3D Geometry Formulas

Surfac Area Formulas

Surface Area of Cube : $6a^2$

Area of Rectangular Prism : $2(lw + lh + wh)$

Surface Area of Sphere : $4\pi r^2$

Surface Area Cylinder: $2\pi r(h + r)$

Surface Area of Cone: $\pi r(r + \sqrt{h^2 + r^2})$

Area (Square Base of Pyramid): $B + \frac{1}{2}P\ell$

Area of Triangular Prism: $bh + (s_1 + s_2 + s_3)l$

Volume Formulas

Volume of a cube: $V = s^3$

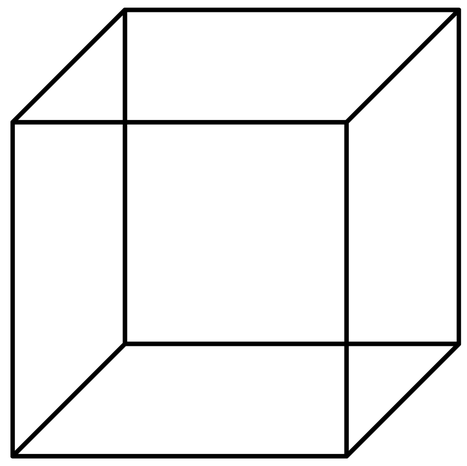
Volume of a rectangular prism: $V = l \cdot w \cdot h$

Volume of a cylinder: $V = \pi r^2 h$

Volume of a cone: $V = \frac{1}{3}\pi r^2 h$

Cube Formulas

(s = side length of the cube)



Surface Area

$$A = 6s^2$$

The surface area (A) of a cube is the total area of all six faces.

Volume

$$V = s^3$$

The volume (V) of a cube is the amount of space enclosed within the cube.

Diagonal of a Face

$$d_f = s\sqrt{2}$$

The diagonal (d_f) of any face of the cube can be found using the Pythagorean theorem.

Space Diagonal

$$d_s = s\sqrt{3}$$

The space diagonal (d_s) of the cube, it can be found using the three-dimensional Pythagorean theorem.

Perimeter of One Face

$$P_f = 4s$$

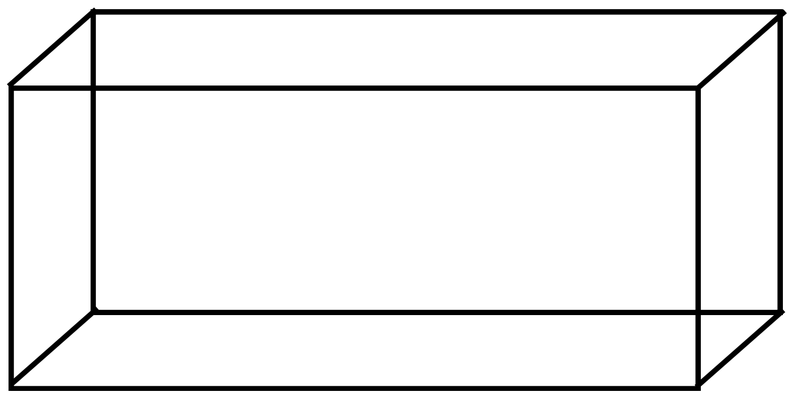
The perimeter (P_f) of one face of the cube is the sum of the lengths of the four edges forming that face.

Total Edge Length

$$E = 12s$$

The total edge length (E) of a cube is the sum of the lengths of all twelve edges.

Cuboid Formulas



- Length (l)
- Width (w)
- Height (h)

Surface Area

$$A = 2(lw + lh + wh)$$

The surface area is the total area of all six faces of the cuboid.

Volume

$$V = l \times w \times h$$

The volume of a cuboid is the amount of space it occupies.

Diagonal Length

$$D = \sqrt{l^2 + w^2 + h^2}$$

The diagonal of a cuboid stretches from one vertex to the opposite vertex through the interior of the cuboid.

Face Diagonals

- **Face Diagonal on Length and Width (Front/Back Face)**

$$\text{Face Diagonal (l, w)} = \sqrt{l^2 + w^2}$$

- **Face Diagonal on Length and Width (Front/Back Face)**

$$\text{Face Diagonal (l, h)} = \sqrt{l^2 + h^2}$$

- **Face Diagonal on Length and Width (Front/Back Face)**

$$\text{Face Diagonal (w, h)} = \sqrt{w^2 + h^2}$$

Cuboid Formulas

Perimeter of Edges

$$\text{Total Edge Length} = 4(l + w + h)$$

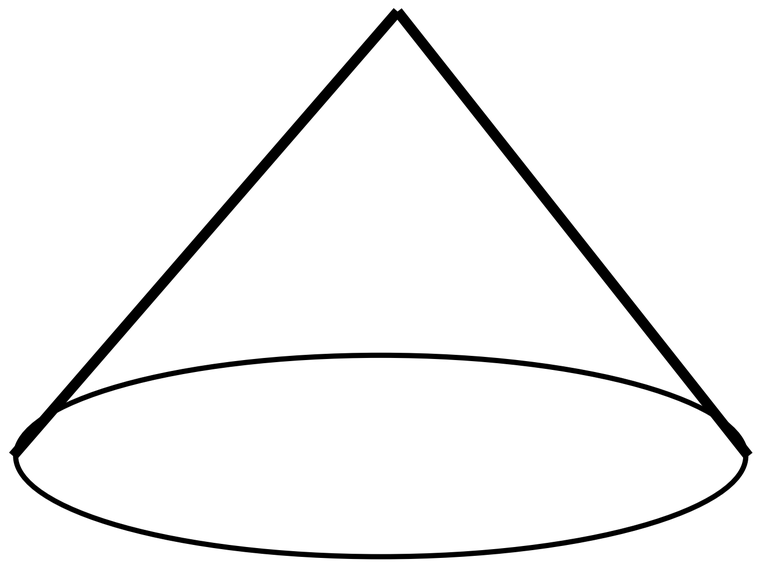
The total perimeter of all the edges of a cuboid.

Lateral Surface Area

$$\text{Lateral Surface Area} = 2h(l + w)$$

The lateral surface area of a cuboid is the sum of the areas of the four vertical faces.

Cone Formulas



Volume of a Cone

$$V = \frac{1}{3}\pi r^2 h$$

The volume V of a cone can be calculated using the following formula:

- r is the radius of the base
- h is the height of the cone

Surface Area

a. Base Area

$$A_{\text{base}} = \pi r^2$$

b. Lateral Surface Area

$$A_{\text{lateral}} = \pi r l$$

c. Total Surface Area

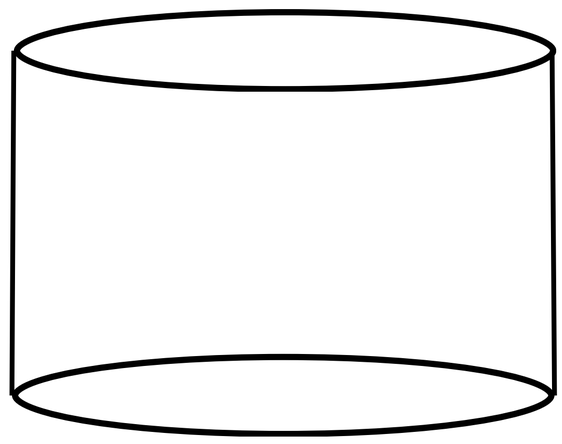
$$l = \sqrt{r^2 + h^2}$$

Total Edge Length

$$A = \pi r(r + l)$$

The slant height l is the distance from the base to the apex along the surface of the cone.

Cylinder Formulas



- V is the volume
- r is the radius of the base
- h is the height

Surface Area

$$A = 2\pi r(r + h)$$

Volume

$$V = \pi r^2 h$$

Lateral Surface Area (Curved Surface Area)

$$A_{\text{lateral}} = 2\pi rh$$

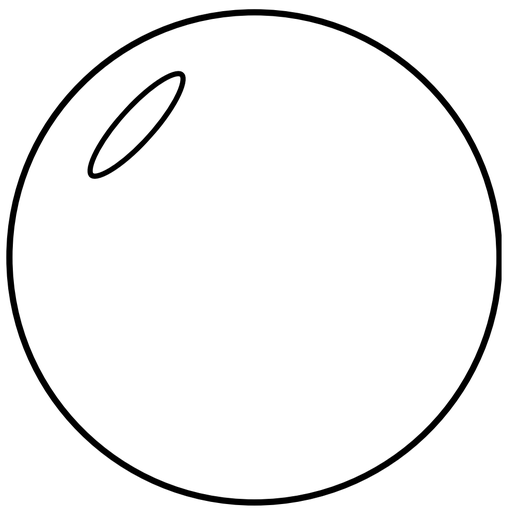
Area of the Circular Bases

$$A_{\text{base}} = \pi r^2$$

Total Surface Area Calculation

$$A_{\text{total}} = A_{\text{lateral}} + 2A_{\text{base}}$$
$$A_{\text{total}} = 2\pi rh + 2\pi r^2$$
$$A_{\text{total}} = 2\pi r(r + h)$$

Sphere Formulas



- r = Radius of the sphere
- π (Pi) = Approximately 3.14159

Surface Area

$$A = 4\pi r^2$$ (A = Surface Area)

Volume

$$V = \frac{4}{3}\pi r^3$$ (V = Volume)

Lateral Surface Area (Curved Surface Area)

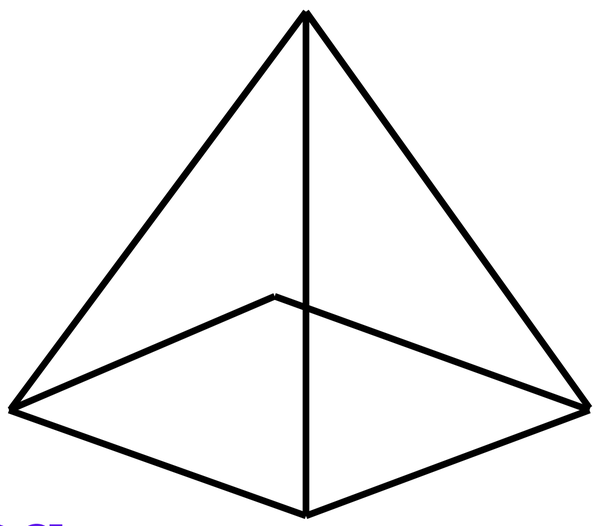
$$C = 2\pi r$$ C = Circumference of the great circle

Area of the Circular Bases

$$(x-h)^2 + (y-k)^2 + (z-l)^2 = r^2$$

- (x, y, z) = Coordinates of any point on the surface of the sphere
- (h, k, l) = Coordinates of the center of the sphere

Pyrmid Formulas



- r = Radius of the sphere
- π (Pi) = Approximately 3.14159

Surface Area

$$SA = B + \text{Lateral Surface Area}$$

Square Base	Rectangular Base	Triangular Base
$B = a^2$	$B = l \times w$	$B = \frac{1}{2} \times b \times h_b$

Volume

$$V = \frac{1}{3} \times B \times h$$

Lateral surface area (regular pyramid)

$$LateralSurfaceArea = \frac{1}{2} \times P \times s$$

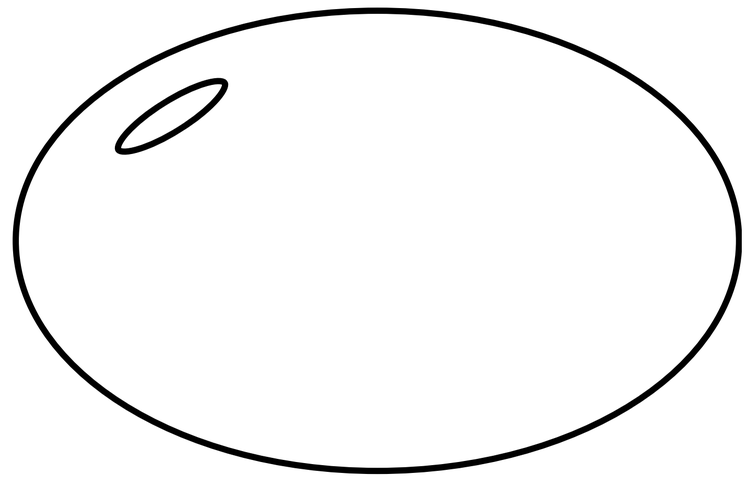
Slant height (square base and rectangular base)

$$s = \sqrt{\left(\frac{a}{2}\right)^2 + h^2}$$

Perimeter (square base, rectangular base & triangular base)

Square Base	Rectangular Base	Triangular Base
$P = 4a$	$P = 2(l + w)$	$P = a + b + c$

Ellipsoid Formulas



Surface Area

$$S \approx 4\pi\left(\frac{(a^pb^p+a^pc^p+b^pc^p)}{3}\right)^{\frac{1}{p}} \quad \text{where} \quad p \approx 1.6075$$

Volume

$$V = \frac{4}{3}\pi abc$$

Eccentricity of an Ellipsoid

$$e_{xy} = \sqrt{1-\frac{b^2}{a^2}}$$

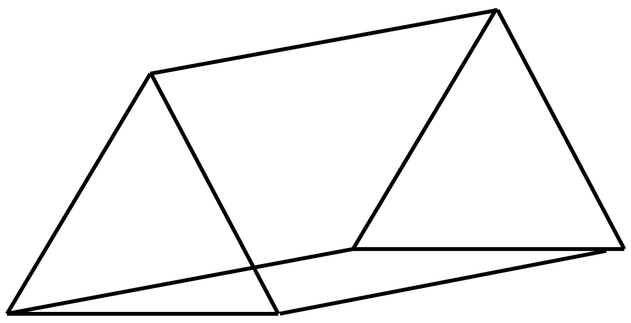
Slant height (square base and rectangular base)

$$e_{xz} = \sqrt{1-\frac{c^2}{a^2}}$$

Perimeter (square base, rectangular base & triangular base)

$$e_{yz} = \sqrt{1-\frac{c^2}{b^2}}$$

Prism Formulas



- B is the area of the base
- P is the perimeter of the base
- h is the height of the prism

Volume

$$V = B \times h$$ The volume V of a prism

Surface Area

$$SA = 2B + Ph$$ The surface area SA of a prism

Lateral Surface Area of a Prism

$$LSA = P \times h$$ The lateral surface area LSA

Base Area Formulas for Specific Prisms

Rectangular Prism

$$B = l \times w$$
$$P = 2(l + w)$$

- B is Area of the base
- P is Perimeter of the base
- l is the length
- w is the width

Triangular Prism

$$B = \frac{1}{2} b \times h_b$$
$$P = a + b + c$$

- P is Perimeter of the base
- b_b is the base length of the triangle
- h is the height of the trianglew is the width
- a, b, and c are the side lengths of the triangle

Cylinder (as a Circular Prism)

$$B = \pi r^2$$
$$P = 2\pi r$$

- B is the Area of the base
- r is the radius of the base
- P is the Perimeter of the base