$$

2) Back Sight given Height of Instrument

Open Calculator

fx $$BS = HI - RL$$

ex $$36\text{m} = 65\text{m} - 29\text{m}$$

3) Combined Error Due to Curvature and Refraction

Open Calculator

fx $$c\_r = 0.0673 \cdot D^2$$

ex $$84.81482\text{m} = 0.0673 \cdot (35.5\text{m})^2$$

4) Correction on Refraction Error

Open Calculator

fx $$c_r = 0.0112 \cdot D^2$$

ex $$14.1148 = 0.0112 \cdot (35.5\text{m})^2$$

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5) Difference in Elevation between Ground Points in short lines under Trigonometric levelling

Open Calculator

fx $$\Delta h = D_p \cdot \sin(M) + h_i - h_t$$

ex $$50.6452\text{m} = 80\text{m} \cdot \sin(37^\circ) + 22\text{m} - 19.5\text{m}$$

6) Difference in Elevation between Two Points using Barometric Levelling

Open Calculator

fx $$D_p = 18336.6 \cdot (\log 10(h_i) - \log 10(h_t)) \cdot \left(1 + \frac{T_1 + T_2}{500}\right)$$

ex $$2058.222\text{m} = 18336.6 \cdot (\log 10(22\text{m}) - \log 10(19.5\text{m})) \cdot \left(1 + \frac{8^\circ\text{C} + 17^\circ\text{C}}{500}\right)$$

7) Distance between Two points under Curvature and Refraction

Open Calculator

fx $$D = \left(2 \cdot R \cdot c + \left(c^2\right)\right)^{\frac{1}{2}}$$

ex $$35.49642\text{m} = \left(2 \cdot 6370 \cdot 0.0989 + \left((0.0989)^2\right)\right)^{\frac{1}{2}}$$

8) Distance for small errors under Curvature and Refraction

Open Calculator

fx $$D = \sqrt{2 \cdot R \cdot c}$$

ex $$35.49628\text{m} = \sqrt{2 \cdot 6370 \cdot 0.0989}$$

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9) Distance to Visible Horizon

Open Calculator

fx $$D = \sqrt{\frac{h}{0.0673}}$$

ex $$35.53873\text{m} = \sqrt{\frac{85\text{m}}{0.0673}}$$

10) Error Due to Curvature Effect

Open Calculator

fx $$c = \frac{D^2}{2 \cdot R}$$

ex $$0.098921 = \frac{(35.5\text{m})^2}{2 \cdot 6370}$$

11) Height of Instrument

Open Calculator

fx $$HI = RL + BS$$

ex $$49\text{m} = 29\text{m} + 20\text{m}$$

12) Height of Observer

Open Calculator

fx $$h = 0.0673 \cdot D^2$$

ex $$84.81482\text{m} = 0.0673 \cdot (35.5\text{m})^2$$

13) Permissible Closing Error for Accurate Levelling

Open Calculator

fx $$e = 12 \cdot \sqrt{D}$$

ex $$71.49825\text{m} = 12 \cdot \sqrt{35.5\text{m}}$$

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14) Permissible Closing Error for Ordinary Levelling

Open Calculator

fx $e = 24 \cdot \sqrt{D}$

ex $142.9965\text{m} = 24 \cdot \sqrt{35.5\text{m}}$

15) Permissible Closing Error for Precise Levelling

Open Calculator

fx $e = 4 \cdot \sqrt{D}$

ex $23.83275\text{m} = 4 \cdot \sqrt{35.5\text{m}}$

16) Permissible Closing Error for Rough Levelling

Open Calculator

fx $e = 100 \cdot \sqrt{D}$

ex $595.8188\text{m} = 100 \cdot \sqrt{35.5\text{m}}$

17) Reduced Level given Height of Instrument

Open Calculator

fx $RL = HI - BS$

ex $45\text{m} = 65\text{m} - 20\text{m}$

Sensitiveness of Level Tube

18) Angle between Line of Sights given Radius of Curvature

Open Calculator

fx $\alpha = n \cdot \frac{l}{R_C}$

ex $0.084507\text{rad} = 9 \cdot \frac{2\text{mm}}{213\text{mm}}$

19) Angle between Line of Sights in Radians

Open Calculator

$$\alpha = \frac{s_i}{D}$$

$$0.084507\text{rad} = \frac{3\text{m}}{35.5\text{m}}$$

20) Distance from Instrument to Staff given Angle between LOS

Open Calculator

$$D = \frac{s_i}{\alpha}$$

$$37.5\text{m} = \frac{3\text{m}}{0.08\text{rad}}$$

21) Number of Division where Bubble Moves given Staff Intercept

Open Calculator

$$n = s_i \cdot \frac{R_C}{l \cdot D}$$

$$9 = 3\text{m} \cdot \frac{213\text{mm}}{2\text{mm} \cdot 35.5\text{m}}$$

22) Radius of Curvature of Tube

Open Calculator

$$R_C = n \cdot l \cdot \frac{D}{s_i}$$

$$213\text{mm} = 9 \cdot 2\text{mm} \cdot \frac{35.5\text{m}}{3\text{m}}$$

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23) Staff Intercept given Angle between LOS

Open Calculator

fx $s_i = \alpha \cdot D$

ex $2.84\text{m} = 0.08\text{rad} \cdot 35.5\text{m}$

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Variables Used

- **BS** Back Sight *(Meter)*
- **c** Error due to Curvature
- **c_r** Refraction Correction
- **c_r** Combined Error *(Meter)*
- **D** Distance between Two Points *(Meter)*
- **D_p** Distance between Points *(Meter)*
- **e** Closing Error *(Meter)*
- **h** Height of Observer *(Meter)*
- **h_i** Height of point A *(Meter)*
- **h_t** Height of point B *(Meter)*
- **HI** Height of Instrument *(Meter)*
- **l** One Division Length *(Millimeter)*
- **M** Measured Angle *(Degree)*
- **n** Number of Division
- **R** Earth Radius in km
- **R_C** Radius of Curvature *(Millimeter)*
- **RL** Reduced Level *(Meter)*
- **s_i** Staff Intercept *(Meter)*
- **T_1** Temperature at Lower Ground Level *(Celsius)*
- **T_2** Temperature at Higher level *(Celsius)*
- **α** Angle between LOS *(Radian)*
- **Δh** Elevation Difference *(Meter)*
- **θ** Dip Angle *(Degree)*

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Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **log10**, log10(Number)
  Common logarithm function (base 10)
- Function: **sin**, sin(Angle)
  Trigonometric sine function
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Meter (m), Millimeter (mm)
  Length Unit Conversion
- Measurement: **Temperature** in Celsius (°C)
  Temperature Unit Conversion
- Measurement: **Angle** in Degree (°), Radian (rad)
  Angle Unit Conversion

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- **Levelling Formulas**

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