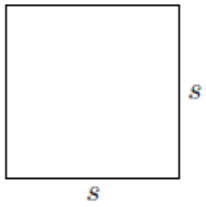
2D GEOMETRY FORMULAS

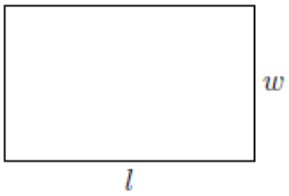
SQUARE

s = side
Area: $A = s^2$
Perimeter: $P = 4s$



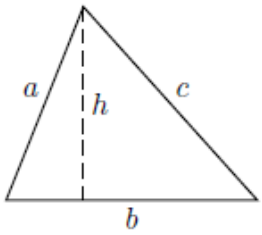
RECTANGLE

l = length, w = width
Area: $A = lw$
Perimeter: $P = 2l + 2w$



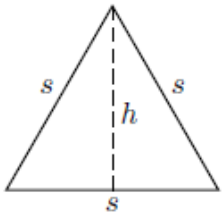
TRIANGLE

b = base, h = height
Area: $A = \frac{1}{2}bh$
Perimeter: $P = a + b + c$



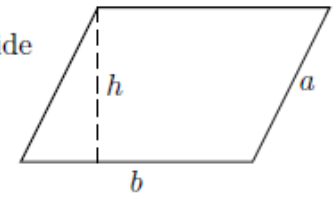
EQUILATERAL TRIANGLE

s = side
Height: $h = \frac{\sqrt{3}}{2}s$
Area: $A = \frac{\sqrt{3}}{4}s^2$



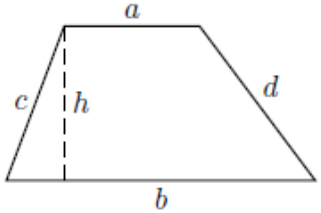
PARALLELOGRAM

b = base, h = height, a = side
Area: $A = bh$
Perimeter: $P = 2a + 2b$



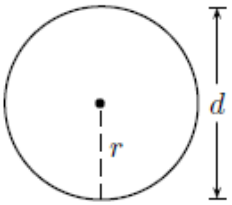
TRAPEZOID

a, b = bases; h = height;
c, d = sides
Area: $A = \frac{1}{2}(a + b)h$
Perimeter:
$P = a + b + c + d$



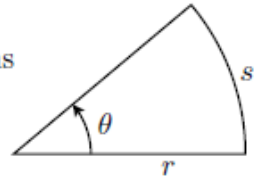
CIRCLE

r = radius, d = diameter
Diameter: $d = 2r$
Area: $A = \pi r^2$
Circumference: $C = 2\pi r = \pi d$



SECTOR OF CIRCLE

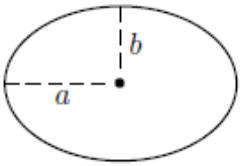
r = radius, θ = angle in radians
Area: $A = \frac{1}{2}\theta r^2$
Arc Length: $s = \theta r$



ELLIPSE

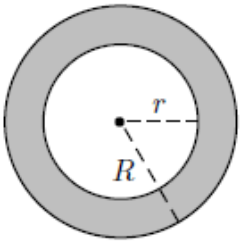
a = semimajor axis
b = semiminor axis
Area: $A = \pi ab$

Circumference:
$C \approx \pi\left(3(a+b) - \sqrt{(a+3b)(b+3a)}\right)$



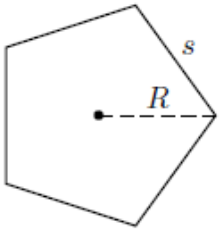
ANNULUS

r = inner radius,
R = outer radius
Average Radius: $\rho = \frac{1}{2}(r + R)$
Width: $w = R - r$
Area: $A = \pi(R^2 - r^2)$
or $A = 2\pi\rho w$



REGULAR POLYGON

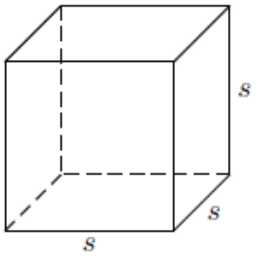
s = side length,
n = number of sides
Circumradius: $R = \frac{1}{2}s\csc(\frac{\pi}{n})$
Area: $A = \frac{1}{4}ns^2\cot(\frac{\pi}{n})$
or $A = \frac{1}{2}nR^2\sin(\frac{2\pi}{n})$



3D GEOMETRY FORMULAS

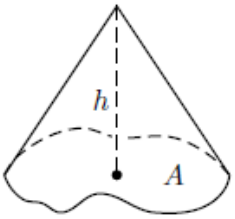
CUBE

s = side
Volume: $V = s^3$
Surface Area: $S = 6s^2$



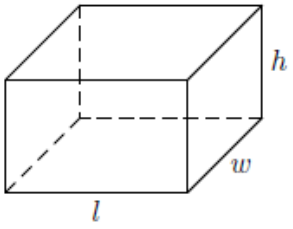
GENERAL CONE OR PYRAMID

A = area of base, h = height
Volume: $V = \frac{1}{3}Ah$



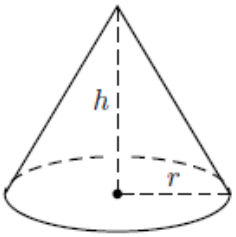
RECTANGULAR SOLID

l = length, w = width,
h = height
Volume: $V = lwh$
Surface Area:
$S = 2lw + 2lh + 2wh$



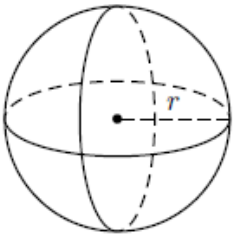
RIGHT CIRCULAR CONE

r = radius, h = height
Volume: $V = \frac{1}{3}\pi r^2 h$
Surface Area:
$S = \pi r\sqrt{r^2 + h^2} + \pi r^2$



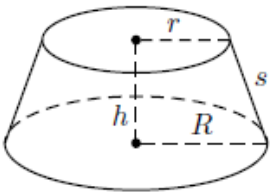
SPHERE

r = radius
Volume: $V = \frac{4}{3}\pi r^3$
Surface Area: $S = 4\pi r^2$



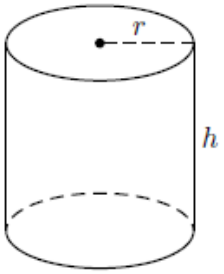
FRUSTUM OF A CONE

r = top radius, R = base radius,
h = height, s = slant height
Volume: $V = \frac{\pi}{3}(r^2 + rR + R^2)h$
Surface Area:
$S = \pi s(R + r) + \pi r^2 + \pi R^2$



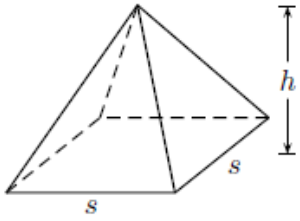
RIGHT CIRCULAR CYLINDER

r = radius, h = height
Volume: $V = \pi r^2 h$
Surface Area: $S = 2\pi rh + 2\pi r^2$



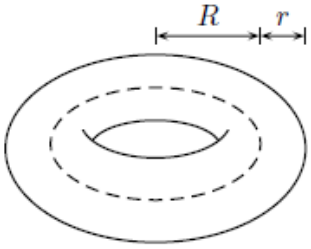
SQUARE PYRAMID

s = side, h = height
Volume: $V = \frac{1}{3}s^2 h$
Surface Area:
$S = s(s + \sqrt{s^2 + 4h^2})$



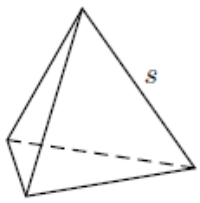
TORUS

r = tube radius,
R = torus radius
Volume: $V = 2\pi^2 r^2 R$
Surface Area: $S = 4\pi^2 rR$

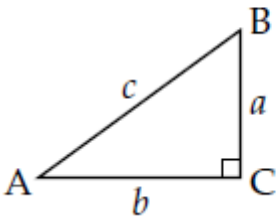


REGULAR TETRAHEDRON

s = side
Volume: $V = \frac{1}{12}\sqrt{2}s^3$
Surface Area: $S = \sqrt{3}s^2$



Formulas for Right Triangles



Pythagorean Theorem:

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

Compound Interest Formula

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

Where,

- P = principal amount (initial investment)
- r = annual nominal interest rate (as a decimal)
- n = number of times the interest is compounded per year
- t = number of years

Equations of a Line

Standard Form:

$Ax + By = C$

where A and B are not both zero

Slope-Intercept Form:

$y = mx + b$ or $y = b + mx$

where m = slope and b = y-intercept

Point-Slope Form:

$y - y_1 = m(x - x_1)$

where m = slope, (x_1, y_1) = point on line

Coordinate Geometry Formulas

Let (x_1, y_1) and (x_2, y_2) be two points in the plane.

slope $= \frac{y_2 - y_1}{x_2 - x_1}$ where $x_2 \neq x_1$

midpoint $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

distance $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Distance Traveled

$d = rt$

distance = rate × time

Simple Interest

$I = prt$

interest = principal × interest rate × time

Polygon Angle Formulas

Sum of degree measures of the interior angles of a polygon:

$180(n - 2)$

Degree measure of an interior angle of a regular polygon:

$\frac{180(n - 2)}{n}$

where n is the number of sides of the polygon

Arithmetic Operations

$ab+ac=a(b+c)$ $\qquad a\left(\frac{b}{c}\right)=\frac{ab}{c}$

$\frac{\left(\frac{a}{b}\right)}{c}=\frac{a}{bc}$ $\qquad \frac{a}{\left(\frac{b}{c}\right)}=\frac{ac}{b}$

$\frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}$ $\qquad \frac{a}{b}-\frac{c}{d}=\frac{ad-bc}{bd}$

$\frac{a-b}{c-d}=\frac{b-a}{d-c}$ $\qquad \frac{a+b}{c}=\frac{a}{c}+\frac{b}{c}$

$\frac{ab+ac}{a}=b+c,\ a\neq 0$ $\qquad \frac{\left(\frac{a}{b}\right)}{\left(\frac{c}{d}\right)}=\frac{ad}{bc}$

Exponent Properties

$a^n a^m=a^{n+m}$ $\qquad \frac{a^n}{a^m}=a^{n-m}=\frac{1}{a^{m-n}}$

$\left(a^n\right)^m=a^{nm}$ $\qquad a^0=1,\ \ a\neq 0$

$(ab)^n=a^n b^n$ $\qquad \left(\frac{a}{b}\right)^n=\frac{a^n}{b^n}$

$a^{-n}=\frac{1}{a^n}$ $\qquad \frac{1}{a^{-n}}=a^n$

$\left(\frac{a}{b}\right)^{-n}=\left(\frac{b}{a}\right)^n=\frac{b^n}{a^n}$ $\qquad a^{\frac{n}{m}}=\left(a^{\frac{1}{m}}\right)^n=\left(a^n\right)^{\frac{1}{m}}$

Properties of Radicals

$\sqrt[n]{a}=a^{\frac{1}{n}}$ $\qquad \sqrt[n]{ab}=\sqrt[n]{a}\sqrt[n]{b}$

$\sqrt[m]{\sqrt[n]{a}}=\sqrt[mn]{a}$ $\qquad \sqrt[n]{\frac{a}{b}}=\frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

$\sqrt[n]{a^n}=a$, if n is odd

$\sqrt[n]{a^n}=|a|$, if n is even

Properties of Inequalities

If $a<b$ then $a+c<b+c$ and $a-c<b-c$

If $a<b$ and $c>0$ then $ac<bc$ and $\frac{a}{c}<\frac{b}{c}$

If $a<b$ and $c<0$ then $ac>bc$ and $\frac{a}{c}>\frac{b}{c}$

Properties of Absolute Value

$$|a|=\begin{cases} a & \text{if } a\geq 0 \\ -a & \text{if } a<0 \end{cases}$$

$|a|\geq 0$ $\qquad |-a|=|a|$

$|ab|=|a||b|$ $\qquad \left|\frac{a}{b}\right|=\frac{|a|}{|b|}$

$|a+b|\leq |a|+|b|$ Triangle Inequality

Distance Formula

If $P_1=(x_1,y_1)$ and $P_2=(x_2,y_2)$ are two points the distance between them is

$$d(P_1,P_2)=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

Complex Numbers

$i=\sqrt{-1}$ $\qquad i^2=-1$ $\qquad \sqrt{-a}=i\sqrt{a},\ \ a\geq 0$

$(a+bi)+(c+di)=a+c+(b+d)i$

$(a+bi)-(c+di)=a-c+(b-d)i$

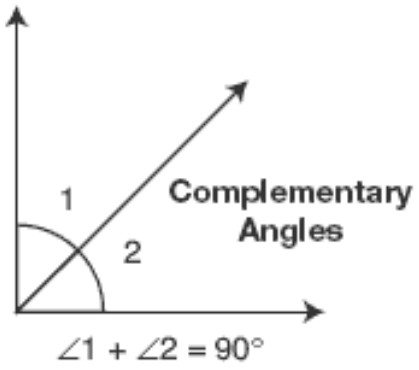
$(a+bi)(c+di)=ac-bd+(ad+bc)i$

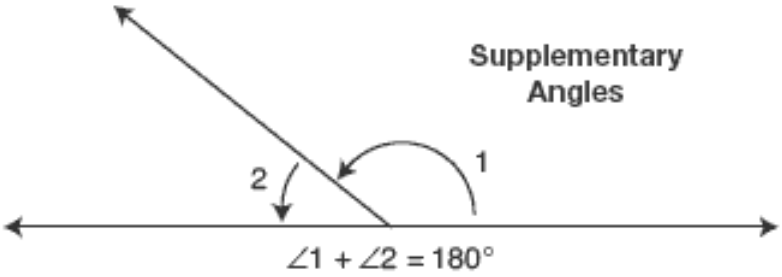
$(a+bi)(a-bi)=a^2+b^2$

$|a+bi|=\sqrt{a^2+b^2}$ Complex Modulus

$\overline{(a+bi)}=a-bi$ Complex Conjugate

$\overline{(a+bi)}(a+bi)=|a+bi|^2$





Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$