

Reciprocal Identities

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

$$\operatorname{cosec} x = \frac{1}{\sin x}$$

$$\cot x = \frac{1}{\tan x} = \frac{\cos x}{\sin x}$$

3rd letter is a clue to
the identity

$\cot$ **t** x **t** for tan

More Identities

$$1 + \tan^2 x = \sec^2 x$$

$$1 + \cot^2 x = \operatorname{cosec}^2 x$$

Quadratic Questions

$$4 \operatorname{cosec}^2 x - \cot x - 9 = 0$$

$$4(1 + \cot^2 x) - \cot x - 9 = 0$$

$$4 + 4\cot^2 x - \cot x - 9 = 0$$

$$(4\cot x - 5)(\cot x + 1) = 0$$

Now solve

Double Angle

(Not in the formula booklet)

$$\sin 2A = 2 \sin A \cos A$$

$$\begin{aligned}\cos 2A &= \cos^2 A - \sin^2 A \\ &= 2\cos^2 A - 1 \\ &= 1 - 2\sin^2 A\end{aligned}$$

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

Addition Formula

(In the formula Booklet)

$$\begin{aligned}\sin(A + B) &= \sin A \cos B + \cos A \sin B \\ \sin(A - B) &= \sin A \cos B - \cos A \sin B\end{aligned}$$

$$\begin{aligned}\cos(A + B) &= \cos A \cos B - \sin A \sin B \\ \cos(A - B) &= \cos A \cos B + \sin A \sin B\end{aligned}$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

Tips: Above formulas can be useful
when you see

$$\cos(3x) = \cos(2x + x)$$

$$\sin(3x) = \sin(2x + x)$$

$$\sin(15) = \sin(45 - 30)$$

R Formula

$$R \sin(x \pm \alpha)$$

or $R \cos(x \pm \alpha)$

work out R $R = \sqrt{a^2 + b^2}$

work out α $\tan \alpha = \frac{b}{a}$ or $\frac{a}{b}$

How to identify a and b

$$3 \sin x + 4 \cos x$$

Compare with addition formula:

$$\cos \alpha \sin x + \sin \alpha \cos x$$

Hence

$$\cos \alpha = 3 \text{ and } \sin \alpha = 4$$

$$\therefore \tan \alpha = \frac{4}{3}$$

R Formula

(Max and Min)

$\sin x$ maximum value is 1

$\sin x$ minimum value is -1

	max	min
$5 \sin x$	5	-5
$2 + 5 \sin x$	7	-7
$2 + 5 \sin 3x$	7	-7
$-\sin x$	1	-1
$\sqrt{2} \sin 3x$	$\sqrt{2}$	$-\sqrt{2}$
$1 + \sqrt{2} \sin 3x$	$1 + \sqrt{2}$	$1 - \sqrt{2}$
$2(1 + \sqrt{2} \sin 3x)$	$2 + 2\sqrt{2}$	$2 - 2\sqrt{2}$

$\cos x$ maximum value is 1

$\cos x$ minimum value is -1

$5 \cos x$	5	-5
$2 + 5 \cos x$	7	-7
$2 + 5 \cos 3x$	7	-7
$-\cos x$	1	-1
$\sqrt{2} \cos 3x$	$\sqrt{2}$	$-\sqrt{2}$
$1 + \sqrt{2} \cos 3x$	$1 + \sqrt{2}$	$1 - \sqrt{2}$
$2(1 + \sqrt{2} \cos 3x)$	$2 + 2\sqrt{2}$	$2 - 2\sqrt{2}$

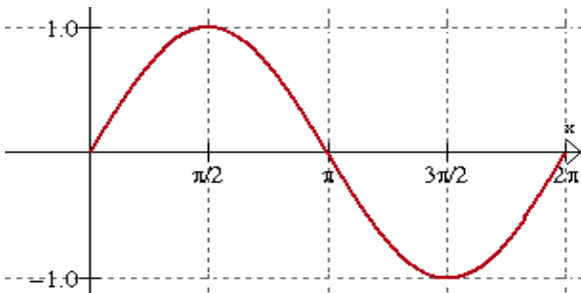
Year 2 Pure Chapter 6 + 7 - Trigonometry Functions

R Formula

(When it Occurs)

$$y = \sin x$$

the first max where $x > 0$
happens at $(90, 1)$



$$y = \sin(x - 30)$$

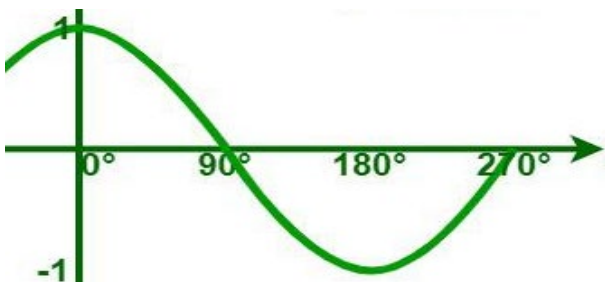
max happens at $(90 + 30, 1)$

$$y = \sin(2x - 30)$$

max happens at $(\frac{90 + 30}{2}, 1)$

$$y = \cos x$$

the first max where $x \geq 0$
happens at $(0, 1)$



$$y = \cos(x + 30)$$

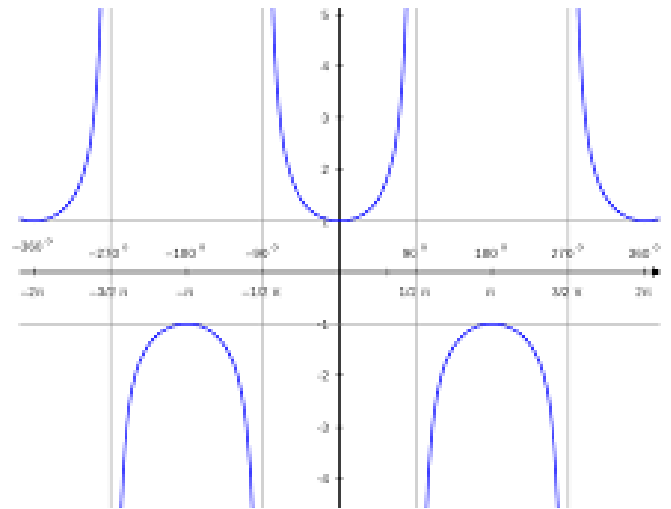
max happens at $(0 - 30, 1)$

$$y = \cos(2x - 30)$$

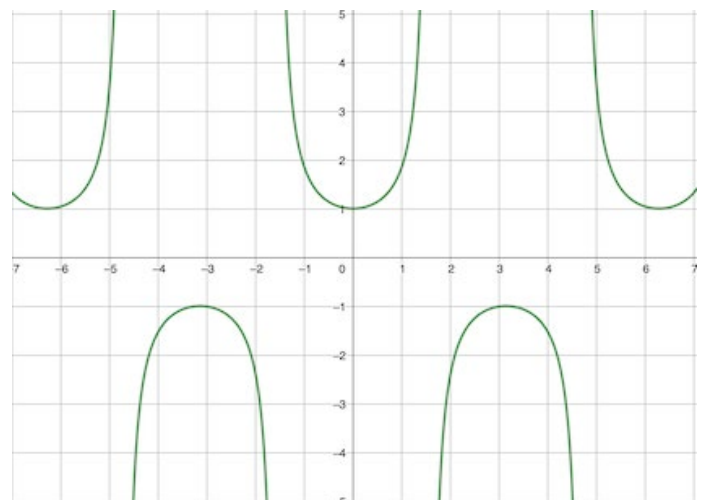
max happens at $(\frac{0 - 30}{2}, 1)$

SEC, COSEC, COT Graphs

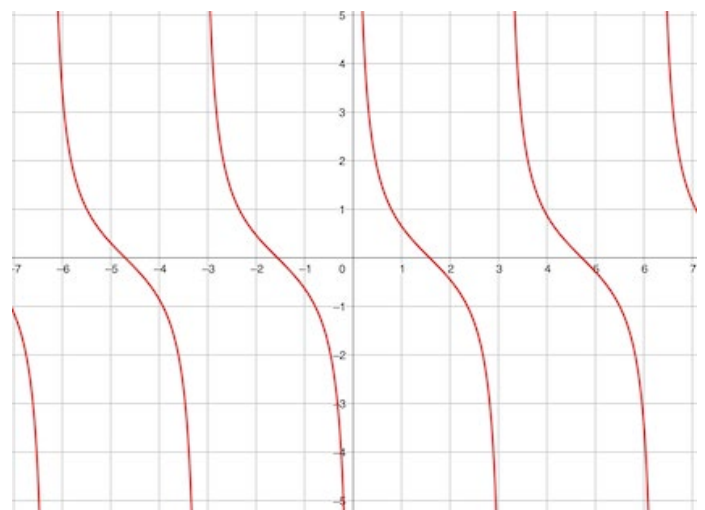
$$y = \sec x$$



$$y = \operatorname{cosec} x$$

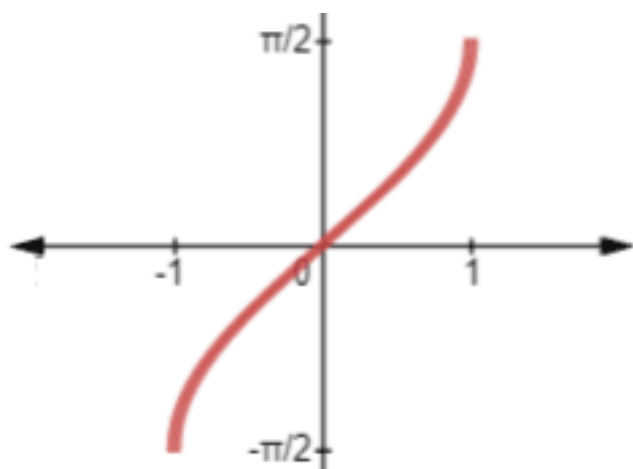


$$y = \cot x$$

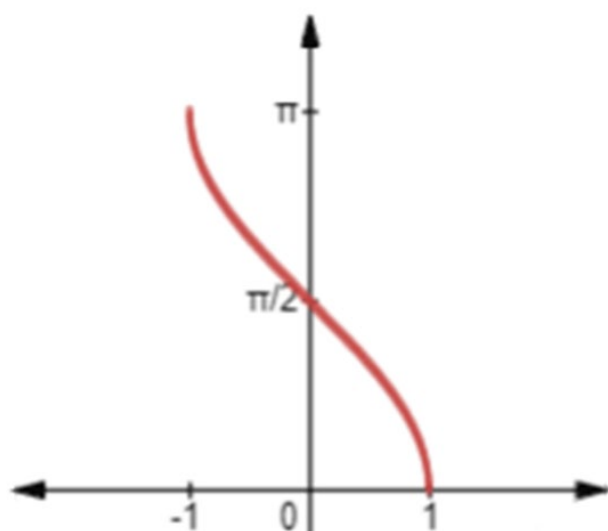


arcsin, arccos, arctan Graphs

$$y = \arcsin x$$



$$y = \arccos x$$



$$y = \arctan x$$

