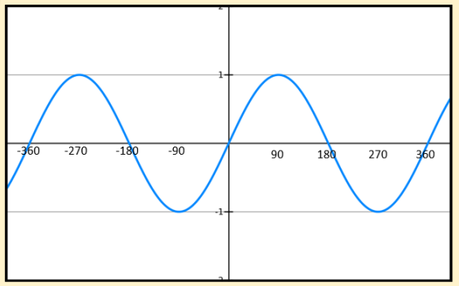
Unit 13a: Trigonometric Graphs

The graphs of sine, cos and Tan

Sine Graph



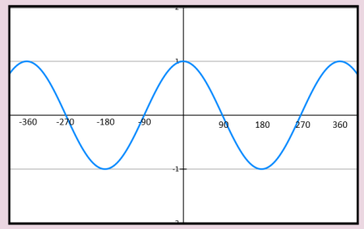
The Sine Graph repeats every 360°

It's largest value is 1

It's smallest value is -1

Each graph is shown between the range of –360 degrees and + 360 degrees. The range can be changed/restricted so make sure you read the range carefully in a question.

Cos Graph



The Cosine Graph repeats every 360°

It's largest value is 1

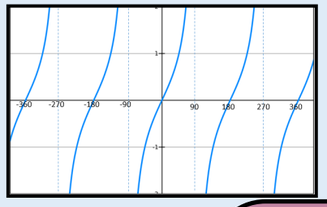
It's smallest value is -1

Tan Graph

The Tan Graph repeats every 180°

There are asymptotes (the dashed lines) that the tan graph never touches.

It doesn't have a maximum or minimum point, it goes between negative infinity and positive infinity.



Solving Equations with Trig Graphs

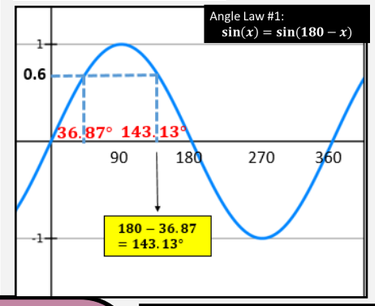
Solve $\sin(x)=0.6$ in the range $0 \le x < 360$

1) Draw a straight horizontal line at 0.6 (you can see we will have **2** solutions)

2) Substitute 0.6 into the **inverse trig function** into your calculator

3) Round to a suitable degree of accuracy: **36.87°**

4) Subtract **36.87°** from **180°** to find the second solution.



$x = \sin^{-1}(0.6) = 36.87°, 143.13°$

Solve $3\cos(x) = 2$ in the range $0 \le x < 360$

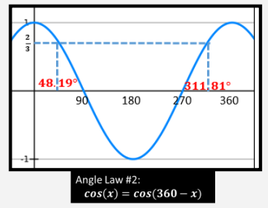
1) Rearrange first to eliminate the 3

2) Draw a horizontal line at $\frac{2}{3}$

3) Substitute $\frac{2}{3}$ into the inverse cos function

4) Round the answer to a suitable degree of accuracy

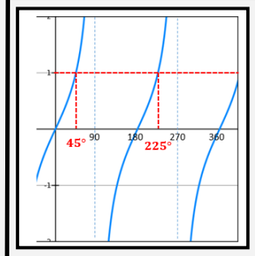
5) Find all solutions



$x = \cos^{-1}\left(\frac{2}{3}\right) = 48.19°, 311.81°$

Steps

1) Sketch the trig graph within the specified range.
2) Draw a straight horizontal line at your given value notice how many times it crosses the graph (this is how many answers there are)
3) Substitute the value given into the **inverse trig function** into your calculator.
4) Round to a suitable degree of accuracy
5) This gives you **one** answer
6) Use your answer to find other solutions of the equation.



Solve $\tan(x) = 1$ in the range $0 \le x < 360$

$x = \tan^{-1}(1) = 45°$

$45° + 180° = 225°$

1) Draw a horizontal line at **1**

2) Substitute **1**into the inverse tan function

3) Find all solutions

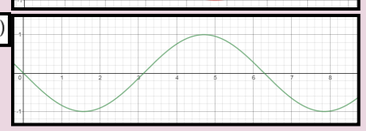
Transformations of Graphs

When we have a negative change inside the bracket

$f(-x)$ *is a reflection of the graph in the* $y-$*axis*

$y = \sin x$

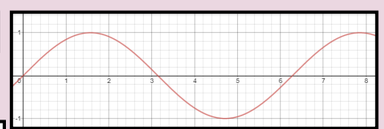
$y = \sin(-x)$



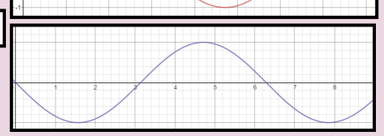
When we have a negative change outside the bracket

$-f(x)$ *is a reflection of the graph in the* $x-$*axis*

$y = \sin x$



$y = -\sin x$



When we add or subtract outside the bracket it translates the graph in y

$f(x) + 1$ *translates the graph by* $\begin{pmatrix}0\\1\end{pmatrix}$

$f(x) - 1$ *translates the graph by* $\begin{pmatrix}0\\-1\end{pmatrix}$

1 $y = \sin x$

2 $y = \sin x + 1$

When we add or subtract inside the bracket it translates the graph in x (in the opposite direction)

$f(x+1)$ *translates the graph by* $\begin{pmatrix}-1\\0\end{pmatrix}$

$f(x-1)$ *translates the graph by* $\begin{pmatrix}1\\0\end{pmatrix}$

1 $y = \sin x$

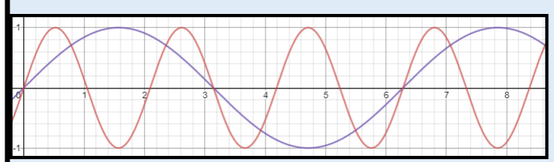
2 $y = \sin(x+1)$

When we have a change inside the bracket

$f(ax)$ *squashes on the x axis by a factor of a*

1 $y = \sin x$

2 $y = \sin 3x$



f(3x) ➡ Squash on x-axis by factor of *3*

When we have a change outside the bracket

$af(x)$ *stretched on the* $y-$*axis by a factor of* a

2f(x) ➡ Stretch on y-axis by factor of *2*

1 $y = \sin x$

2 $y = 2\sin x$