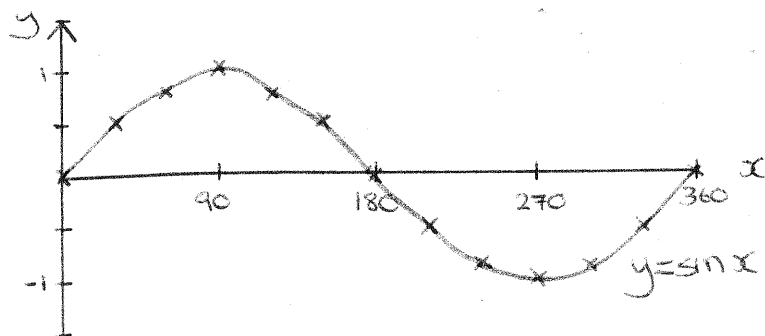


Achievement Standard 2.9

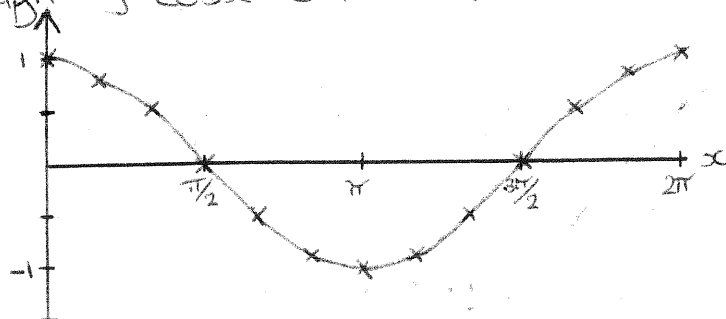
Trig Equations

1) Graph  $y = \sin x$  on  $0 \leq x \leq 360^\circ$



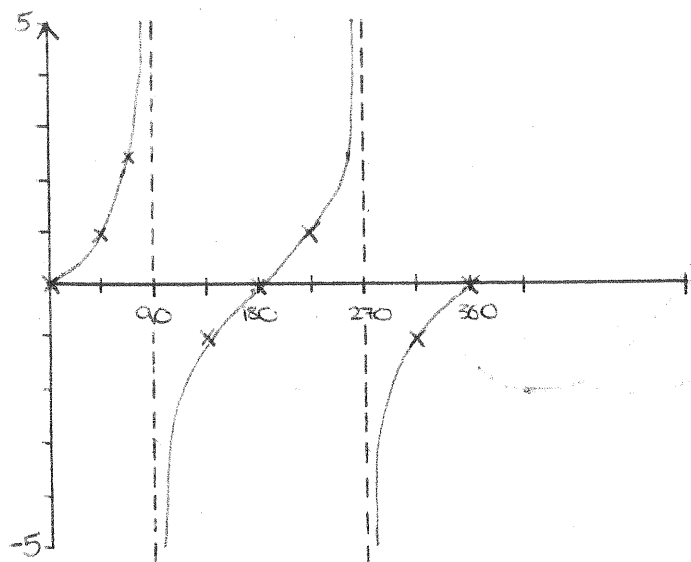
Period =  $360^\circ$   
Amplitude = 1

2) Graph  $y = \cos x$  on  $0 \leq x \leq 2\pi$



Period =  $2\pi$  (or  $360^\circ$ )  
Amplitude = 1

3) Graph  $y = \tan x$  on  $0 \leq x \leq 360^\circ$

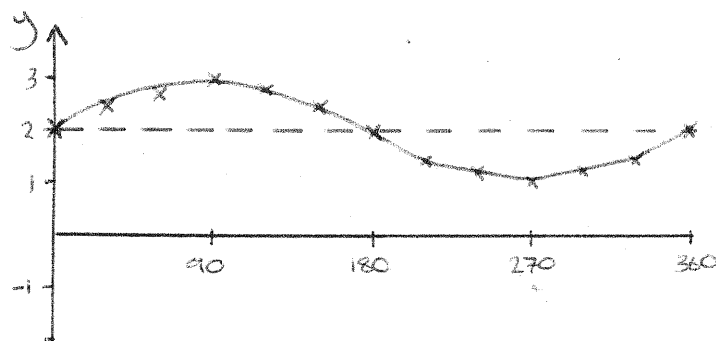


Period =  $180^\circ$  ( $\pi$ )

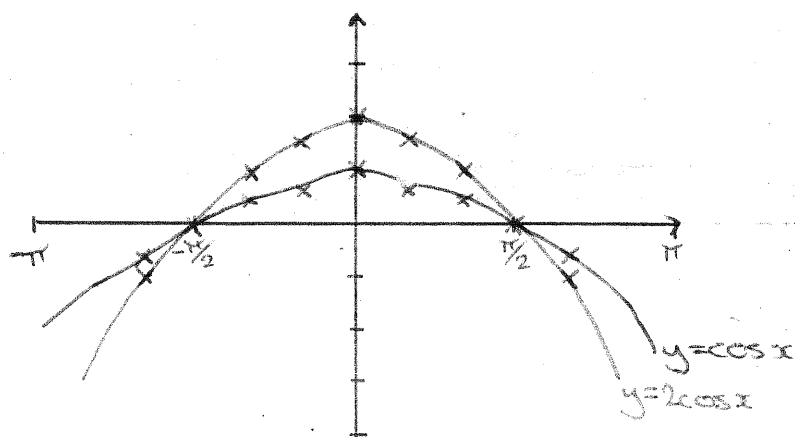
## Trig Transformations

Sur  
We  
The

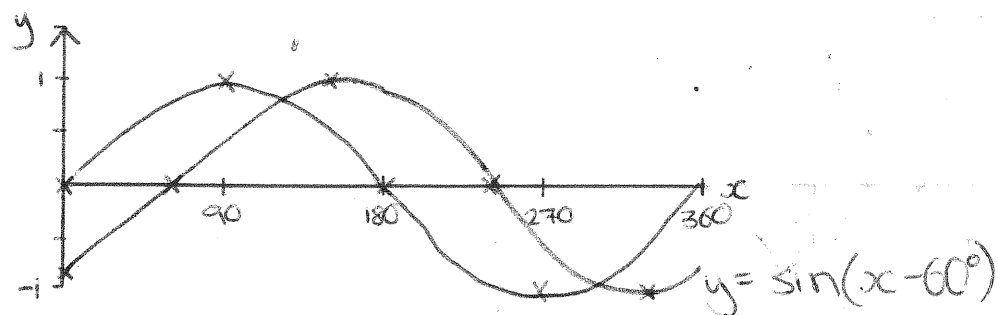
1) Graph  $y = \sin x + 2$  on  $0 \leq x \leq 360^\circ$



2) Graph  $y = 2\cos x$  on  $-\pi \leq x \leq \pi$



3) Graph  $y = \sin(x - 60^\circ)$  on  $0^\circ \leq x \leq 360^\circ$



## Trig Equations

Using a graphics calculator:

$$\text{Solve } 3 \sin 2x = 1.5 \text{ on } 0 \leq x < 360$$

Steps:

- 1) Use SETUP and select Deg
- 2) From menu, select Graph. Enter  $Y_1 = 3 \sin 2x$   
 $Y_2 = 1.5$
- 3) Use V-window and set  
 $X_{\min} = 0$   
 $X_{\max} = 360$   
 $Y_{\min} = -3$   
 $Y_{\max} = 3$
- 4) Return to graph and select DRAW
- 5) Use G-Solv and select INSCT

## Problems

1)  $\tan x = 1.8$  on  $0 \leq x < 360$   
 $x \in \{60.9^\circ, 240.9^\circ\}$

2)  $3 \sin x + 1 = 2$  on  $0 \leq x < 2\pi$   
 $x \in \{0.34, 2.80\}$

3)  $\cos(\theta + 70^\circ) = -0.3$  on  $-180^\circ \leq x \leq 180^\circ$   
 $\theta \in \{-177.5^\circ, 37.5^\circ\}$

4) The water depth  $d$  is given by  $d = 8 - 2.5 \cos\left(\frac{\pi t}{6}\right)$  where  $t$  is time in hours since low tide. In one tidal cycle, for how long is water more than 9.8m deep?

$$\text{Period} = \frac{\pi t}{6} = 2\pi$$

$$t = 12 \text{ hours}$$

$$9.8 = 8 - 2.5 \cos\left(\frac{\pi t}{6}\right)$$

$$1.8 = -2.5 \cos\left(\frac{\pi t}{6}\right)$$

$$\cos\left(\frac{\pi t}{6}\right) = -0.72$$

$$t \in \{4.54 \text{ h}, 7.45 \text{ h}\}$$

$$\text{Time above } 9.8 \text{ m} = 7.45 - 4.54 = 2.91 \text{ hours} = 2 \text{ h } 55 \text{ minutes}$$

5) The loudness of a siren is given by

$$L = 50 + 30 \sin\left(\frac{2\pi t}{5}\right)$$

The siren is on for 20 seconds

For how much of time will loudness exceed 70db?

$$\text{Period} = \frac{2\pi t}{5} = 2\pi$$

$$2\pi t = 10\pi$$

$$2t = 10$$

$$t = 5 \text{ seconds}$$

Solve:

$$70 = 50 + 30 \sin\left(\frac{2\pi t}{5}\right)$$

$$20 = 30 \sin\left(\frac{2\pi t}{5}\right)$$

$$\frac{2}{3} = \sin\left(\frac{2\pi t}{5}\right)$$

$$t \in \{0.58, 1.92\}$$

$$\begin{aligned} \text{Time per cycle} &= 1.92 - 0.58 \\ &= 1.36 \end{aligned}$$

$$\begin{aligned} \text{Total time} &= 1.36 \times 4 \\ &= 5.36 \text{ seconds} \end{aligned}$$