chapter

2 **Trigonometry 1**

Section 2.7 Graphs of trigonometric functions

PROJECT MATHS – STRAND 2
Text & Tests 4
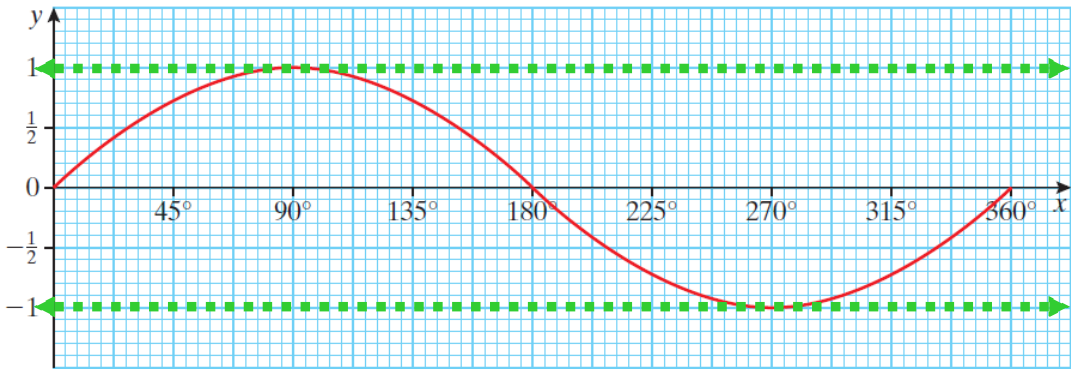**LEAVING CERTIFICATE**
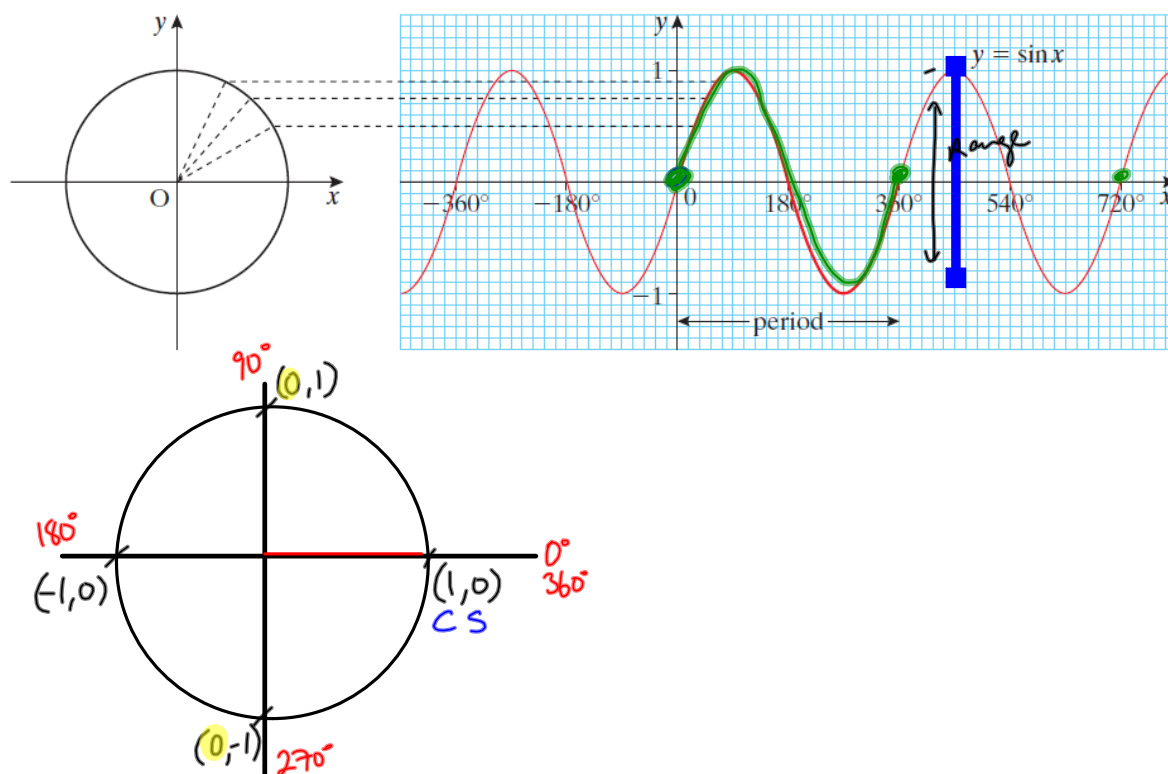**HIGHER LEVEL**

60

Graph of $y = \sin x$

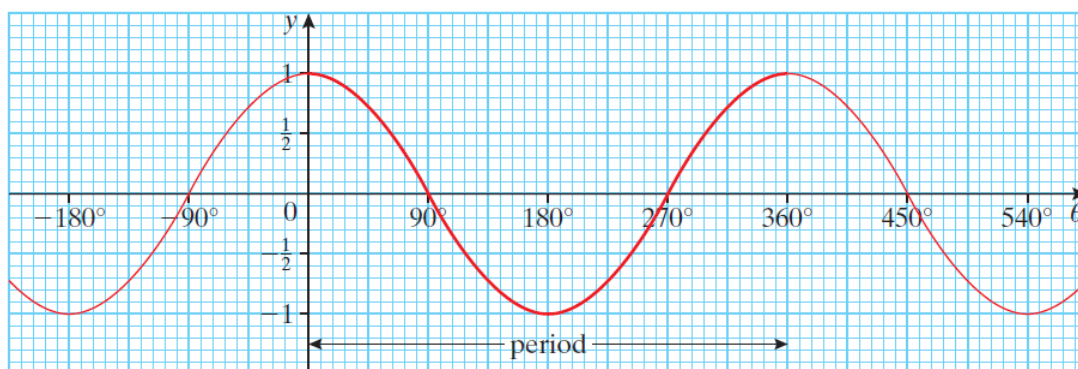| $x =$	0°	45°	90°	135°	180°	225°	270°	315°	360°
$y = \sin x$	0	0.7	1	0.7	0	-0.7	-1	-0.7	0

Graph of $y = \sin x$

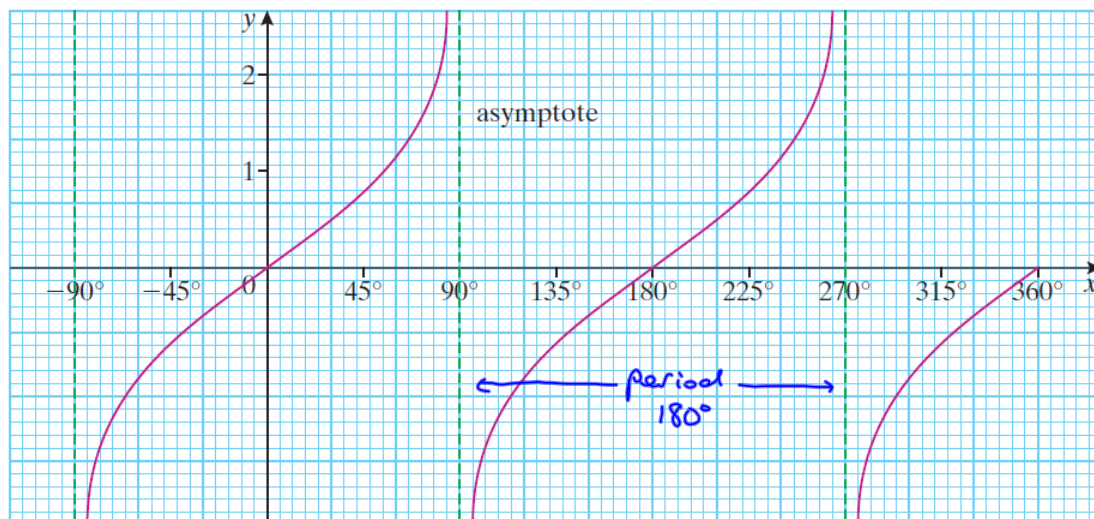The graph of $y = \sin x$ for $-360° \leqslant x \leqslant 720°$ is shown below.

Graph of $y = \cos x$

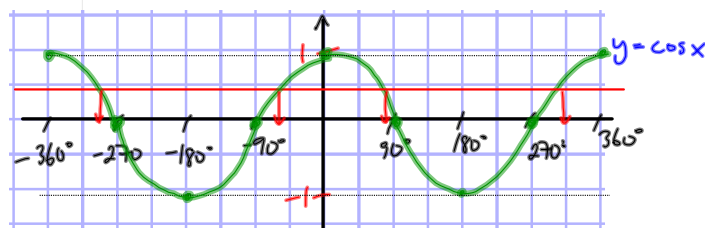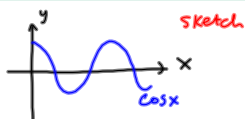**Graph of** $y = \tan x$ $= \dfrac{\sin x}{\cos x}$ ← When $\cos x = 0$ $\tan x$ doesn't exist

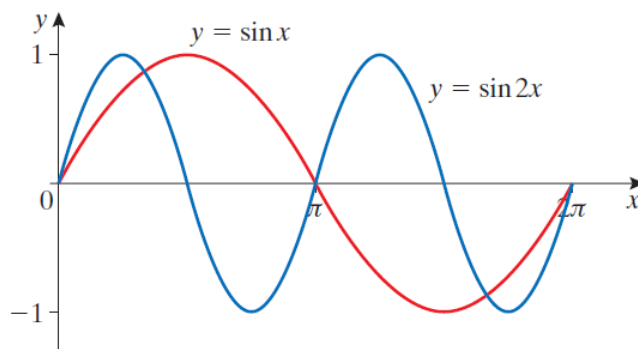| x =	0°	45°	90°	135°	180°	225°	270°	315°	360°
y = tan	0	1	undefined	−1	0	1	undefined	−1	0

asymptote

period 180°

Example 1

Draw a graph of $y = \cos x$ in the domain $-360° \leqslant x \leqslant 360°$.

Show on the graph that there are four angles in this domain that satisfy the equation $\cos x = \frac{1}{2}$.
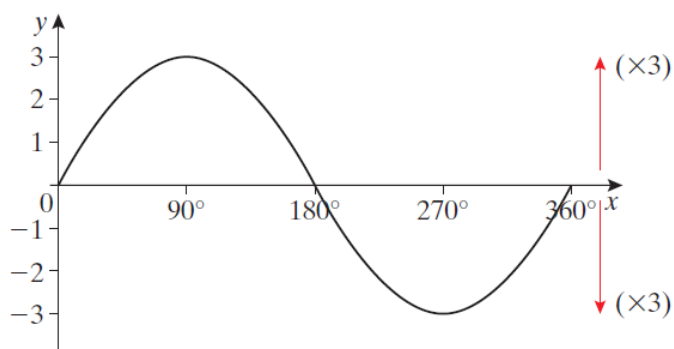

sketch

cosx

$y = \cos x$

Graphs of $a \sin nx$ and $a \cos nx,\ n \in \mathbb{N}$

$y = \sin x$ has period 2π

$y = \sin 2x$ has period $\dfrac{2\pi}{2} = \pi$

$y = \sin 3x$ has period $\dfrac{2\pi}{3}$

$y = \sin nx$ has period $\dfrac{2\pi}{n}$

$y = \sin x$

$y = \sin 2x$

Graph of $y = a \sin x$
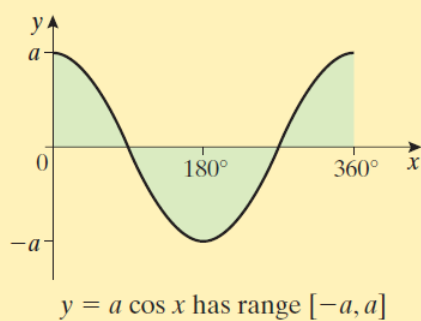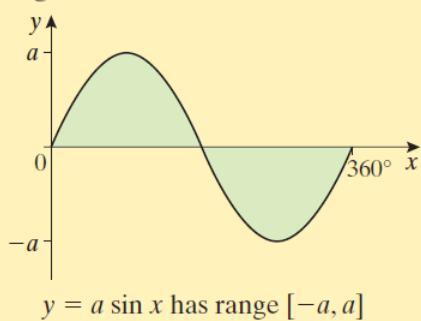
Consider the graph of $y = \mathbf{3} \sin x$.

The effect of the **3** is to stretch vertically the graph of $y = \sin x$ by a factor of 3.
It has no effect on the x-direction of the graph.
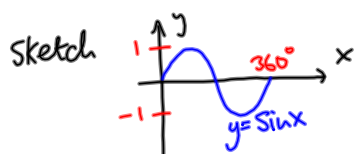
The graph of $y = 3 \sin x$ is shown on the right.
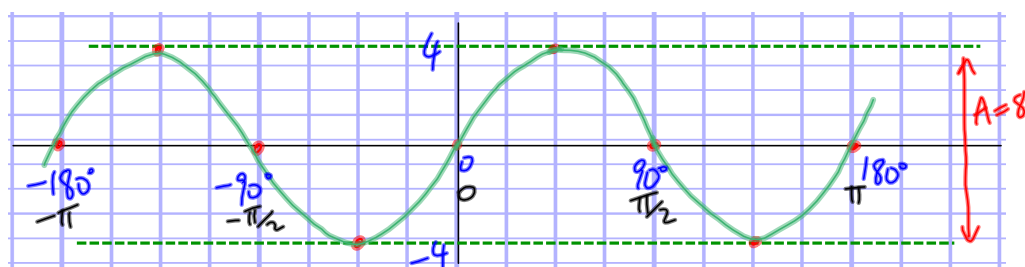
The range is $(-3, 3)$.

The range of a function

$y = a \sin x$ has range $[-a, a]$　　　　$y = a \cos x$ has range $[-a, a]$

Example 2

Sketch the graph of $y = 4 \sin 2x$ in the domain $-180° \leqslant x \leqslant 180°$.
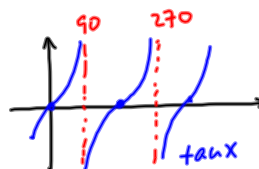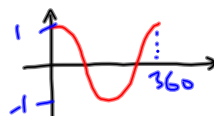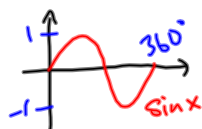
sketch

$y = \sin x$

If $y = 4 \sin 2x$

Amplitude 4 times bigger than 2

Compared to $\sin x$

Period $= \frac{360°}{2} = 180°$

$A = 8$

– graph the trigonometric functions sine, cosine, tangent
– graph trigonometric functions of type
  • $f(\theta) = a + b\sin c\theta$
  • $g(\theta) = a + b\cos c\theta$
  for $a, b, c \in \mathbf{R}$

Graph   shift up $\frac{3}{3}$ period $= 360(2) = 720°$

$$y = 3 + 2\cos \frac{x}{2}$$

$A = 2 \times 2$

in domain
$0 \geq x \geq 720°$

90   270

$\tan x$

$\sin x$ 360   360

y=5
y=3
y=1
720°   1440°

2. **Trig graphs**
   e.g. A trigonometric function is given by
   $$f(x) = a + b\cos cx,$$
   where $a, b, c \in \mathbb{R}$ and x is in degrees.

   The range of the graph $y = f(x)$ is
   $[-10, 50]$ and its period is $72°$.

   If $b < 0$, find the values of the constants a, b and c.

TRY this question for HW.
Solution on Trigonometry Revision Page.

(b) The graphs of three functions are shown on the diagram below. The scales on the axes are not labelled. The three functions are:
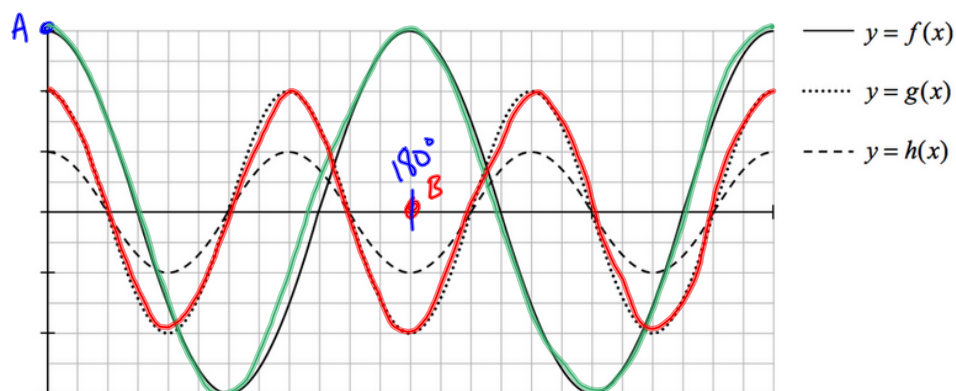
$$x \to \cos 3x$$
$$x \to 2\cos 3x$$
$$x \to 3\cos 2x$$

Identify which function is which, and write your answers in the spaces below the diagram.

2010
P:2
Q5

A

——— $y = f(x)$

········· $y = g(x)$

- - - - $y = h(x)$

180°
B

$f : x \to$ _____ **3Cos 2x** $g : x \to$ _____ **2. Cos 3x** $h : x \to$ _____ **Cos 3x**

(c) Label the scales on the axes in the diagram in part **(b)**.

$A = (0, 3)$
$B = (180°, 0)$

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