

Circle

$$C = 2\pi r = \pi D$$

$$S = R\theta = \frac{1}{2}D\theta = D\cos^{-1}(d/R)$$

$$l = 2\sqrt{R^2 - d^2} = 2R\sin(\theta/2) = 2d\tan(\theta/2)$$

$$d = \frac{1}{2}\sqrt{4R^2 - l^2} = R\cos(\theta/2) = \frac{1}{2}l\cotn(\theta/2)$$

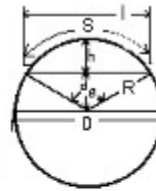
$$h = R - d$$

$$\theta = S/R = 2S/D = 2\cos^{-1}(d/R) = 2\tan^{-1}(l/2d) = 2\sin^{-1}(l/D)$$

$$A(\text{circle}) = \pi R^2 = \frac{1}{4}\pi D^2$$

$$A(\text{sector}) = \frac{1}{2}Rs = \frac{1}{2}R^2\theta$$

$$A(\text{segment}) = A(\text{sector}) - A(\text{triangle}) = \frac{1}{2}R^2(\theta - \sin\theta) \\ = R^2\cos^{-1}((R-h)/R) - (R-h)\sqrt{2Rh-h^2}$$



where:

C = circumference

R = radius

D = diameter

A = area

S = length of arc subtended by θ

l = chord subtended by arc S

h = rise

θ = central angle in radians

π = 3.14159...

Cone and Pyramid

Cone:

$$V = \pi r^2 / 3$$

$$S = \pi r s + \pi r^2 = \pi r \sqrt{r^2 + h^2} + \pi r^2$$



Cone

Pyramid:

$$V = a b c / 3$$

$$S = bh + ci + bc$$

where:

V = volume,

S = surface area,

$\pi = 3.14159 \dots$



Pyramid

Cube and Cuboid

$$V = abc$$

$$S = 2ac + 2bc + 2ab$$

$$f = \sqrt{a^2 + b^2}$$

$$d = \sqrt{a^2 + b^2 + c^2}$$

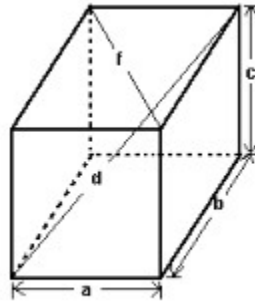
where:

V = volume,

S = surface area,

f = face diagonal,

d = space diagonal.



Cylinder or Prism

Cylinder:

$$V = \pi r^2 h = \frac{1}{4} \pi d^2 h$$

$$S = 2\pi r^2 + 2\pi rh = \frac{1}{2} \pi d^2 + \pi dh$$

Prism:

$$V = abh$$

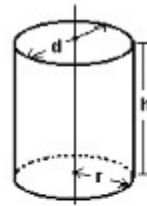
$$S = 2ab + 2ah + 2bh$$

where:

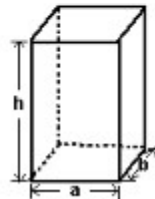
V = volume,

S = surface area,

$\pi = 3.14159\dots$



Cylinder



Prism

Ellipse

$$A = \pi a b,$$

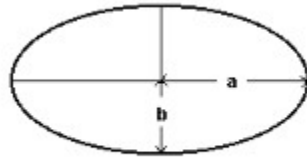
where:

A = area,

a = semi-major axis,

b = semi-minor axis.

$\pi = 3.14159\dots$



Ellipsoid

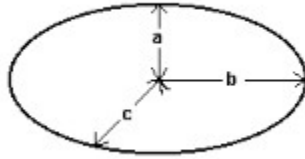
$$V = \frac{4}{3} \pi abc$$

where:

V = volume,

a, b, c = length of semi-axes,

$\pi = 3.14159\dots$



Parabola

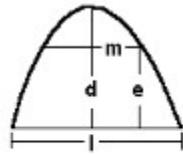
$$\text{Area} = 2ld/3$$

where:

$$\text{height of } e = d/l^2 (l^2 - m^2),$$

$$\text{width of } m = l \sqrt{(d - e)/d},$$

$$\text{length of arc} = l \left[1 + \frac{2}{3}(2d/l)^2 - \frac{2}{5}(2d/l)^4 + \dots \right].$$



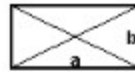
Parallelogram

$$A = ab$$

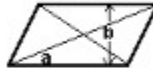
where:

A = area

In a parallelogram all diagonals bisect each other, neighboring interior angles are supplementary and opposite interior angles are complementary.



Rectangle



Rhomboid



Square



Rhombus

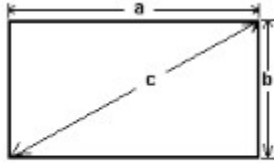
Rectangle

$$\text{Area} = ab$$

$$c = \sqrt{a^2 + b^2}$$

$$a = \sqrt{c^2 - b^2}$$

$$b = \sqrt{c^2 - a^2}$$



where:

a, b = length of side.

Regular Polygon

$$A = \frac{1}{4} n z^2 \cot(180 / n)$$

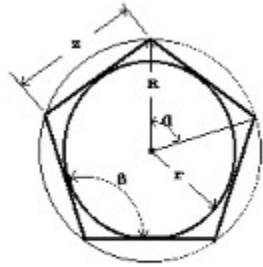
$$R = \frac{1}{2} z \csc(180 / n)$$

$$r = \frac{1}{2} z \cot(180 / n)$$

$$\alpha = 360 / n = 2\pi / n$$

$$\beta = 180((n - 2) / n) = \pi((n - 2) / n)$$

$$z = 2 r \tan(\alpha / 2) = 2 R \sin(\alpha / 2)$$



where:

A = area of polygon,

α , β are in radians.

$\pi = 3.14159 \dots$

Sphere

$$A (\text{sphere}) = 4\pi r^2 = \pi D^2$$

$$A (\text{zone}) = 2\pi rk = \pi Dk$$

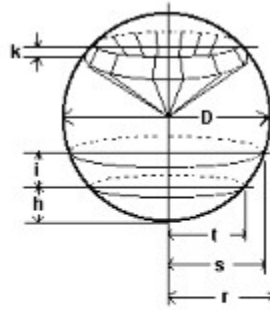
$$A (\text{lune}) = 2r^2\varnothing$$

$$V (\text{sphere}) = \frac{4}{3}\pi r^3 = \frac{1}{6}\pi D^3$$

$$V (\text{spherical sector}) = \frac{2}{3}\pi r^2k = \frac{1}{6}\pi D^2k$$

$$V (\text{spherical segment of one base}) = \frac{1}{6}\pi h(3t^2 + h^2)$$

$$V (\text{spherical segment of two bases}) = \frac{1}{6}\pi i(3t^2 + 3s^2 + i^2) = 2r^2\varnothing$$



where:

A = area,

V = volume,

\varnothing = angle of lune in radians,

$\pi = 3.14159\dots$

Torus

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

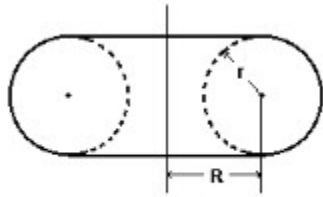
$$S = 4\pi^2 R r$$

where:

V = volume,

S = surface area,

$\pi = 3.14159\dots$



Trapezoid

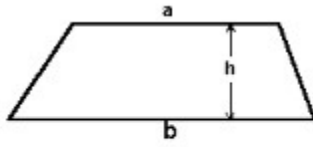
$$A = \frac{1}{2} h(a + b)$$

where:

A = area,

a, b = length of parallel sides,

h = altitude.



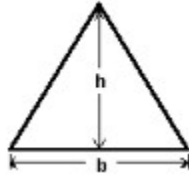
Triangle

$$\text{Area} = bh / 2$$

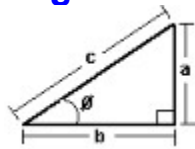
where:

b = length of base,

h = height of triangle.



Trigonometry



$$\sin \theta = a/c \quad \cos \theta = b/c$$

$$\tan \theta = a/b \quad \cot \theta = b/a$$

$$\sec \theta = c/b$$

$$\csc \theta = c/a$$

$$\operatorname{exsec} \theta = c/b - 1$$

$$\operatorname{vers} \theta = 1 - b/c$$

$$\operatorname{covers} \theta = 1 - a/c$$

$$\operatorname{hav} \theta = \frac{1}{2}(1 - b/c)$$

$$\sin^2 x + \cos^2 x = 1$$

$$\tan x = \sin x / \cos x$$

$$\cot x = 1 / \tan x = \cos x / \sin x$$

$$\sec^2 x = 1 + \tan^2 x$$

$$\csc^2 x = 1 + \cot^2 x$$

$$\cot x - \cot y = \sin(y-x) / (\sin x \sin y)$$

$$\sin^2 x - \sin^2 y = \cos^2 y - \cos^2 x$$

$$\cos^2 x - \sin^2 y = \cos^2 y - \sin^2 x$$

$$\sin(-x) = -\sin x \quad \cos(-x) = \cos x$$

$$\tan(-x) = -\tan x$$

$$c^2 = a^2 + b^2$$

$$\sin(x+y) = \sin x \cos y + \cos x \sin y$$

$$\cos(x+y) = \cos x \cos y - \sin x \sin y$$

$$\tan(x+y) = (\tan x + \tan y) / (1 - \tan x \tan y)$$

$$\cot(x+y) = (\cot x \cot y - 1) / (\cot x + \cot y)$$

$$\sin(x-y) = \sin x \cos y - \cos x \sin y$$

$$\cos(x-y) = \cos x \cos y + \sin x \sin y$$

$$\tan(x-y) = (\tan x - \tan y) / (1 + \tan x \tan y)$$

$$\cot(x-y) = (\cot x \cot y + 1) / (\cot y - \cot x)$$

$$\sin x + \sin y = 2 \sin \frac{1}{2}(x+y) \cos \frac{1}{2}(x-y)$$

$$\sin x - \sin y = 2 \cos \frac{1}{2}(x+y) \sin \frac{1}{2}(x-y)$$

$$\cos x + \cos y = 2 \cos \frac{1}{2}(x+y) \cos \frac{1}{2}(x-y)$$

$$\cos x - \cos y = -2 \sin \frac{1}{2}(x+y) \sin \frac{1}{2}(x-y)$$

$$\tan x + \tan y = \sin(x+y) / (\cos x \cos y)$$

$$\cot x + \cot y = \sin(x+y) / (\sin x \sin y)$$

$$\tan x - \tan y = \sin(x-y) / (\cos x \cos y)$$

