Trigonometry

Sine Sin [Soh] → $\frac{opposite}{hypotenuse}$ **Cosecant** csc → $\frac{hypotenuse}{opposite}$ $(\frac{1}{\sin\theta})$

Cosine Cos [Cah] → $\frac{adjacent}{hypotenuse}$ **Secant** sec → $\frac{hypotenuse}{adjacent}$ $(\frac{1}{\cos\theta})$

Tangent Tan [Toa] → $\frac{opposite}{adjacent}$ **Cotangent** cot → $\frac{adjacent}{opposite}$ $(\frac{1}{\tan\theta})$

$\tan\theta = \frac{\sin\theta}{\cos\theta}$ unit circle: (x,y) = (cos, sin)

S+	STC+
T+	C+

Trigonometry laws

(ASA, SSA) **Sin law** → $\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$

(SAS, SSS) **Cosine law** → $c^2 = a^2 + b^2 - 2ab(\cos C)$ $[ABC] = \frac{1}{2}ab(\sin c)$

Basic identities

2nd Quadrant (Sine)	**Complementary Angles:**
$sin(180 - \theta) = sin\,\theta$ $cos(180 - \theta) = -cos\,\theta$ $tan(180 - \theta) = -tan\theta$	$sin(90 - \theta) = cos\theta$ $cos(90 - \theta) = sin\theta$ $tan(90 - \theta) = \frac{1}{\tan\theta}$
3rd Quadrant (Tangent)	**4th Quadrant (Cosine)**
$sin(180 + \theta) = -sin\,\theta$ $cos(180 + \theta) = -cos\,\theta$ $tan(180 + \theta) = tan\theta$	$sin(360 - \theta) = sin(-\theta) = -sin\,\theta$ $cos(360 - \theta) = cos(-\theta) = cos\,\theta$ $tan(360 - \theta) = tan(-\theta) = -tan\,\theta$

Pythagorean	Negatives	
$sin^2\theta + cos^2\theta = 1$	$sin(-\theta) = -sin\,\theta$	$sec(180 - \theta) = -sec\,\theta$
$tan^2\theta + 1 = sec^2\theta$	$cos(-\theta) = cos\,\theta$	$csc(180 - \theta) = csc\,\theta$

$cot^2\theta + 1 = csc^2\theta$	$tan(-\theta) = -tan\theta$	$cot(180 - \theta) = -cot\theta$

Sum and differences

$sin(A \pm B) = sin\,A\,cos\,B \pm sin\,B\,cos\,A$

$cos(A \pm B) = cos\,A\,cos\,B \mp sin\,A\,sin\,B$

$tan\,(A \pm B) = \frac{tan\,A \pm tan\,B}{1 \mp tan\,A\,tan\,B}$

Double and Half identities

$sin\,2A = 2sinA\,cosA$

$cos2A = cos^2A - sin^2A = 2cos^2A - 1 = 1 - 2sin^2A$

$tan2A = \frac{2tanA}{1-tan^2A}$

$sin\frac{g}{2} = \pm\sqrt{\frac{1-cosg}{2}}$ $\quad cos\frac{g}{2} = \pm\sqrt{\frac{1+cosg}{2}}$ $\quad tan\frac{g}{2} = \frac{sin\,g}{1+cos\,g} = \frac{1-cos\,g}{sin\,g}$

Sum to product

$cos\,a + cos\,b = 2cos(\frac{a+b}{2})cos(\frac{a-b}{2}))$

$cos\,a - cos\,b = -2sin(\frac{a+b}{2})sin(\frac{a-b}{2}))$

$sin\,a + sin\,b = 2sin(\frac{a+b}{2})cos(\frac{a-b}{2}))$

$sin\,a - sin\,b = 2cos(\frac{a+b}{2})sin(\frac{a-b}{2}))$

Product and sum

$cocs\,a\,cos\,b = \frac{1}{2}(cos(a + b) + cos(a - b))$

$sin\,a\,sin\,b = \frac{1}{2}(cos(a - b) - cos(a + b))$

$sin\,a\,cos\,b = \frac{1}{2}(sin(a + b) + sin(a - b))$

$cos\,a\,sin\,b = \frac{1}{2}(sin(a + b) - sin(a - b))$

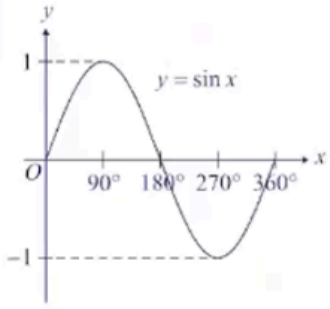
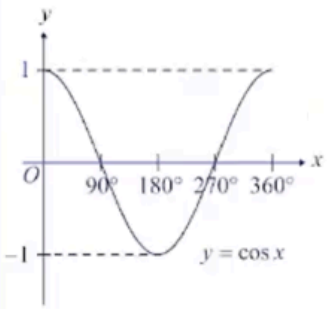
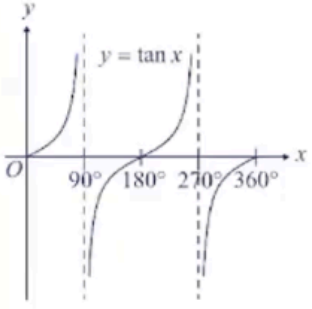
R Formulae

$asin\,\theta \pm bcos\,\theta = Rsin(\theta \pm \alpha)$ $\quad acos\,\theta \pm bsin\,\theta = Rcos(\theta \mp \alpha)$

Where a, b > 0, $R = \sqrt{a^2 + b^2}$ and $\alpha = tan^{-1}(\frac{b}{a})$

Degree	Radian	Sin θ	Cos θ	Tan θ
0º	0	0	1	0
15º	$\frac{\pi}{12}$	$\frac{\sqrt{6}-\sqrt{2}}{4}$	$\frac{\sqrt{6}+\sqrt{2}}{4}$	$2-\sqrt{3}$
30º	$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$
45º	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1
60º	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
90º	$\frac{\pi}{2}$	1	0	-
180º	$\frac{3\pi}{2}$	0	-1	0
360º	2π	0	1	0

GRAPHS

	$y = \sin x$	$y = \cos x$	$y = \tan x$
Graph			
Range	$-1 \le y \le 1$	$-1 \le y \le 1$	All real values

Degress	Sin graph	Cos graph	Tan graph
0°	0	1	0
90°	1	0	error
180°	0	-1	0
270°	-1	0	error
360°	0	1	0

	Sin graph	**Cos graph**	**Tan graph**
Amplitude	1	1	NIL
Period	360°	360°	180°
Lines of symmetry	$x = 0º$ $x = \pm 180º$	$x = 90º$ $x = \pm 270º$	No line of symmetry

Y = asin(bx) + c

a - scales the **amplitude/height** of the graph

b - scales the **period** of the graph (horizontally) - $\frac{2\pi}{period}$

b > 1, the period decreases by a factor of b, if b < 1, the period increases by a factor of b

c - affects **max** and **min** - shifts the graph up (if pos) and down (if neg) by c

Amplitude - vertical distance from the centerline to the max or min point

Period - the length of the interval that a periodic function goes through before it repeats itself