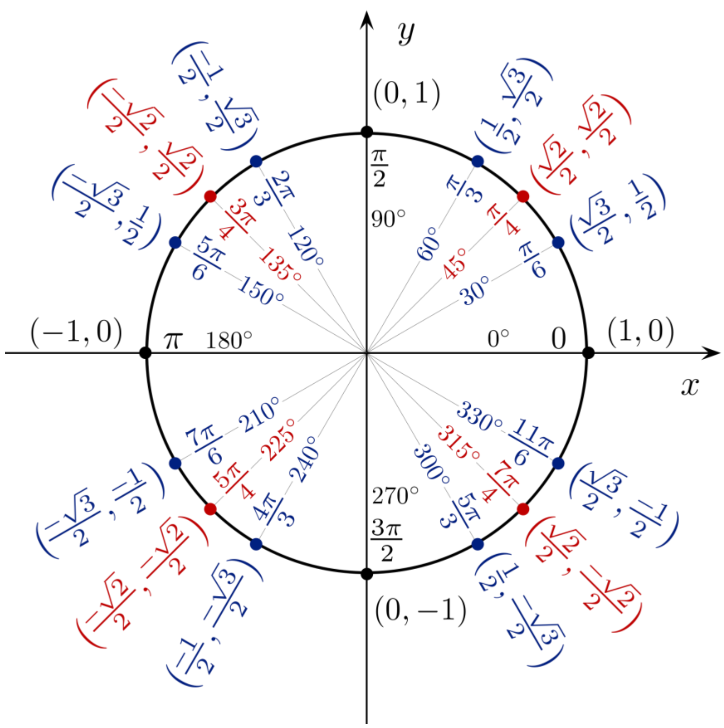
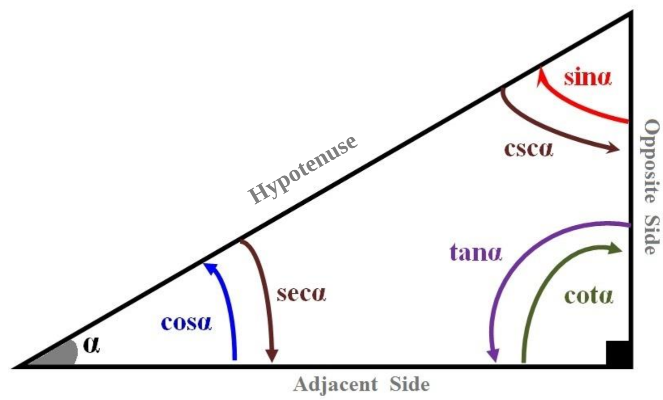
2π (radians) $\equiv 360° \equiv 1$ revolution $\qquad \theta = \frac{s}{r}$ (radians) $\qquad v = \frac{s}{t} = r\omega = r\frac{\theta}{t} \qquad \omega = \frac{\theta}{t} = \frac{v}{r} = \frac{s}{rt} = \frac{v\theta}{s}$

$$3600\ rev / minute = \frac{3600\ rev}{1\ min}\frac{2\pi\ (radians)}{1\ rev}\frac{1\ min}{60\ sec} = \frac{120\pi\ (radians)}{1\ sec}$$

$$r = \sqrt{\left(x_2 - x_1\right)^2 + \left(y_2 - y_1\right)^2} \qquad (x-h)^2 + (y-k)^2 = r^2$$

$\sin\theta = \frac{Opposite}{Hypotenuse} = \frac{opp}{hyp}$	$\cos\theta = \frac{Adjacent}{Hypotenuse} = \frac{adj}{hyp}$	$\tan\theta = \frac{opposite}{adjacent} = \frac{opp}{adj} = \frac{\sin\theta}{\cos\theta}$
$\csc\theta = \frac{hyp}{opp} = \frac{1}{\sin\theta}$	$\sec\theta = \frac{hyp}{adj} = \frac{1}{\cos\theta}$	$\cot\theta = \frac{adj}{opp} = \frac{\cos\theta}{\sin\theta} = \frac{1}{\tan\theta}$





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

cos(-α) = cosα $\qquad$ sin(-α) = - sinα $\qquad$ tan(-α) = - tanα

cos(90° - α) = sinα $\qquad$ sin(90° - α) = cosα $\qquad$ tan(90° - α) = cotα

cos(α - β) = cosα cosβ + sinα sinβ cos(α + β) = cosα cosβ - sinα sinβ	sin(α - β) = sinα cosβ - cosα sinβ sin(α + β) = sinα cosβ + cosα sinβ	$\tan(\alpha-\beta) = \frac{\tan\alpha - \tan\beta}{1+\tan\alpha\tan\beta}$ $\tan(\alpha+\beta) = \frac{\tan\alpha + \tan\beta}{1-\tan\alpha\tan\beta}$

Half-Angle: $\cos\left(\frac{\alpha}{2}\right) = \pm\sqrt{\frac{1+\cos\alpha}{2}} \qquad \sin\left(\frac{\alpha}{2}\right) = \pm\sqrt{\frac{1-\cos\alpha}{2}} \qquad \tan\left(\frac{\alpha}{2}\right) = \frac{\sin\alpha}{1+\cos\alpha} = \frac{1-\cos\alpha}{\sin\alpha}$

$a\sin x + b\cos x = k\sin(x+\alpha)$ where $k = \sqrt{a^2+b^2}$, $\sin\alpha = \frac{b}{\sqrt{a^2+b^2}}$, and $\cos\alpha = \frac{a}{\sqrt{a^2+b^2}}$

Double-Angle

$\cos 2\alpha = \cos^2\alpha - \sin^2\alpha$ $= 1 - 2\sin^2\alpha$ $= 2\cos^2\alpha - 1$	$\sin 2\alpha = 2\sin\alpha\cos\alpha$	$\tan 2\alpha = \dfrac{2\tan\alpha}{1-\tan^2\alpha}$
$\cos^2\alpha = \dfrac{1+\cos 2\alpha}{2}$	$\sin^2\alpha = \dfrac{1-\cos 2\alpha}{2}$	$\tan^2\alpha = \dfrac{1-\cos 2\alpha}{1+\cos 2\alpha}$

Product-to-Sum:

$\sin\alpha\cos\beta = \frac{1}{2}\left[\sin(\alpha+\beta)+\sin(\alpha-\beta)\right]$	$\cos\alpha\sin\beta = \frac{1}{2}\left[\sin(\alpha+\beta)-\sin(\alpha-\beta)\right]$
$\cos\alpha\cos\beta = \frac{1}{2}\left[\cos(\alpha+\beta)+\cos(\alpha-\beta)\right]$	$\sin\alpha\sin\beta = \frac{1}{2}\left[\cos(\alpha-\beta)-\cos(\alpha+\beta)\right]$

Sum-to-Product:

$\cos x + \cos y = 2\cos\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)$	$\sin x + \sin y = 2\sin\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)$
$\cos x - \cos y = -2\sin\left(\frac{x+y}{2}\right)\sin\left(\frac{x-y}{2}\right)$	$\sin x - \sin y = 2\cos\left(\frac{x+y}{2}\right)\sin\left(\frac{x-y}{2}\right)$

Law of Sines: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$ $\qquad$ $\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$

Law of Cosines:

$a^2 = b^2 + c^2 - 2bc\cos A$	$b^2 = a^2 + c^2 - 2ac\cos B$	$c^2 = a^2 + b^2 - 2ab\cos C$
$A = \cos^{-1}\left(\dfrac{b^2+c^2-a^2}{2bc}\right)$	$B = \cos^{-1}\left(\dfrac{a^2+c^2-b^2}{2ac}\right)$	$C = \cos^{-1}\left(\dfrac{a^2+b^2-c^2}{2ab}\right)$

Area: $A = \frac{1}{2}r^2\theta$ (*sector*)

$K = \frac{1}{2}bc\sin A = \frac{1}{2}ac\sin B = \frac{1}{2}ab\sin C$ $\qquad$ $K = \sqrt{s(s-a)(s-b)(s-c)}$ $\quad$ $s = \frac{1}{2}(a+b+c)$

Vectors:

Magnitude: $\lvert V\rvert = \sqrt{a^2+b^2}$	*Angle:* $\cos\theta = \dfrac{U \bullet V}{\lvert U\rvert\lvert V\rvert}$
Dot Product: $U \bullet V = (ai+bj)\bullet(ci+dj) = ac+bd$	

$z = r(\cos\theta + i\,\sin\theta) = r\ cis\theta$ $\qquad$ $r = \sqrt{x^2+y^2}$ $\qquad$ $\cos\theta = \frac{x}{r}$, $\sin\theta = \frac{y}{r}$, *and* $\tan\theta = \frac{y}{x}$

$(r_1 cis\theta_1)(r_2 cis\theta_2) = r_1 r_2 cis(\theta_1+\theta_2)$ $\qquad$ $\dfrac{r_1 cis\theta_1}{r_2 cis\theta_2} = \dfrac{r_1}{r_2}cis(\theta_1-\theta_2)$

De Moivre's *Theorem*: $[rcis\theta]^n = r^n(cisn\theta)$ $\qquad$ $[rcis\theta]^{1/n} = \sqrt[n]{r}cis\alpha$ $\qquad$ $\alpha = \dfrac{\theta}{n} + \dfrac{360°k}{n}$

The graphs of $y = A\sin(Bx + C) + D$ and $y = A\cos(Bx + C) + D$, where $B > 0$, will have the following characteristics:

Amplitude = $|A|$ Period = $\frac{2\pi}{|B|}$ Phase Shift $= \varphi = -\frac{C}{B}$ One cycle: $0 \le argument \le 2\pi$

Vertical Shift: $y = D$

To graph "Sine or Cosine"

1- Find the Amplitude
2- Find the Period
3- Construct a table

x	$y = A\cos(Bx + C) + D$	$y = A\sin(Bx + C) + D$
φ	$D + A$	D
$\varphi + \frac{P}{4}$	D	$D + A$
$\varphi + \frac{P}{2}$	$D - A$	D
$\varphi + \frac{3P}{4}$	D	$D - A$
$\varphi + P$	$D + A$	D

4- Graph *One Cycle*
5- Extend the graph, if necessary

The graphs of $y = A\tan(Bx + C) + D$ and $y = A\cot(Bx + C) + D$, where $B > 0$, will have the following characteristics:

No Amplitude Period $= \frac{\pi}{|B|}$ Phase Shift $= -\frac{C}{B}$ One cycle: $0 \le argument \le \pi$

Vertical Shift: $y = D$

x	$y = A\tan(Bx + C) + D$	$y = A\cot(Bx + C) + D$
φ	D	∞
$\varphi + \frac{P}{4}$	$D + A$	$D + A$
$\varphi + \frac{P}{2}$	∞	D
$\varphi + \frac{3P}{4}$	$D - A$	$D - A$
$\varphi + P$	D	∞