EQUATIONS

definition & reciprocal:

1) $\tan x = \frac{\sin x}{\cos x}$
2) $\sec x = \frac{1}{\cos x}$
3) $\operatorname{cosec} x = \frac{1}{\sin x}$
4) $\cot x = \frac{\cos x}{\sin x} = \frac{1}{\tan x}$

look at the 3rd letter to match

5) $\sin^2 x = (\sin x)^2$
6) $\tan^2 x = \frac{\sin^2 x}{\cos^2 x}$

complementary angles:

1) $\sin(90° - x) = \cos x$
2) $\cos(90° - x) = \sin x$
3) $\tan(90° - x) = \frac{1}{\tan x}$

Negative angles:

1) $\sin(-x) = -\sin x$
2) $\cos(-x) = \cos x$
3) $\tan(-x) = -\tan x$

Identities:

1) $\sin^2 x + \cos^2 x = 1$
2) $1 + \tan^2 x = \sec^2 x$
3) $1 + \cot^2 x = \operatorname{cosec}^2 x$

Addition formula:

1) $\sin(A \pm B) = \sin A \cos B \pm \cos A \cos B$
2) $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$
3) $\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

R formula:

1) $a\sin\theta \pm b\sin\theta = R\sin(\theta \pm \alpha)$
2) $a\cos\theta \pm b\cos\theta = R\cos(\theta \mp \alpha)$

min value: $-R$ when $\cos(\theta \pm \alpha)$ or $\sin(\theta \pm \alpha) = -1$

max value: R when $\cos(\theta \mp \alpha)$ or $\sin(\theta \mp \alpha) = 1$

$R = \sqrt{a^2 + b^2}$, $\alpha = \tan^{-1}\left(\frac{b}{a}\right)$

$a > 0$ (must be true), $b > 0$

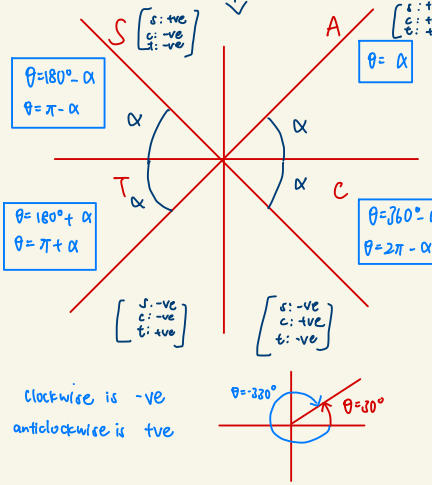
Double angle formula:

1) $\sin 2A = 2\sin A \cos A$
   - $\sin A = 2\sin\frac{A}{2}\cos\frac{A}{2}$
   - $\sin 4A = 2\sin 2A \cos 2A$
2) $\cos 2A = 2\cos^2 A - 1$
   - $\cos A = 2\cos^2\frac{A}{2} - 1 \Rightarrow \cos\frac{A}{2} = \sqrt{\frac{\cos A + 1}{2}}$
   - $\cos 4A = 2\cos^2 2A - 1$
3) $\cos 2A = 1 - 2\sin^2 A$
   - $\cos A = 1 - 2\sin^2\frac{A}{2} \Rightarrow \sin\frac{A}{2} = \sqrt{\frac{1 - \cos A}{2}}$
   - $\cos 4A = 1 - 2\sin^2 2A$
4) $\cos 2A = \cos^2 A - \sin^2 A$
5) $\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$

Ratios of angles

x (in degrees)	x (in radians)	$\sin x$	$\cos x$	$\tan x$ → $\tan x = \frac{\sin x}{\cos x}$
0°	0	0	1	$\frac{0}{1} = 0$
30°	$\frac{\pi}{6}$	$\frac{\sqrt{1}}{2} = \frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$
45°	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$	$\frac{\sqrt{2}}{2}$	1
60°	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{1}}{2}$	$\sqrt{3}$
90°	$\frac{\pi}{2}$	1	0	∞ undefined

Trigonometry



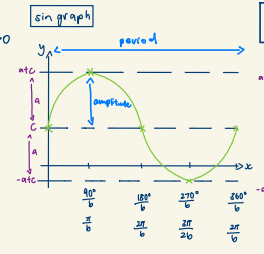
Clockwise is -ve

anticlockwise is +ve

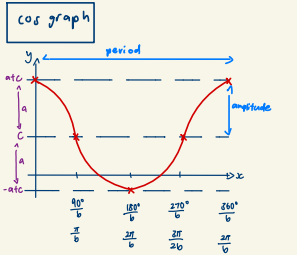
graphs

1) $y = a\sin bx + c$, $a > 0$
2) $y = a\cos bx + c$, $a > 0$
   - amplitude: a
   - period: $\frac{360°}{b}$ or $\frac{2\pi}{b}$ (1 cycle ⇒ 4 markings)
   - centre line: $y = c$
   - range: $-a \le a\sin bx \le a$: $-a \le a\cos bx \le a$
   - asymptotes: none

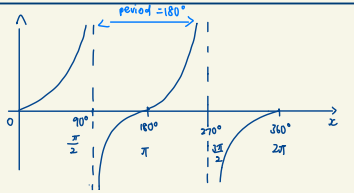
sin graph



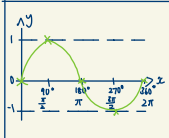
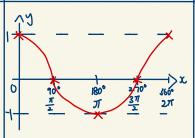
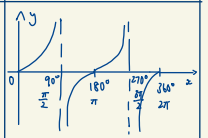
cos graph



3) $y = a\tan bx$
   - amplitude: ∞
   - period: $\frac{180°}{b}$ or $\frac{\pi}{b}$
   - range: any real number
   - asymptotes: $x = 90°$, $y = 270°$

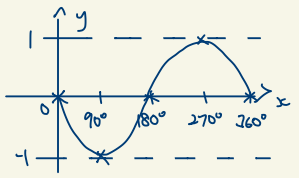


EXAMPLE:

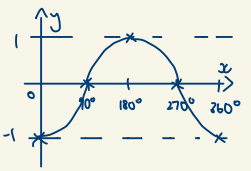
$y = \sin x$ $(a=1, b=1)$	$y = \cos x$ $(a=1, b=1)$	$y = \tan x$ $(a=1, b=1)$
		
amplitude: 1	amplitude: 1	amplitude: ∞
period: 360° or 2π	period: 360° or 2π	period: 180° or π
asymptote: none	asymptote: none	asymptote: $x = 90°/\frac{\pi}{2}$, $x = 270°/\frac{3\pi}{2}$
range: $-1 \le \sin x \le 1$	range: $-1 \le \cos x \le 1$	range: any real number

when $a < 0$,

sin graph



cos graph



tan graph