

Cut here and keep for reference

ALGEBRA

ARITHMETIC OPERATIONS

$$a(b + c) = ab + ac$$

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

$$\frac{a + c}{b} = \frac{a}{b} + \frac{c}{b}$$

$$\frac{\frac{a}{b}}{\frac{c}{d}} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$$

EXPONENTS AND RADICALS

$$x^m x^n = x^{m+n}$$

$$\frac{x^m}{x^n} = x^{m-n}$$

$$(x^m)^n = x^{mn}$$

$$x^{-n} = \frac{1}{x^n}$$

$$(xy)^n = x^n y^n$$

$$\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$$

$$x^{1/n} = \sqrt[n]{x}$$

$$x^{m/n} = \sqrt[n]{x^m} = (\sqrt[n]{x})^m$$

$$\sqrt[n]{xy} = \sqrt[n]{x} \sqrt[n]{y}$$

$$\sqrt[n]{\frac{x}{y}} = \frac{\sqrt[n]{x}}{\sqrt[n]{y}}$$

FACTORIZING SPECIAL POLYNOMIALS

$$x^2 - y^2 = (x + y)(x - y)$$

$$x^3 + y^3 = (x + y)(x^2 - xy + y^2)$$

$$x^3 - y^3 = (x - y)(x^2 + xy + y^2)$$

BINOMIAL THEOREM

$$(x + y)^2 = x^2 + 2xy + y^2 \quad (x - y)^2 = x^2 - 2xy + y^2$$

$$(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$$

$$(x - y)^3 = x^3 - 3x^2y + 3xy^2 - y^3$$

$$(x + y)^n = x^n + nx^{n-1}y + \frac{n(n-1)}{2}x^{n-2}y^2 + \dots + \binom{n}{k}x^{n-k}y^k + \dots + nxy^{n-1} + y^n$$

where $\binom{n}{k} = \frac{n(n-1) \dots (n-k+1)}{1 \cdot 2 \cdot 3 \cdot \dots \cdot k}$

QUADRATIC FORMULA

If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

INEQUALITIES AND ABSOLUTE VALUE

- If $a < b$ and $b < c$, then $a < c$.
- If $a < b$, then $a + c < b + c$.
- If $a < b$ and $c > 0$, then $ca < cb$.
- If $a < b$ and $c < 0$, then $ca > cb$.
- If $a > 0$, then
 - $|x| = a$ means $x = a$ or $x = -a$
 - $|x| < a$ means $-a < x < a$
 - $|x| > a$ means $x > a$ or $x < -a$

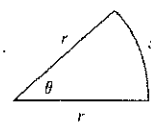
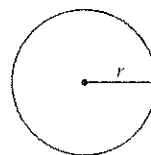
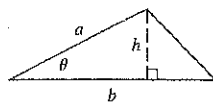
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GEOMETRY

GEOMETRIC FORMULAS

Formulas for area A , circumference C , and volume V :

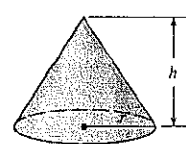
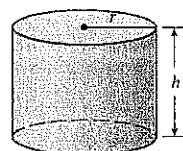
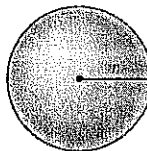
Triangle	Circle	Sector of Circle
$A = \frac{1}{2}bh$	$A = \pi r^2$	$A = \frac{1}{2}r^2\theta$
$= \frac{1}{2}ab \sin \theta$	$C = 2\pi r$	$s = r\theta$ (θ in radians)



Sphere
 $V = \frac{4}{3}\pi r^3$
 $A = 4\pi r^2$

Cylinder
 $V = \pi r^2 h$

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



DISTANCE AND MIDPOINT FORMULAS

Distance between $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$:

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

Midpoint of $\overline{P_1P_2}$: $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

LINES

Slope of line through $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Point-slope equation of line through $P_1(x_1, y_1)$ with slope m :

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

Slope-intercept equation of line with slope m and y -intercept b :

$$y = mx + b$$

CIRCLES

Equation of the circle with center (h, k) and radius r :

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

TRIGONOMETRY

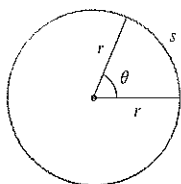
ANGLE MEASUREMENT

π radians = 180°

$1^\circ = \frac{\pi}{180}$ rad 1 rad = $\frac{180^\circ}{\pi}$

$s = r\theta$

(θ in radians)



RIGHT ANGLE TRIGONOMETRY

$\sin \theta = \frac{\text{opp}}{\text{hyp}}$

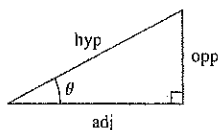
$\csc \theta = \frac{\text{hyp}}{\text{opp}}$

$\cos \theta = \frac{\text{adj}}{\text{hyp}}$

$\sec \theta = \frac{\text{hyp}}{\text{adj}}$

$\tan \theta = \frac{\text{opp}}{\text{adj}}$

$\cot \theta = \frac{\text{adj}}{\text{opp}}$



TRIGONOMETRIC FUNCTIONS

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

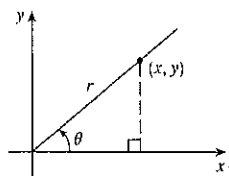
$\csc \theta = \frac{r}{y}$

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

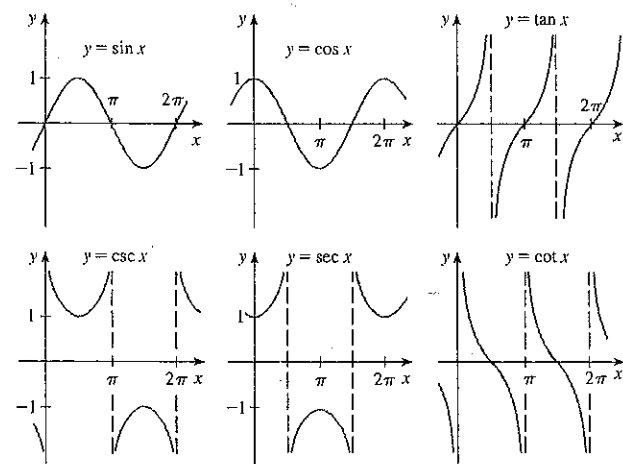
$\sec \theta = \frac{r}{x}$

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

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



GRAPHS OF THE TRIGONOMETRIC FUNCTIONS



TRIGONOMETRIC FUNCTIONS OF IMPORTANT ANGLES

θ	radians	$\sin \theta$	$\cos \theta$	$\tan \theta$
0°	0	0	1	0
30°	$\pi/6$	$1/2$	$\sqrt{3}/2$	$\sqrt{3}/3$
45°	$\pi/4$	$\sqrt{2}/2$	$\sqrt{2}/2$	1
60°	$\pi/3$	$\sqrt{3}/2$	$1/2$	$\sqrt{3}$
90°	$\pi/2$	1	0	—

FUNDAMENTAL IDENTITIES

$\csc \theta = \frac{1}{\sin \theta}$

$\sec \theta = \frac{1}{\cos \theta}$

$\tan \theta = \frac{\sin \theta}{\cos \theta}$

$\cot \theta = \frac{\cos \theta}{\sin \theta}$

$\cot \theta = \frac{1}{\tan \theta}$

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

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

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

$\sin(-\theta) = -\sin \theta$

$\cos(-\theta) = \cos \theta$

$\tan(-\theta) = -\tan \theta$

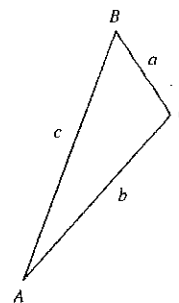
$\sin\left(\frac{\pi}{2} - \theta\right) = \cos \theta$

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

$\tan\left(\frac{\pi}{2} - \theta\right) = \cot \theta$

THE LAW OF SINES

$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$



THE LAW OF COSINES

$a^2 = b^2 + c^2 - 2bc \cos A$

$b^2 = a^2 + c^2 - 2ac \cos B$

$c^2 = a^2 + b^2 - 2ab \cos C$

ADDITION AND SUBTRACTION FORMULAS

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

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

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

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

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

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

DOUBLE-ANGLE FORMULAS

$\sin 2x = 2 \sin x \cos x$

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

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

HALF-ANGLE FORMULAS

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

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