Log Rules:

$\log_a a = 1$

$\log_a 1 = 0$

$\log_a MN = \log_a M + \log_a N$

$\log_a \dfrac{M}{N} = \log_a M - \log_a N$

$\log_a M^r = r \log_a M$

if $\log_a M = \log_a N$ then $M = N$

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Trigonometry:

a.) Reciprocal

$$\sin\theta = \frac{1}{\csc\theta} \qquad \cos\theta = \frac{1}{\sec\theta} \qquad \tan\theta = \frac{1}{\cot\theta}$$

$$\csc\theta = \frac{1}{\sin\theta} \qquad \sec\theta = \frac{1}{\cos\theta} \qquad \cot\theta = \frac{1}{\tan\theta}$$

b.) Quotient/Ratio

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

c.) Pythagorean

$$\sin^2\theta + \cos^2\theta = 1 \qquad 1 + \tan^2\theta = \sec^2\theta \qquad 1 + \cot^2\theta = \csc^2\theta$$

d.) Even/Odd

$$\sin(-\theta) = -\sin\theta \qquad \cos(-\theta) = \cos\theta \qquad \tan(-\theta) = -\tan\theta$$

e.) Cofunctions

$$\sin\left(\frac{\pi}{2} - \theta\right) = \cos\theta \qquad \sec\left(\frac{\pi}{2} - \theta\right) = \csc\theta \qquad \tan\left(\frac{\pi}{2} - \theta\right) = \cot\theta$$

Trigonometric Formulas:

a.) Sum and Difference Formulas

$\sin(\alpha+\beta)=\sin\alpha\cos\beta+\cos\alpha\sin\beta$

$\sin(\alpha-\beta)=\sin\alpha\cos\beta-\cos\alpha\sin\beta$

$\cos(\alpha+\beta)=\cos\alpha\cos\beta-\sin\alpha\sin\beta$

$\cos(\alpha-\beta)=\cos\alpha\cos\beta+\sin\alpha\sin\beta$

$\tan(\alpha+\beta)=\dfrac{\tan\alpha+\tan\beta}{1-\tan\alpha\tan\beta}$

$\tan(\alpha-\beta)=\dfrac{\tan\alpha-\tan\beta}{1+\tan\alpha\tan\beta}$

b.) Double Angle Formulas:

$\sin 2\theta=2\sin\theta\cos\theta$

$\cos 2\theta=\cos^2\theta-\sin^2\theta$ or $1-2\sin^2\theta$ or $2\cos^2\theta-1$

c.) Half Angle Formulas:

$\sin\dfrac{\theta}{2}=\pm\sqrt{\dfrac{1-\cos\theta}{2}}$

$\tan\dfrac{\theta}{2}=\pm\sqrt{\dfrac{1-\cos\theta}{1+\cos\theta}}$

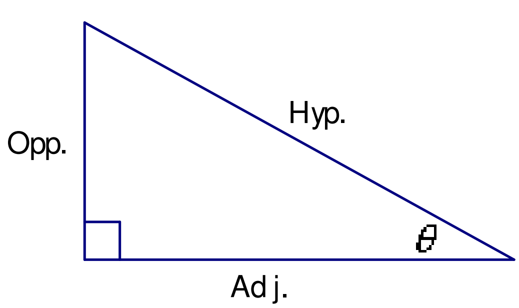
$\cos\dfrac{\theta}{2}=\pm\sqrt{\dfrac{1+\cos\theta}{2}}$

Right Triangle Trigonometry:

$\sin\theta=\dfrac{Opp}{Hyp}$ $\csc\theta=\dfrac{Hyp}{Opp}$

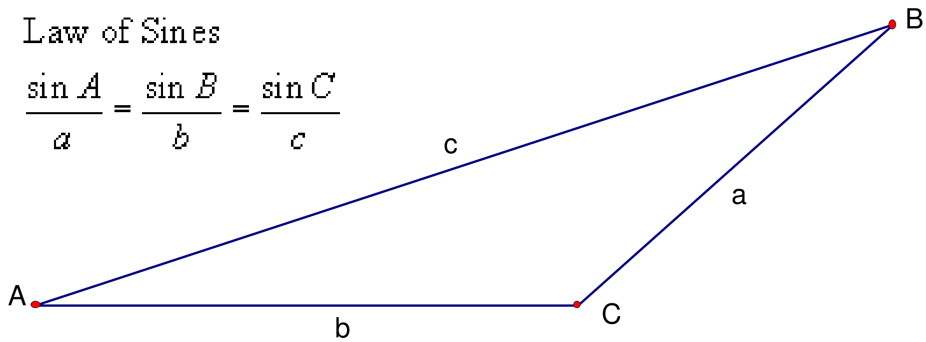
$\cos\theta=\dfrac{Adj}{Hyp}$ $\sec\theta=\dfrac{Hyp}{Adj}$

$\tan\theta=\dfrac{Opp}{Adj}$ $\cot\theta=\dfrac{Adj}{Opp}$



Law of Sines

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

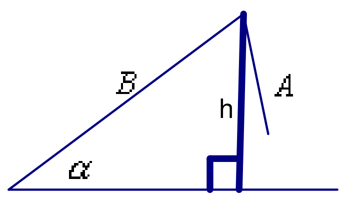


Use for ASA, AAS or SSA

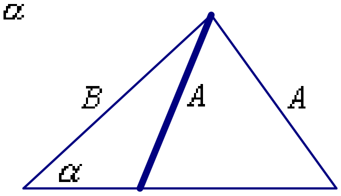
SSA - ambiguous case

$h = B \sin \alpha$

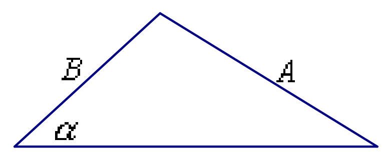
One Right Triangle if $A = B \sin \alpha$



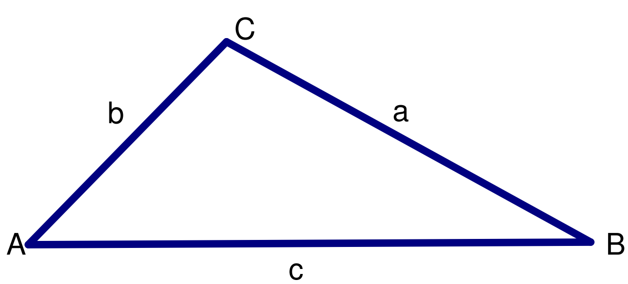
No triangle if $A < B \sin \alpha$



Two possible triangles if $B \sin \alpha < A < B$



One possible triangle if $A > B$



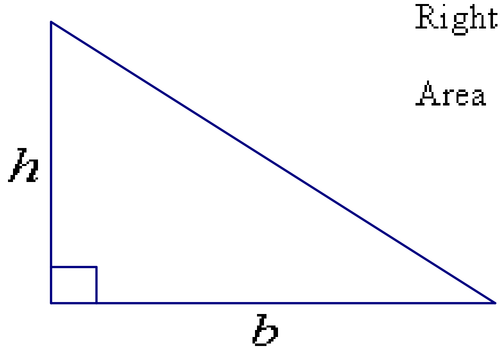
Law of Cosines for SAS:

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

Law of Cosines SSS:

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

Triangle Area



Right Triangle:

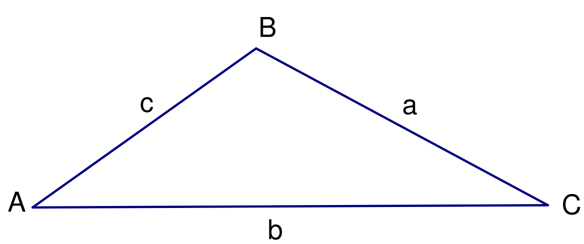
Area $= \frac{1}{2}bh$

Oblique Triangle:

SAS: $A = \frac{1}{2}ab\sin C$

SSS: "Heron's Formula" $A = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{1}{2}(a+b+c)$

ASA: $A = \dfrac{c^2 \sin A \sin B}{2\sin C}$



Parametric Equations:

$x = x_o + at$

$y = y_o + bt$

To find the parametric equation of a line between two points, we just need to solve for: x_o, y_o, a, b

Example:

Find the equation of the parametric equation between the points $(3,-2)$ and $(-4,1)$.

Step 1: Let $t = 0$ for $(3,-2)$ and $t = 1$ for $(-4,1)$.

Step 2: By substitution, $3 = x_o + a \bullet 0$ and $-2 = y_0 + b \bullet 0$, or $3 = x_o$ and $-2 = y_0$

Step 3: Again by substitution, $-4 = 3 + a \bullet 1$ and $1 = -2 + b \bullet 1$, or $a = -7$ and $b = 3$

Step 4: Write the parametric equations: $\left\{ \begin{matrix} x = 3 - 7t \\ y = -2 + 3t \end{matrix} \right\}$

Polar coordinates:

Instead of rempresenting coordiates with rectangular values like (x, y).

We can represent the position of a point by it's distance from the origin "r" and an angle θ.

Remember:

$x = r\cos\theta$

$y = r\sin\theta$

$x^2 + y^2 = r^2$

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

Example1:

Convert the rectangular coordinates $(-5,3)$ to a pair of polar coordiantes.

$(-5)^2 + (3)^2 = r^2$ so $r = \pm\sqrt{34}$

$\tan\theta = -\dfrac{3}{5}$, so $\theta = \tan^{-1}\left(-\dfrac{3}{5}\right) = -31^o$

$(-5,3)$ is in quadrant two, so your pair of polar coordinates should put you in quadrant two.

$\left(\sqrt{34}, 149^o\right)$ or $\left(-\sqrt{34}, -31^o\right)$

Example 2: Convert the polar coordinates $\left(2, \dfrac{\pi}{3}\right)$ to rectangular.

Super Easy! $x = 2\cos\dfrac{\pi}{3} = 2 \bullet \dfrac{1}{2} = 1$ and $y = 2\sin\dfrac{\pi}{3} = 2 \bullet \dfrac{\sqrt{3}}{2} = \sqrt{3}$......$\left(1, \sqrt{3}\right)$