



List of 26 Important Elliptical Shapes and Sub Sections Formulas

1) Elliptical Ring Formulas

1.1) Area of Elliptical Ring Formulas

1.1.1) Area of Elliptical Ring Formula

Formula	Example with Units
$A_{\text{Ring}} = \pi \cdot \left((a_{\text{Outer}} \cdot b_{\text{Outer}}) - (a_{\text{Inner}} \cdot b_{\text{Inner}}) \right)$	$141.3717 \text{ m}^2 = 3.1416 \cdot \left((10 \text{ m} \cdot 8 \text{ m}) - (7 \text{ m} \cdot 5 \text{ m}) \right)$

Evaluate Formula

1.1.2) Area of Elliptical Ring given Linear Eccentricities and Semi Major Axes Formula

Formula
$A_{\text{Ring}} = \pi \cdot \left(\left(\sqrt{a_{\text{Outer}}^2 - c_{\text{Outer}}^2} \cdot a_{\text{Outer}} \right) - \left(\sqrt{a_{\text{Inner}}^2 - c_{\text{Inner}}^2} \cdot a_{\text{Inner}} \right) \right)$

Evaluate Formula

Example with Units
$124.9979 \text{ m}^2 = 3.1416 \cdot \left(\left(\sqrt{10 \text{ m}^2 - 6 \text{ m}^2} \cdot 10 \text{ m} \right) - \left(\sqrt{7 \text{ m}^2 - 4 \text{ m}^2} \cdot 7 \text{ m} \right) \right)$

1.1.3) Area of Elliptical Ring given Linear Eccentricities and Semi Minor Axes Formula

Formula
$A_{\text{Ring}} = \pi \cdot \left(\left(\sqrt{b_{\text{Outer}}^2 + c_{\text{Outer}}^2} \cdot b_{\text{Outer}} \right) - \left(\sqrt{b_{\text{Inner}}^2 + c_{\text{Inner}}^2} \cdot b_{\text{Inner}} \right) \right)$

Evaluate Formula

Example with Units
$150.7474 \text{ m}^2 = 3.1416 \cdot \left(\left(\sqrt{8 \text{ m}^2 + 6 \text{ m}^2} \cdot 8 \text{ m} \right) - \left(\sqrt{5 \text{ m}^2 + 4 \text{ m}^2} \cdot 5 \text{ m} \right) \right)$

1.1.4) Area of Elliptical Ring given Width and Outer Semi Axes Formula

Formula
$A_{\text{Ring}} = \pi \cdot \left((a_{\text{Outer}} \cdot b_{\text{Outer}}) - ((a_{\text{Outer}} - w_{\text{Ring}}) \cdot (b_{\text{Outer}} - w_{\text{Ring}})) \right)$

Evaluate Formula

Example with Units
$141.3717 \text{ m}^2 = 3.1416 \cdot \left((10 \text{ m} \cdot 8 \text{ m}) - ((10 \text{ m} - 3 \text{ m}) \cdot (8 \text{ m} - 3 \text{ m})) \right)$

1.2) Inner Axis of Elliptical Ring Formulas

1.2.1) Inner Semi Major Axis of Elliptical Ring Formula

Formula	Example with Units
$a_{\text{Inner}} = a_{\text{Outer}} - w_{\text{Ring}}$	$7 \text{ m} = 10 \text{ m} - 3 \text{ m}$

Evaluate Formula

1.2.2) Inner Semi Minor Axis of Elliptical Ring Formula

Formula	Example with Units
$b_{\text{Inner}} = b_{\text{Outer}} - w_{\text{Ring}}$	$5 \text{ m} = 8 \text{ m} - 3 \text{ m}$

Evaluate Formula

1.3) Outer Axis of Elliptical Ring Formulas

1.3.1) Outer Semi Major Axis of Elliptical Ring Formula

Formula	Example with Units
$a_{\text{Outer}} = a_{\text{Inner}} + w_{\text{Ring}}$	$10 \text{ m} = 7 \text{ m} + 3 \text{ m}$

Evaluate Formula

1.3.2) Outer Semi Minor Axis of Elliptical Ring Formula

Formula	Example with Units
$b_{\text{Outer}} = b_{\text{Inner}} + w_{\text{Ring}}$	$8 \text{ m} = 5 \text{ m} + 3 \text{ m}$

Evaluate Formula



1.4) Ring Width of Elliptical Ring Formulas

1.4.1) Ring Width of Elliptical Ring given Outer and Inner Semi Major Axes Formula

Formula

$$w_{\text{Ring}} = a_{\text{Outer}} - a_{\text{Inner}}$$

Example with Units

$$3\text{ m} = 10\text{ m} - 7\text{ m}$$

Evaluate Formula

1.4.2) Ring Width of Elliptical Ring given Outer and Inner Semi Minor Axes Formula

Formula

$$w_{\text{Ring}} = b_{\text{Outer}} - b_{\text{Inner}}$$

Example with Units

$$3\text{ m} = 8\text{ m} - 5\text{ m}$$

Evaluate Formula

2) Elliptical Sector Formulas

2.1) Angle of Elliptical Sector Formula

Formula

$$\angle_{\text{Sector}} = \angle_{\text{Leg}(2)} - \angle_{\text{Leg}(1)}$$

Example with Units

$$90^\circ = 120^\circ - 30^\circ$$

Evaluate Formula

2.2) Area of Elliptical Sector Formula

Formula

$$A_{\text{Sec}} = \left(\frac{a_{\text{Sector}} \cdot b_{\text{Sector}}}{2} \right) \cdot \left(\angle_{\text{Sector}} - \text{atan} \left(\frac{(b_{\text{Sector}} - a_{\text{Sector}}) \cdot \sin(2 \cdot \angle_{\text{Leg}(2)})}{a_{\text{Sector}} + b_{\text{Sector}} + ((b_{\text{Sector}} - a_{\text{Sector}}) \cdot \cos(2 \cdot \angle_{\text{Leg}(2)}))} \right) + \text{atan} \left(\frac{(b_{\text{Sector}} - a_{\text{Sector}}) \cdot \sin(2 \cdot \angle_{\text{Leg}(1)})}{a_{\text{Sector}} + b_{\text{Sector}} + ((b_{\text{Sector}} - a_{\text{Sector}}) \cdot \cos(2 \cdot \angle_{\text{Leg}(1)}))} \right) \right)$$

Example with Units

$$34.1432\text{ m}^2 = \left(\frac{10\text{ m} \cdot 6\text{ m}}{2} \right) \cdot \left(90^\circ - \text{atan} \left(\frac{(6\text{ m} - 10\text{ m}) \cdot \sin(2 \cdot 120^\circ)}{10\text{ m} + 6\text{ m} + ((6\text{ m} - 10\text{ m}) \cdot \cos(2 \cdot 120^\circ))} \right) + \text{atan} \left(\frac{(6\text{ m} - 10\text{ m}) \cdot \sin(2 \cdot 30^\circ)}{10\text{ m} + 6\text{ m} + ((6\text{ m} - 10\text{ m}) \cdot \cos(2 \cdot 30^\circ))} \right) \right)$$

Evaluate Formula

2.3) First Leg Angle of Elliptical Sector Formula

Formula

$$\angle_{\text{Leg}(1)} = \angle_{\text{Leg}(2)} - \angle_{\text{Sector}}$$

Example with Units

$$30^\circ = 120^\circ - 90^\circ$$

Evaluate Formula

2.4) First Leg of Elliptical Sector Formula

Formula

$$l_1 = \sqrt{\frac{a_{\text{Sector}}^2 \cdot b_{\text{Sector}}^2}{\left(a_{\text{Sector}}^2 \cdot \sin(\angle_{\text{Leg}(1)})^2 \right) + \left(b_{\text{Sector}}^2 \cdot \cos(\angle_{\text{Leg}(1)})^2 \right)}}$$

Example with Units

$$8.3205\text{ m} = \sqrt{\frac{10\text{ m}^2 \cdot 6\text{ m}^2}{\left(10\text{ m}^2 \cdot \sin(30^\circ)^2 \right) + \left(6\text{ m}^2 \cdot \cos(30^\circ)^2 \right)}}$$

Evaluate Formula

2.5) Second Leg Angle of Elliptical Sector Formula

Formula

$$\angle_{\text{Leg}(2)} = \angle_{\text{Sector}} + \angle_{\text{Leg}(1)}$$

Example with Units

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

Evaluate Formula

2.6) Second Leg of Elliptical Sector Formula

Formula

$$l_2 = \sqrt{\frac{a_{\text{Sector}}^2 \cdot b_{\text{Sector}}^2}{\left(a_{\text{Sector}}^2 \cdot \sin(\angle_{\text{Leg}(2)})^2 \right) + \left(b_{\text{Sector}}^2 \cdot \cos(\angle_{\text{Leg}(2)})^2 \right)}}$$

Example with Units

$$6.5465\text{ m} = \sqrt{\frac{10\text{ m}^2 \cdot 6\text{ m}^2}{\left(10\text{ m}^2 \cdot \sin(120^\circ)^2 \right) + \left(6\text{ m}^2 \cdot \cos(120^\circ)^2 \right)}}$$

Evaluate Formula



3) Elliptical Segment Formulas ↻

3.1) Area of Elliptical Segment Formula ↻

Evaluate Formula ↻

$$A_{\text{Segment}} = \left(\frac{2a \cdot 2b}{4} \right) \cdot \left(\arccos \left(1 - \left(\frac{2 \cdot h_{\text{Segment}}}{2a} \right) \right) - \left(1 - \left(\frac{2 \cdot h_{\text{Segment}}}{2a} \right) \right) \cdot \sqrt{\left(\frac{4 \cdot h_{\text{Segment}}}{2a} \right) - \left(\frac{4 \cdot h_{\text{Segment}}^2}{2a^2} \right)} \right)$$

Example with Units

$$26.8377 \text{ m}^2 = \left(\frac{20 \text{ m} \cdot 12 \text{ m}}{4} \right) \cdot \left(\arccos \left(1 - \left(\frac{2 \cdot 4 \text{ m}}{20 \text{ m}} \right) \right) - \left(1 - \left(\frac{2 \cdot 4 \text{ m}}{20 \text{ m}} \right) \right) \cdot \sqrt{\left(\frac{4 \cdot 4 \text{ m}}{20 \text{ m}} \right) - \left(\frac{4 \cdot 4 \text{ m}^2}{20 \text{ m}^2} \right)} \right)$$

3.2) Major Axis of Elliptical Segment Formula ↻

Formula

$$2a = 2 \cdot a_{\text{Segment}}$$

Example with Units

$$20 \text{ m} = 2 \cdot 10 \text{ m}$$

Evaluate Formula ↻

3.3) Minor Axis of Elliptical Segment Formula ↻

Formula

$$2b = 2 \cdot b_{\text{Segment}}$$

Example with Units

$$12 \text{ m} = 2 \cdot 6 \text{ m}$$

Evaluate Formula ↻

3.4) Semi Major Axis of Elliptical Segment Formula ↻

Formula

$$a_{\text{Segment}} = \frac{2a}{2}$$

Example with Units

$$10 \text{ m} = \frac{20 \text{ m}}{2}$$

Evaluate Formula ↻

3.5) Semi Minor Axis of Elliptical Segment Formula ↻

Formula

$$b_{\text{Segment}} = \frac{2b}{2}$$

Example with Units

$$6 \text{ m} = \frac{12 \text{ m}}{2}$$

Evaluate Formula ↻

4) Semi Ellipse Formulas ↻

4.1) Arc Length of Semi Ellipse given Perimeter Formula ↻

Formula

$$l_{\text{Arc}} = P - (2 \cdot s_{\text{Axis}})$$

Example with Units

$$25 \text{ m} = 45 \text{ m} - (2 \cdot 10 \text{ m})$$

Evaluate Formula ↻

4.2) Area of Semi Ellipse Formula ↻

Formula

$$A_{\text{Semi}} = \left(\frac{\pi}{2} \right) \cdot s_{\text{Axis}} \cdot h_{\text{Semi}}$$

Example with Units

$$94.2478 \text{ m}^2 = \left(\frac{3.1416}{2} \right) \cdot 10 \text{ m} \cdot 6 \text{ m}$$

Evaluate Formula ↻

4.3) Height of Semi Ellipse given Area Formula ↻

Formula

$$h_{\text{Semi}} = \frac{2 \cdot A_{\text{Semi}}}{\pi \cdot s_{\text{Axis}}}$$

Example with Units

$$6.0479 \text{ m} = \frac{2 \cdot 95 \text{ m}^2}{3.1416 \cdot 10 \text{ m}}$$

Evaluate Formula ↻

4.4) Perimeter of Semi Ellipse Formula ↻

Formula

$$P = (2 \cdot s_{\text{Axis}}) + l_{\text{Arc}}$$

Example with Units

$$45 \text{ m} = (2 \cdot 10 \text{ m}) + 25 \text{ m}$$

Evaluate Formula ↻

4.5) Semi Axis of Semi Ellipse given Area Formula ↻

Formula

$$s_{\text{Axis}} = \frac{2 \cdot A_{\text{Semi}}}{\pi \cdot h_{\text{Semi}}}$$

Example with Units

$$10.0798 \text{ m} = \frac{2 \cdot 95 \text{ m}^2}{3.1416 \cdot 6 \text{ m}}$$




Evaluate Formula ↻



Variables used in list of Elliptical Shapes and Sub Sections Formulas above

- $\angle_{\text{Leg}(1)}$ First Leg Angle of Elliptical Sector (Degree)
- $\angle_{\text{Leg}(2)}$ Second Leg Angle of Elliptical Sector (Degree)
- \angle_{Sector} Angle of Elliptical Sector (Degree)
- **2a** Major Axis of Elliptical Segment (Meter)
- **2b** Minor Axis of Elliptical Segment (Meter)
- **a_{Inner}** Inner Semi Major Axis of Elliptical Ring (Meter)
- **a_{Outer}** Outer Semi Major Axis of Elliptical Ring (Meter)
- **A_{Ring}** Area of Elliptical Ring (Square Meter)
- **A_{Sec}** Area of Elliptical Sector (Square Meter)
- **a_{Sector}** Semi Major Axis of Elliptical Sector (Meter)
- **a_{Segment}** Semi Major Axis of Elliptical Segment (Meter)
- **A_{Segment}** Area of Elliptical Segment (Square Meter)
- **A_{Semi}** Area of Semi Ellipse (Square Meter)
- **b_{Inner}** Inner Semi Minor Axis of Elliptical Ring (Meter)
- **b_{Outer}** Outer Semi Minor Axis of Elliptical Ring (Meter)
- **b_{Sector}** Semi Minor Axis of Elliptical Sector (Meter)
- **b_{Segment}** Semi Minor Axis of Elliptical Segment (Meter)
- **c_{Inner}** Inner Linear Eccentricity of Elliptical Ring (Meter)
- **c_{Outer}** Outer Linear Eccentricity of Elliptical Ring (Meter)
- **h_{Segment}** Height of Elliptical Segment (Meter)
- **h_{Semi}** Height of Semi Ellipse (Meter)
- **l₁** First Leg of Elliptical Sector (Meter)
- **l₂** Second Leg of Elliptical Sector (Meter)
- **l_{Arc}** Arc Length of Semi Ellipse (Meter)
- **P** Perimeter of Semi Ellipse (Meter)
- **s_{Axis}** Semi Axis of Semi Ellipse (Meter)
- **w_{Ring}** Ring Width of Elliptical Ring (Meter)

Constants, Functions, Measurements used in list of Elliptical Shapes and Sub Sections Formulas above

- **constant(s):** pi, 3.14159265358979323846264338327950288
Archimedes' constant
- **Functions:** arccos, arccos(Number)
Arccosine function, is the inverse function of the cosine function. It is the function that takes a ratio as an input and returns the angle whose cosine is equal to that ratio.
- **Functions:** atan, atan(Number)
Inverse tan is used to calculate the angle by applying the tangent ratio of the angle, which is the opposite side divided by the adjacent side of the right triangle.
- **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:** 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: Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement: Angle** in Degree (°)
Angle Unit Conversion 



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