Important Surveying Curves Formulas PDF

Formulas
Examples
with Units

List of 21
Important Surveying Curves Formulas

1) Offsets from Long Chord Formulas

1.1) Mid Ordinate given Ox Formula

Evaluate Formula

Formula

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

Example with Units

$$2.0127\,\text{m} = -\sqrt{40\,\text{m}^2 - 3\,\text{m}^2} + 1.9\,\text{m} + 40\,\text{m}$$

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

Evaluate Formula

Formula

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

Example with Units

$$17.034\,\text{m} = 40\,\text{m} - \sqrt{40\,\text{m}^2 - \left(\frac{65.5\,\text{m}}{2}\right)^2}$$

1.3) Offset at Distance x from Mid-Point Formula

Evaluate Formula

Formula

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

Example with Units

$$1.8873\,\text{m} = \sqrt{40\,\text{m}^2 - 3\,\text{m}^2} - \left(40\,\text{m} - 2\,\text{m}\right)$$

2) Perpendicular Offsets from Tangents Formulas

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

Evaluate Formula

Formula

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

Example with Units

$$1.9565\,\text{m} = \frac{3\,\text{m}^2}{2 \cdot 2.3\,\text{m}}$$

2.2) Radius given Approximate Equation for Offset Formula

Evaluate Formula

Formula

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

Example with Units

$$2.3684\,\text{m} = \frac{3\,\text{m}^2}{1.9\,\text{m} \cdot 2}$$

3) Setting Out Curve using Offsets from Chords Formulas

3.1) Deflection Angle of First Chord Formula

Evaluate Formula

Formula

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

Example with Units

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

3.2) First Offset given First Chord Length Formula

Evaluate Formula

Formula

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

Example with Units

$$500\,\text{m} = \frac{5\,\text{m}^2}{2} \cdot 40\,\text{m}$$

3.3) Length of First Chord for given Deflection Angle of First Chord Formula

Evaluate Formula

Formula

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

Example with Units

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

3.4) N-th Offset using Chords Produced Formula

Evaluate Formula

Formula

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

Example with Units

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

3.5) Second Offset using Chord Lengths Formula

Evaluate Formula

Formula

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

Example with Units

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

4) Simple Circular Curve Formulas

4.1) Apex Distance Formula

Evaluate Formula

Formula

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

Example with Units

$$37.1378\,\text{m} = 200\,\text{m} \cdot \left(\sec\left(\frac{65^\circ}{2} \right) - 1 \right)$$

4.2) Deflection Angle given Length of Curve Formula

Evaluate Formula

Formula

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

Example with Units

$$42.9718^\circ = \frac{150\,\text{m}}{200\,\text{m}}$$

4.3) Length of Curve Formula

Evaluate Formula

Formula

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

Example with Units

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

4.4) Length of Curve if 20m Chord Definition Formula

Evaluate Formula

Formula

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

Example with Units

$$61.9048\,\text{m} = 20 \cdot \frac{65^\circ}{21} \cdot \left(\frac{180}{3.1416} \right)$$

4.5) Length of Curve if 30m Chord Definition Formula

Evaluate Formula

Formula

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

Example with Units

$$92.8571\,\text{m} = 30 \cdot \frac{65^\circ}{21} \cdot \left(\frac{180}{3.1416} \right)$$

4.6) Mid Ordinate Formula

Evaluate Formula

Formula

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

Example with Units

$$31.3217\,\text{m} = 200\,\text{m} \cdot \left(1 - \cos\left(\frac{65^\circ}{2} \right) \right)$$

4.7) Radius given Apex Distance Formula

Evaluate Formula

Formula

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

Example with Units

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

4.8) Radius of Curve given Length Formula

Evaluate Formula

Formula

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

Example with Units

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

4.9) Radius of Curve given Long Chord Formula

Evaluate Formula

Formula

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

Example with Units

$$60.953\,\text{m} = \frac{65.5\,\text{m}}{2 \cdot \sin\left(\frac{65^\circ}{2}\right)}$$

4.10) Radius of Curve given Tangent Formula

Evaluate Formula

Formula

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

Example with Units

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

4.11) Tangent Length Formula

Evaluate Formula

Formula

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

Example with Units

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

Variables used in list of Surveying Curves Formulas above

- **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 in list of Surveying Curves Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **cos**, cos(Angle) *Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- Functions: **sec**, sec(Angle) *Secant is a trigonometric function that is defined ratio of the hypotenuse to the shorter side adjacent to an acute angle (in a right-angled triangle); the reciprocal of a cosine.*
- Functions: **sin**, sin(Angle) *Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.*
- Functions: **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.*
- Functions: **tan**, tan(Angle) *The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.*
- Measurement: **Length** in Meter (m) *Length Unit Conversion*
- Measurement: **Angle** in Degree (°) *Angle Unit Conversion*

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