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GEOMETRY BACKGROUND

LINEAR INFORMATION:

Slope: $\frac{y_2 - y_1}{x_2 - x_1}$ Midpoint: $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ Distance Formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

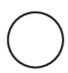
Parallel Lines: same slope

Perpendicular Lines: slopes are negative reciprocals $\left(m_1 = -\frac{1}{m_2} \text{ and } m_1 m_2 = -1\right)$

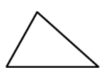
Slope – Point Equation of a Line: $y - y_1 = m(x - x_1)$

Slope – y intercept Equation of a Line: $y = mx + b$

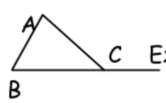
ANGLE INFORMATION:



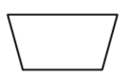
360° in a circle



Sum of the angles in a triangle = 180°

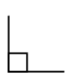


Exterior Angle = Sum of the interior opposite angles $(\angle A + \angle B = \angle C)$

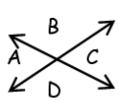


Sum of the Angles in a Quadrilateral = 360°
For each additional side in a polygon, add 180°

Straight Line = 180°   (2 angles that add to 180° are called Supplementary Angles)

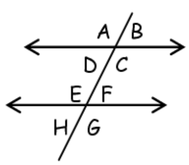


Right Angle = 90°   (2 angles that add to 90° are called Complimentary Angles)



Vertically Opposite Angles $(\angle A = \angle C, \angle B = \angle D)$

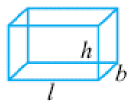
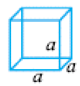
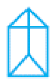
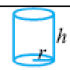
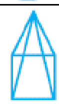
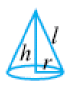
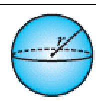
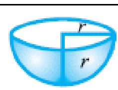
Parallel Lines:



Interior Alternate Angles are Equal – Form a Z Pattern
$(\angle D = \angle F, \angle C = \angle E)$

Corresponding Angles are Equal – Form an F Pattern
$(\angle B = \angle F, \angle A = \angle E, \angle C = \angle G, \angle D = \angle H)$

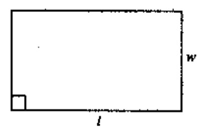
Interior Angles on same side of transversal are Supplementary (C Pattern)
$(\angle D + \angle E = 180^\circ, \angle C + \angle F = 180^\circ)$

Name of the Solid	Figure	Lateral/Curved Surface Area	Total Surface Area	Volume	Nomenclature
Cuboid		$2h\,(l + b)$	$2(lb+bh+hl)$	lbh	l : length b : breadth h : height
Cube		$4a^2$	$6a^2$	a^3	a: side of the cube
Right prism		Perimeter of base $\times$ height	Lateral surface area + 2 (area of one end)	Area of base $\times$ height	–
Right circular cylinder		$2\pi rh$	$2\pi r\,(r+h)$	$\pi r^2 h$	r : radius of the base h : height
Right pyramid		$\frac{1}{2}$(perimeter of base) $\times$ slant height	Lateral surface area + area of the base	$\frac{1}{3}$(area of the base) $\times$ height	–
Right circular cone		πrl	$\pi r\,(l + r)$	$\frac{1}{3}\pi r^2 h$	r : radius of the base h : height l : slant height
Sphere (Solid)		$4\pi r^2$	$4\pi r^2$	$\frac{4}{3}\pi r^3$	r : radius
Hemisphere (Solid)		$2\pi r^2$	$3\pi r^2$	$\frac{2}{3}\pi r^3$	r : radius

GEOMETRIC FORMULAS

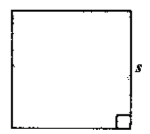
USE $\pi = 3.14$ or $\pi = \frac{22}{7}$

Rectangle



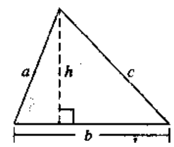
Perimeter: $P = 2l + 2w$
Area: $A = lw$

Square



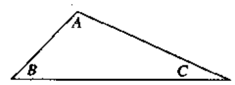
Perimeter: $P = 4s$
Area: $A = s^2$

Triangle



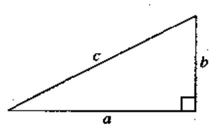
Perimeter: $P = a + b + c$
Area: $A = \frac{1}{2}bh$

Sum of Angles of Triangle



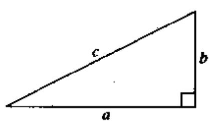
$A + B + C = 180°$
The sum of the measures of the three angles is 180°.

Right Triangle



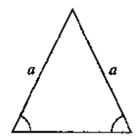
Perimeter: $P = a + b + c$
Area: $A = \frac{1}{2}ab$
One 90° (right) angle

Pythagorean Theorem (for right triangles)



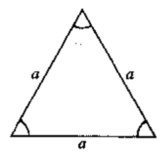
$a^2 + b^2 = c^2$

Isosceles Triangle



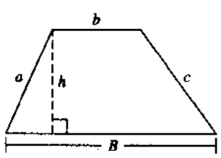
Triangle has:
two equal sides and two equal angles.

Equilateral Triangle



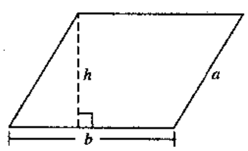
Triangle has:
three equal sides and three equal angles.
Measure of each angle is 60°.

Trapezoid



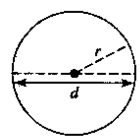
Perimeter:
$P = a + b + c + B$
Area: $A = \frac{1}{2}h(B + b)$

Parallelogram



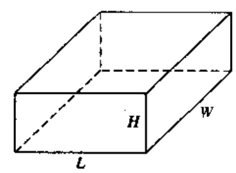
Perimeter: $P = 2a + 2b$
Area: $A = bh$

Circle



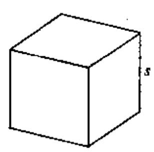
Circumference: $C = \pi d$
$C = 2\pi r$
Area: $A = \pi r^2$

Rectangular Solid



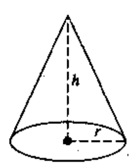
Volume: $V = LWH$

Cube



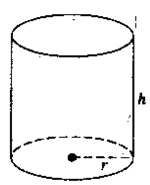
Volume: $V = s^3$

Cone



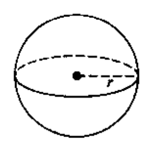
Volume: $V = \frac{1}{3}\pi r^2 h$

Right Circular Cylinder



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

Sphere



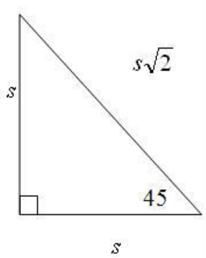
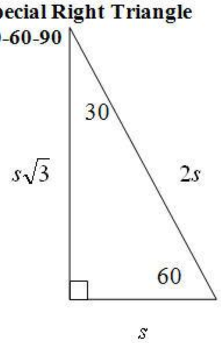
Volume: $V = \frac{4}{3}\pi r^3$

Other Formulas

Distance: $d = rt$ (r = rate, t = time)
Percent: $p = br$ (p = percentage, b = base, r = rate)

Temperature: $F = \frac{9}{5}C + 32$ $\quad C = \frac{5}{9}(F - 32)$
Simple Interest: $I = Prt$
(P = principal, r = annual interest rate, t = time in years)

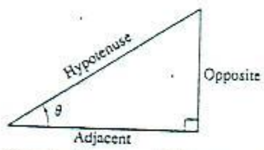
Formulas

Right Prism LA = ph SA = LA + $2B$ V = Bh	**Right Cylinder** LA= $\pi d h$ or LA = $2\pi r h$ SA = LA + $2B$ SA = $\pi d h + 2\pi r^2$ V = Bh or V = $\pi r^2 h$	**Rectangle** ***Perimeter*** $P = 2b + 2h$ or $2l + 2w$ ***Area*** $A = bh$	**Square** ***Perimeter*** $P = 4s$ ***Area*** $A = s^2$
Regular Pyramid LA = $\frac{1}{2}pl$ SA = LA + B V = $\frac{1}{3}Bh$	**Right Cone** LA = $\pi r l$ SA = LA + B SA = $\pi r l + \pi r^2$ V = $\frac{1}{3}Bh$ or V = $\frac{1}{3}\pi r^2 h$	**Area of a Parallelogram** $A = bh$ **Area of a Triangle** $A = \frac{1}{2}bh$ **Area of a Regular Polygon** $A = \frac{1}{2}ap$ **Area of an Equilateral Triangle** $A = \frac{1}{4}(s^2)(\sqrt{3})$	**Area of a Trapezoid** $A = \frac{1}{2}h(b_1 + b_2)$ **Midsegments of a Trapezoid** $Midsegment = \frac{1}{2}(b_1 + b_2)$ **Area of a Rhombus or Kite** $\frac{1}{2}d_1 d_2$
Sphere SA = $4\pi r^2$ V = $\frac{4}{3}\pi r^3$	**Slope Intercept Form** $y = mx + b$ **Point Slope Form** $(y_1 - y_2) = m(x_1 - x_2)$ **Slope Formula** $m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$		
Circle Circumference $C = 2\pi r$ or πd **Area** $A = \pi r^2$	**Circle ~ Length of Arc** Length of $\widehat{AB} = \frac{m\widehat{AB}}{360} \bullet 2\pi r$ **Equation of a Circle** $(x-h)^2 + (y-k)^2 = r^2$	**Area of a Sector of a Circle** $A = \frac{arc}{360}\pi r^2$ **Area of a Segment of a Circle** $A = \frac{arc}{360}\pi r^2 - \frac{1}{2}bh$	**Area of an Annulus of a Circle** $A = \pi R^2 - \pi r^2$
Special Right Triangle 45-45-90 	**Special Right Triangle 30-60-90** 	**Pythagorean Theorem** $a^2 + b^2 = c^2$ **Distance Formula** $d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$ **Midpoint Formula** $M = \frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2}$	**Interior Measure of a Polygon (sum of the angles)** $(n-2)180$ **One angle** $\frac{(n-2)180}{n}$ **Exterior Measure of a Polygon (Sum)** 360 degrees **One exterior Angle** $\frac{360}{n}$

TRIGONOMETRY

Definition of the Six Trigonometric Functions

Right triangle definitions, where $0 < \theta < \pi/2$.

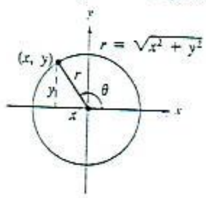


$$\sin\theta = \frac{\text{opp.}}{\text{hyp.}} \quad \csc\theta = \frac{\text{hyp.}}{\text{opp.}}$$

$$\cos\theta = \frac{\text{adj.}}{\text{hyp.}} \quad \sec\theta = \frac{\text{hyp.}}{\text{adj.}}$$

$$\tan\theta = \frac{\text{opp.}}{\text{adj.}} \quad \cot\theta = \frac{\text{adj.}}{\text{opp.}}$$

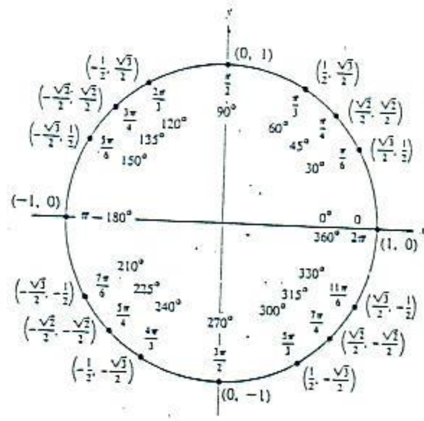
Circular function definitions, where θ is any angle.



$$\sin\theta = \frac{y}{r} \quad \csc\theta = \frac{r}{y}$$

$$\cos\theta = \frac{x}{r} \quad \sec\theta = \frac{r}{x}$$

$$\tan\theta = \frac{y}{x} \quad \cot\theta = \frac{x}{y}$$



Reciprocal Identities

$$\sin x = \frac{1}{\csc x} \quad \sec x = \frac{1}{\cos x} \quad \tan x = \frac{1}{\cot x}$$

$$\csc x = \frac{1}{\sin x} \quad \cos x = \frac{1}{\sec x} \quad \cot x = \frac{1}{\tan x}$$

Tangent and Cotangent Identities

$$\tan x = \frac{\sin x}{\cos x} \quad \cot x = \frac{\cos x}{\sin x}$$

Pythagorean Identities

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

$$1 + \tan^2 x = \sec^2 x \quad 1 + \cot^2 x = \csc^2 x$$

Cofunction Identities

$$\sin\left(\frac{\pi}{2} - x\right) = \cos x \quad \cos\left(\frac{\pi}{2} - x\right) = \sin x$$

$$\csc\left(\frac{\pi}{2} - x\right) = \sec x \quad \tan\left(\frac{\pi}{2} - x\right) = \cot x$$

$$\sec\left(\frac{\pi}{2} - x\right) = \csc x \quad \cot\left(\frac{\pi}{2} - x\right) = \tan x$$

Reduction Formulas

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

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

$$\sec(-x) = \sec x \quad \cot(-x) = -\cot x$$

Sum and Difference Formulas

$$\sin(u \pm v) = \sin u \cos v \pm \cos u \sin v$$

$$\cos(u \pm v) = \cos u \cos v \mp \sin u \sin v$$

$$\tan(u \pm v) = \frac{\tan u \pm \tan v}{1 \mp \tan u \tan v}$$

Double-Angle Formulas

$$\sin 2u = 2 \sin u \cos u$$

$$\cos 2u = \cos^2 u - \sin^2 u = 2\cos^2 u - 1 = 1 - 2\sin^2 u$$

$$\tan 2u = \frac{2\tan u}{1 - \tan^2 u}$$

Power-Reducing Formulas

$$\sin^2 u = \frac{1 - \cos 2u}{2}$$

$$\cos^2 u = \frac{1 + \cos 2u}{2}$$

$$\tan^2 u = \frac{1 - \cos 2u}{1 + \cos 2u}$$

Sum-to-Product Formulas

$$\sin u + \sin v = 2\sin\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$$

$$\sin u - \sin v = 2\cos\left(\frac{u+v}{2}\right)\sin\left(\frac{u-v}{2}\right)$$

$$\cos u + \cos v = 2\cos\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$$

$$\cos u - \cos v = -2\sin\left(\frac{u+v}{2}\right)\sin\left(\frac{u-v}{2}\right)$$

Product-to-Sum Formulas

$$\sin u \sin v = \frac{1}{2}[\cos(u-v) - \cos(u+v)]$$

$$\cos u \cos v = \frac{1}{2}[\cos(u-v) + \cos(u+v)]$$

$$\sin u \cos v = \frac{1}{2}[\sin(u+v) + \sin(u-v)]$$

$$\cos u \sin v = \frac{1}{2}[\sin(u+v) - \sin(u-v)]$$

Mr. Siderer

Circles – Ellipses – Hyperbolas (centered on origin.)

Ellipse

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$$ where a is the intercept on the major axis, which can be the x or y axis.

or $$\frac{x^2}{b^2}+\frac{y^2}{a^2}=1$$ b is the intercept on the minor axis which can be the x or y axis.

$|c|$ is the center-to-focus distance

$$b^2=a^2-c^2$$ $a>b$. If the x^2 term has the larger denominator, then the x axis is the major axis. If the y^2 term has the larger denominator, then the y axis is the major axis.

Circle $$x^2+y^2=r^2$$ A circle is a special ellipse with equal x and y intercepts and radius r.

or $$\frac{x^2}{r^2}+\frac{y^2}{r^2}=1$$ where $a^2=b^2,\ c=0$ or, $a=b$

Hyperbola $$\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$$ a^2 belongs to the positive term and a is the axis intercept. If the x^2 term is positive, then there is an x intercept, and if y^2 positive, then there is a y intercept. b^2 belongs to the negative term.

$$b^2=c^2-a^2$$ c is the center-to-focus distance

If a hyperbola is oriented so its graph crosses the x-axis, then the equation of the asymptotes is $y=+/-\left(\frac{b}{a}\right)x$.

If a hyperbola is oriented so its graph crosses the y-axis, then the equation of the asymptotes is $y=+/-\left(\frac{a}{b}\right)x$.