Trigonometry Facts for HL

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$\boldsymbol{\theta}$	**sin** $\boldsymbol{\theta}$	**Memory Trick for sin** $\boldsymbol{\theta}$ **count 0, 1, 2, 3, 4**	**cos** $\boldsymbol{\theta}$ (same as sin θ, but in reverse order)	**tan** $\boldsymbol{\theta} = \frac{\sin\theta}{\cos\theta}$
$0,\ 2\pi$	0	$\frac{\sqrt{0}}{2} = 0$	1	0
$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{1}}{2} = \frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$
$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$	$\frac{\sqrt{2}}{2}$	1
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
$\frac{\pi}{2}$	1	$\frac{\sqrt{4}}{2} = 1$	0	undefined
π	0		-1	0
$\frac{3\pi}{2}$	-1		0	undefined

Arc length = $s = r\,\theta$ (**<u>in radians only</u>**)

Area of a sector = $\frac{1}{2}r^2\theta = \frac{1}{2}sr$ (**<u>in radians only</u>**)

Area of a triangle = $\frac{1}{2}ab\sin C$

(plus 2 more interchanging the letters)

Trig functions definitions

Function	Using the sides of a right triangle	Using a point (x, y) on the terminal side	Using the point (x, y) on the unit circle
$\sin\theta$	$\frac{opp}{hyp}$	$\frac{y}{r}$	y
$\cos\theta$	$\frac{adj}{hyp}$	$\frac{x}{r}$	x
$\tan\theta$	$\frac{opp}{adj}$	$\frac{y}{x}$	$\frac{y}{x}$

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

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

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

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

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

The quadrants in which the function is positive:
Mnemonic: "**A**ll **S**tudents **T**ake **C**alculus"

S (sine)	A (all)
T (tangent)	C (cosine)

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

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

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

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

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

$\tan(2A) = \frac{2\tan A}{1 - \tan^2 A}$

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

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

$a^2 = b^2 + c^2 - 2bc\cos A$ (plus 2 more interchanging the letters)

$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ (plus 2 more interchanging the letters)

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

The co-functions of complementary angles are equal:

$\sin\theta = \cos(90 - \theta)$ $\cos\theta = \sin(90 - \theta)$

$\tan\theta = \cot(90 - \theta)$ $\cot\theta = \tan(90 - \theta)$

$\sec\theta = \csc(90 - \theta)$ $\csc\theta = \sec(90 - \theta)$

$\sin(180° - \theta) = \sin\theta$
$\cos(180° - \theta) = -\cos\theta$
$\tan(180° - \theta) = -\tan\theta$

$\sin(\theta + 90°) = +\cos\theta$
$\cos(\theta + 90°) = -\sin\theta$
$\tan(\theta + 90°) = -\cot\theta$

$\sin(\theta + 180°) = -\sin\theta$
$\cos(\theta + 180°) = -\cos\theta$
$\tan(\theta + 180°) = +\tan\theta$

Angle between two lines with slopes

m_1 and m_2: $\tan\theta = \frac{m_2 - m_1}{1 + m_1 m_2}$