Algebra Properties

ARITHMETIC PROPERTIES

ASSOCIATIVE	$a(bc) = (ab)c$
COMMUTATIVE	$a + b = b + a$ and $ab = ba$
DISTRIBUTIVE	$a(b + c) = ab + ac$

ARITHMETIC OPERATIONS EXAMPLES

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

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

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

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

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

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

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

$\frac{ab + ac}{a} = b + c, a \neq 0$

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

$\frac{\left(\frac{a}{b}\right)}{\left(\frac{c}{d}\right)} = \frac{ad}{bc}$

QUADRATIC EQUATION

For the equation $ax^2 + bx + c = 0$

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

EXPONENT PROPERTIES

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

$(a^n)^m = a^{nm}$

$(ab)^n = a^n b^n$

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

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

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

$a^0 = 1, a \neq 0$

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

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

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

RADICAL PROPERTIES

$a, b \geq 0$ for even n

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

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

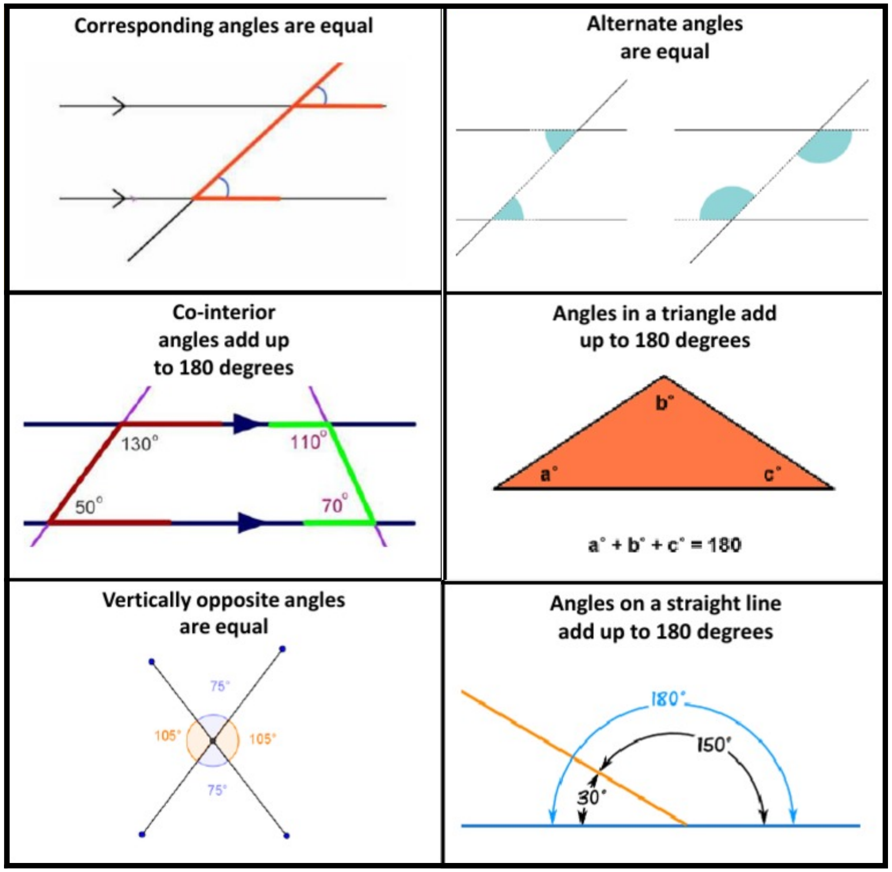
$\sqrt[n]{ab} = \sqrt[n]{a}\sqrt[n]{b}$

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

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

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

Angle Properties



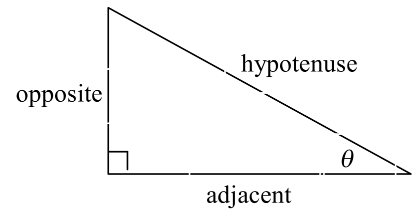
Basic Trigonometry Properties

Definition of the Trig Functions

Right triangle definition

For this definition we assume that

$0 < \theta < \frac{\pi}{2}$ or $0° < \theta < 90°$.



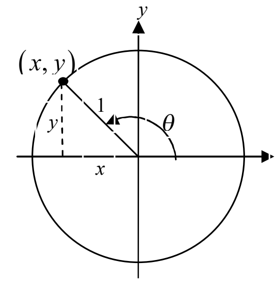
$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}} \qquad \csc\theta = \frac{\text{hypotenuse}}{\text{opposite}}$$

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}} \qquad \sec\theta = \frac{\text{hypotenuse}}{\text{adjacent}}$$

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}} \qquad \cot\theta = \frac{\text{adjacent}}{\text{opposite}}$$

Unit circle definition

For this definition θ is any angle.



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

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

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

Inverse Properties

$$\cos\left(\cos^{-1}(x)\right) = x \qquad \cos^{-1}\left(\cos(\theta)\right) = \theta$$

$$\sin\left(\sin^{-1}(x)\right) = x \qquad \sin^{-1}\left(\sin(\theta)\right) = \theta$$

$$\tan\left(\tan^{-1}(x)\right) = x \qquad \tan^{-1}\left(\tan(\theta)\right) = \theta$$