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Surveying Curves Formulas

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List of 21 Surveying Curves Formulas

Surveying Curves

Offsets from Long Chord

1) Mid Ordinate given Ox

fx Open Calculator

$$L_{mo} = -\sqrt{R_{\text{Mid Ordinate}}^2 - x^2} + O_x + R_{\text{Mid Ordinate}}$$

ex $$2.012659\text{m} = -\sqrt{(40\text{m})^2 - (3\text{m})^2} + 1.9\text{m} + 40\text{m}$$

2) Mid Ordinate when Offsets from Long Chord is Used for Setting Out

fx Open Calculator

$$L_{mo} = R_{\text{Mid Ordinate}} - \sqrt{R_{\text{Mid Ordinate}}^2 - \left(\frac{C}{2}\right)^2}$$

ex $$17.03399\text{m} = 40\text{m} - \sqrt{(40\text{m})^2 - \left(\frac{65.5\text{m}}{2}\right)^2}$$

3) Offset at Distance x from Mid-Point

Open Calculator

$$O_x = \sqrt{R_{\text{Mid Ordinate}}^2 - x^2} - (R_{\text{Mid Ordinate}} - L_{mo})$$

ex $$1.887341\text{m} = \sqrt{(40\text{m})^2 - (3\text{m})^2} - (40\text{m} - 2\text{m})$$

Perpendicular Offsets from Tangents

4) Approximate Equation for Offset at Distance x from Mid-Point

Open Calculator

$$O_x = \frac{x^2}{2 \cdot R}$$

ex $$1.956522\text{m} = \frac{(3\text{m})^2}{2 \cdot 2.3\text{m}}$$

5) Radius given Approximate Equation for Offset

Open Calculator

$$R = \frac{x^2}{O_x \cdot 2}$$

ex $$2.368421\text{m} = \frac{(3\text{m})^2}{1.9\text{m} \cdot 2}$$

Setting Out Curve using Offsets from Chords

6) Deflection Angle of First Chord

Open Calculator

fx $$\delta 1 = \left(\frac{C_1}{2 \cdot R_{\text{Mid Ordinate}}} \right)$$

ex $$0.0625 = \left(\frac{5\text{m}}{2 \cdot 40\text{m}} \right)$$

7) First Offset given First Chord Length

Open Calculator

fx $$O_1 = \frac{C_1^2}{2} \cdot R_{\text{Mid Ordinate}}$$

ex $$500\text{m} = \frac{(5\text{m})^2}{2} \cdot 40\text{m}$$

8) Length of First Chord for given Deflection Angle of First Chord

Open Calculator

fx $$C_1 = \delta 1 \cdot 2 \cdot R_{\text{Mid Ordinate}}$$

ex $$5\text{m} = 0.0625 \cdot 2 \cdot 40\text{m}$$

9) N-th Offset using Chords Produced

Open Calculator

fx $$O_n = \left(\frac{C_n}{2} \cdot R_{\text{Mid Ordinate}} \right) \cdot (C_{n\text{-}1} + C_n)$$

ex $$1920\text{m} = \left(\frac{8\text{m}}{2} \cdot 40\text{m} \right) \cdot (4\text{m} + 8\text{m})$$

10) Second Offset using Chord Lengths

Open Calculator

fx $$O_2 = \left(\frac{C_2}{2} \cdot R_{\text{Mid Ordinate}}\right) \cdot (C_1 + C_2)$$

ex $$298.2\text{m} = \left(\frac{2.1\text{m}}{2} \cdot 40\text{m}\right) \cdot (5\text{m} + 2.1\text{m})$$

Simple Circular Curve

11) Apex Distance

Open Calculator

fx $$L_{ad} = R_{\text{Curve}} \cdot \left(\sec\left(\frac{\Delta}{2}\right) - 1\right)$$

ex $$37.13781\text{m} = 200\text{m} \cdot \left(\sec\left(\frac{65^\circ}{2}\right) - 1\right)$$

12) Deflection Angle given Length of Curve

Open Calculator

fx $$\Delta = \frac{L_{\text{Curve}}}{R_{\text{Curve}}}$$

ex $$42.97183^\circ = \frac{150\text{m}}{200\text{m}}$$

13) Length of Curve

Open Calculator

fx $$L_{\text{Curve}} = R_{\text{Curve}} \cdot \Delta$$

ex $$226.8928\text{m} = 200\text{m} \cdot 65^\circ$$

14) Length of Curve if 20m Chord Definition

Open Calculator

fx $$L_{Curve} = 20 \cdot \frac{\Delta}{D} \cdot \left(\frac{180}{\pi}\right)$$

ex $$61.90476\text{m} = 20 \cdot \frac{65^\circ}{21} \cdot \left(\frac{180}{\pi}\right)$$

15) Length of Curve if 30m Chord Definition

Open Calculator

fx $$L_{Curve} = 30 \cdot \frac{\Delta}{D} \cdot \left(\frac{180}{\pi}\right)$$

ex $$92.85714\text{m} = 30 \cdot \frac{65^\circ}{21} \cdot \left(\frac{180}{\pi}\right)$$

16) Mid Ordinate

Open Calculator

fx $$L_{mo} = R_{Curve} \cdot \left(1 - \cos\left(\frac{\Delta}{2}\right)\right)$$

ex $$31.32171\text{m} = 200\text{m} \cdot \left(1 - \cos\left(\frac{65^\circ}{2}\right)\right)$$

17) Radius given Apex Distance

Open Calculator

fx $$R_{Curve} = \frac{L_{ad}}{\sec\left(\frac{\Delta}{2}\right) - 1}$$

ex $$118.4776\text{m} = \frac{22\text{m}}{\sec\left(\frac{65^\circ}{2}\right) - 1}$$

18) Radius of Curve given Length

Open Calculator

fx $$R_{Curve} = \frac{L_{Curve}}{\Delta}$$

ex $$132.221\text{m} = \frac{150\text{m}}{65^\circ}$$

19) Radius of Curve given Long Chord

Open Calculator

fx $$R_{Curve} = \frac{C}{2 \cdot \sin\left(\frac{\Delta}{2}\right)}$$

ex $$60.95296\text{m} = \frac{65.5\text{m}}{2 \cdot \sin\left(\frac{65^\circ}{2}\right)}$$

20) Radius of Curve given Tangent

Open Calculator

fx $$\mathrm{R_{Curve}} = \frac{\mathrm{T}}{\tan\left(\frac{\Delta}{2}\right)}$$

ex $$199.9779\mathrm{m} = \frac{127.4\mathrm{m}}{\tan\left(\frac{65^\circ}{2}\right)}$$

21) Tangent Length

Open Calculator

fx $$\mathrm{T} = \mathrm{R_{Curve}} \cdot \tan\left(\frac{\Delta}{2}\right)$$

ex $$127.4141\mathrm{m} = 200\mathrm{m} \cdot \tan\left(\frac{65^\circ}{2}\right)$$

Variables Used

- **C** Length of Long Chord *(Meter)*
- **C_1** First Sub Chord *(Meter)*
- **C_2** Second Sub Chord *(Meter)*
- **C_n** Last Sub Chord *(Meter)*
- **C_{n-1}** Sub Chord n-1 *(Meter)*
- **D** Angle for Arc
- **L_{ad}** Apex Distance *(Meter)*
- **L_{Curve}** Length of Curve *(Meter)*
- **L_{mo}** Mid Ordinate *(Meter)*
- **O_1** First Offset *(Meter)*
- **O_2** Second Offset *(Meter)*
- **O_n** Offset n *(Meter)*
- **O_x** Offset at x *(Meter)*
- **R** Radius of Curve *(Meter)*
- **R_{Curve}** Curve Radius *(Meter)*
- **$R_{Mid\ Ordinate}$** Radius of Curve for Mid Ordinate *(Meter)*
- **T** Tangent Length *(Meter)*
- **x** Distance x *(Meter)*
- **Δ** Deflection Angle *(Degree)*
- **δ1** Deflection Angle 1

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- Function: **sec**, sec(Angle)
  Trigonometric secant function
- Function: **sin**, sin(Angle)
  Trigonometric sine function
- Function: **sqrt**, sqrt(Number)
  Square root function
- Function: **tan**, tan(Angle)
  Trigonometric tangent function
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion

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