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Measurement of Distance with Tapes Formulas

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List of 24 Measurement of Distance with Tapes Formulas

Measurement of Distance with Tapes

Correction for Temperature and Measurements on Slope

1) Correction to be Subtracted from Slope Distance

Open Calculator

fx $$C_h = (s \cdot (1 - \cos(\theta)))$$

ex $$1.029958\text{m} = (10.993\text{m} \cdot (1 - \cos(25^\circ)))$$

2) Correction to be Subtracted from Slope Distance given difference in Elevation

Open Calculator

fx $$C = \frac{(\Delta H)^2}{2 \cdot s}$$

ex $$10.23379\text{m} = \frac{(15\text{m})^2}{2 \cdot 10.993\text{m}}$$

3) Measured Length given Correction to be Subtracted from Slope Distance

Open Calculator

fx $$s = \left(\frac{C_h}{1 - \cos(\theta)} \right)$$

ex $$10.99344\text{m} = \left(\frac{1.03\text{m}}{1 - \cos(25^\circ)} \right)$$

4) Measured Length given Temperature Correction

Open Calculator

fx $$s = \left(\frac{C_t}{0.0000065 \cdot (T_f - t)} \right)$$

ex $$10\text{m} = \left(\frac{0.00078\text{m}}{0.0000065 \cdot (22^\circ\text{C} - 10^\circ\text{C})} \right)$$

5) Temperature Correction to Measured Length

Open Calculator

fx $$C_t = (0.000065 \cdot (T_f - t))$$

ex $$0.00078\text{m} = (0.000065 \cdot (22^\circ\text{C} - 10^\circ\text{C}))$$

Correction for Tension and Sag to Measured Length

6) Sag Correction of Unsupported Tape

Open Calculator

$$C_s = \frac{\left(W^2\right) \cdot \left(U_l^3\right)}{24 \cdot \left(P_i^2\right)}$$

$$4.271484\text{m} = \frac{\left((3\text{kg/m})^2\right) \cdot \left((9\text{m})^3\right)}{24 \cdot \left((8\text{N})^2\right)}$$

7) Tape Cross-Sectional Area for Tension Correction to Measured Length

Open Calculator

$$A = \left(\left(P_f - P_i\right) \cdot s\right) \cdot \frac{100000}{C_p \cdot E_s}$$

$$4.166051\text{m}^2 = \left(\left(11.1\text{N} - 8\text{N}\right) \cdot 10.993\text{m}\right) \cdot \frac{100000}{4.09\text{m} \cdot 200000\text{MPa}}$$

8) Tape Elasticity Modulus given Tension Correction to Measured Length

Open Calculator

$$E_s = \left(\left(P_f - P_i\right) \cdot s\right) \cdot \frac{100000}{C_p \cdot A}$$

$$200290.9\text{MPa} = \left(\left(11.1\text{N} - 8\text{N}\right) \cdot 10.993\text{m}\right) \cdot \frac{100000}{4.09\text{m} \cdot 4.16\text{m}^2}$$

9) Tape Weight given Sag Correction of Unsupported Tape

Open Calculator

fx $$W = \left(\frac{C_s \cdot 24 \cdot \left(P_i^2 \right)}{U_l^3} \right)^{\frac{1}{2}}$$

ex $$2.99983\text{kg/m} = \left(\frac{4.271\text{m} \cdot 24 \cdot \left((8\text{N})^2 \right)}{(9\text{m})^3} \right)^{\frac{1}{2}}$$

10) Tension Correction to Measured Length

Open Calculator

fx $$C_p = \left(((P_f - P_i) \cdot s) \cdot \frac{100000}{A \cdot E_s} \right)$$

ex $$4.09595\text{m} = \left(((11.1\text{N} - 8\text{N}) \cdot 10.993\text{m}) \cdot \frac{100000}{4.16\text{m}^2 \cdot 200000\text{MPa}} \right)$$

Orthometric Correction

11) Departure given Distance in Feet

Open Calculator

fx $$C_f = 0.0239 \cdot (F)^2$$

ex $$80.31404\text{ft} = 0.0239 \cdot (105\text{ft})^2$$

12) Departure given Distance in Kilometers

Open Calculator

$$C_m = 0.0785 \cdot (K)^2$$

$$706.5\text{m} = 0.0785 \cdot (3.0\text{km})^2$$

13) Displacement given Distance in Feet

Open Calculator

$$R_f = 0.0033 \cdot (F)^2$$

$$11.08939\text{ft} = 0.0033 \cdot (105\text{ft})^2$$

14) Displacement given Distance in Kilometers

Open Calculator

$$R_f = 0.011 \cdot (D)^2$$

$$11.72539\text{ft} = 0.011 \cdot (0.57\text{km})^2$$

15) Displacement given Distance in Miles

Open Calculator

$$R_f = \frac{0.093 \cdot (M)^2}{5280}$$

$$12.29925\text{ft} = \frac{0.093 \cdot (11.5\text{mi})^2}{5280}$$

Slope Corrections

16) Horizontal Distance in Slope Measurements

Open Calculator

fx $$R = L \cdot \cos(x)$$

ex $$1.879385\text{m} = 2\text{m} \cdot \cos(20^\circ)$$

17) Horizontal offset given Slope Correction for Slopes of 10 Percent or Less

Open Calculator

fx $$\Delta H = (2 \cdot U_l \cdot Cs)^{\frac{1}{2}}$$

ex $$15.87451\text{m} = (2 \cdot 9\text{m} \cdot 14\text{m})^{\frac{1}{2}}$$

18) Slope Correction for Slopes Greater than 10 Percent

Open Calculator

fx $$Cs = \left(\frac{h^2}{2 \cdot U_l}\right) + \left(\frac{h^4}{8 \cdot U_l^3}\right)$$

ex $$14.28618\text{m} = \left(\frac{(13\text{m})^2}{2 \cdot 9\text{m}}\right) + \left(\frac{(13\text{m})^4}{8 \cdot (9\text{m})^3}\right)$$

19) Slope Correction for Slopes of 10 Percent or Less

Open Calculator

fx $$\mathrm{Cs} = \frac{\Delta \mathrm{H}^2}{2 \cdot \mathrm{U_l}}$$

ex $$12.5\mathrm{m} = \frac{(15\mathrm{m})^2}{2 \cdot 9\mathrm{m}}$$

Temperature Corrections

20) Pull-on Tape given Sag Correction between Points of Support

Open Calculator

fx $$\mathrm{P} = \sqrt{\frac{-\mathrm{W}^2 \cdot \mathrm{U_l}^3}{24 \cdot \mathrm{C_s}}}$$

ex $$8.000454\mathrm{N} = \sqrt{\frac{-(3\mathrm{kg/m})^2 \cdot (9\mathrm{m})^3}{24 \cdot 4.271\mathrm{m}}}$$

21) Sag Correction between Points of Support

Open Calculator

fx $$\mathrm{C_s} = -\left(\mathrm{W}^2\right) \cdot \frac{\mathrm{U_l}^3}{24 \cdot \mathrm{P}^2}$$

ex $$-4.271484\mathrm{m} = -\left((3\mathrm{kg/m})^2\right) \cdot \frac{(9\mathrm{m})^3}{24 \cdot (8.00\mathrm{N})^2}$$

22) Tape Weight per Foot for Sag Correction between Points of Support

Open Calculator

fx $$W = \sqrt{\frac{C_s \cdot 24 \cdot P^2}{U_l^3}}$$

ex $$2.99983\text{kg/m} = \sqrt{\frac{4.271\text{m} \cdot 24 \cdot (8.00\text{N})^2}{(9\text{m})^3}}$$

23) Temperature Corrections for Incorrect Tape Length

Open Calculator

fx $$C_{temp} = \frac{(L_a - A_o) \cdot U_l}{A_o}$$

ex $$18.5\text{m} = \frac{(5.5\text{m} - 1.8\text{m}) \cdot 9\text{m}}{1.8\text{m}}$$

24) Unsupported Tape Length given Sag Correction between Points of Support

Open Calculator

fx $$U_l = \left(\frac{24 \cdot C_s \cdot P^2}{W^2}\right)^{\frac{1}{3}}$$

ex $$8.99966\text{m} = \left(\frac{24 \cdot 4.271\text{m} \cdot (8.00\text{N})^2}{(3\text{kg/m})^2}\right)^{\frac{1}{3}}$$

Variables Used

- **A** Area of Tape *(Square Meter)*
- A_o Nominal Tape Length *(Meter)*
- **C** Correction to be Subtracted *(Meter)*
- C_f Departure in ft *(Foot)*
- C_h Correction to be Subtracted from Slope Distance *(Meter)*
- C_m Departure in Meter *(Meter)*
- C_p Tension Correction *(Meter)*
- C_s Sag Correction *(Meter)*
- C_t Length Correction due to Temperature *(Meter)*
- C_{temp} Temperature Corrections for Incorrect Tape Length *(Meter)*
- **Cs** Slope Correction *(Meter)*
- **D** Distance *(Kilometer)*
- E_s Modulus of Elasticity of Steel *(Megapascal)*
- **F** Distance in ft *(Foot)*
- **h** Elevation Difference *(Meter)*
- **K** Distance in Kilometers *(Kilometer)*
- **L** Slope Distance *(Meter)*
- L_a Actual Tape Length *(Meter)*
- **M** Distance in Miles *(Mile)*
- **P** Pull on Tape *(Newton)*
- P_f Final Tension *(Newton)*
- P_i Initial Tension *(Newton)*

- **R** Horizontal Distance *(Meter)*
- $\mathbf{R_f}$ Displacement in ft *(Foot)*
- **s** Measured Length *(Meter)*
- **t** Initial Temperature *(Celsius)*
- $\mathbf{T_f}$ Final Temperature *(Celsius)*
- $\mathbf{U_l}$ Unsupported Length *(Meter)*
- **W** Weight of Tape per Unit Length *(Kilogram per Meter)*
- **x** Vertical Angle *(Degree)*
- **ΔH** Difference in Elevation *(Meter)*
- **θ** Slope Angle *(Degree)*

Constants, Functions, Measurements used

- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m), Foot (ft), Kilometer (km), Mile (mi)
  Length Unit Conversion
- Measurement: **Temperature** in Celsius (°C)
  Temperature Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Linear Mass Density** in Kilogram per Meter (kg/m)
  Linear Mass Density Unit Conversion

Check other formula lists

- Photogrammetry Stadia and Compass Surveying Formulas
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