

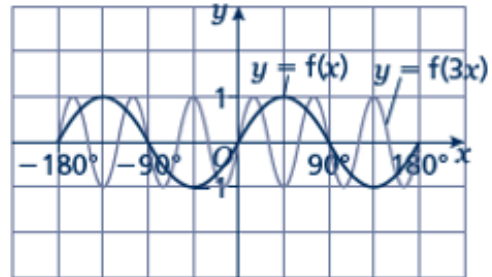
Transforming trigonometric graphs

A LEVEL LINKS

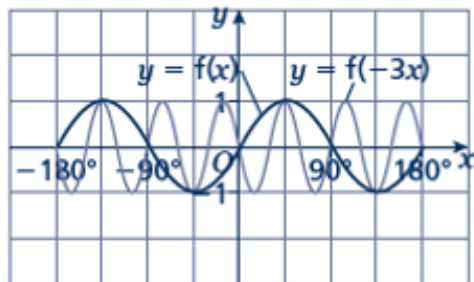
Scheme of work: 4a. Trigonometric ratios and graphs

Key points

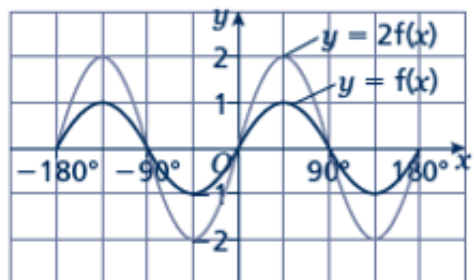
- The transformation $y = f(ax)$ is a horizontal stretch of $y = f(x)$ with scale factor $\frac{1}{a}$ parallel to the x -axis.



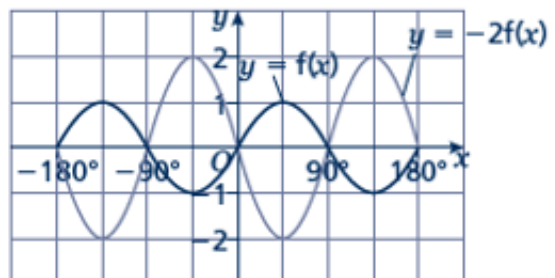
- The transformation $y = f(-ax)$ is a horizontal stretch of $y = f(x)$ with scale factor $\frac{1}{a}$ parallel to the x -axis and then a reflection in the y -axis.



- The transformation $y = af(x)$ is a vertical stretch of $y = f(x)$ with scale factor a parallel to the y -axis.



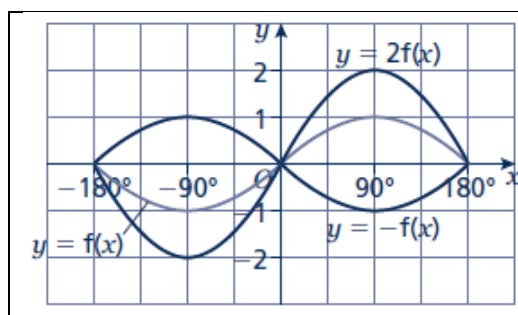
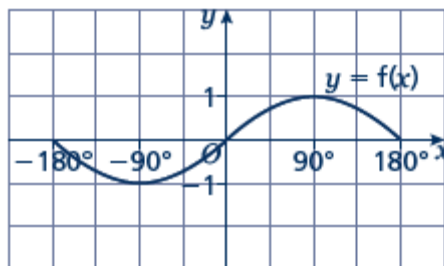
- The transformation $y = -af(x)$ is a vertical stretch of $y = f(x)$ with scale factor a parallel to the y -axis and then a reflection in the x -axis.



Examples

Example 1 The graph shows the function $y = f(x)$.

Sketch and label the graphs of $y = 2f(x)$ and $y = -f(x)$.

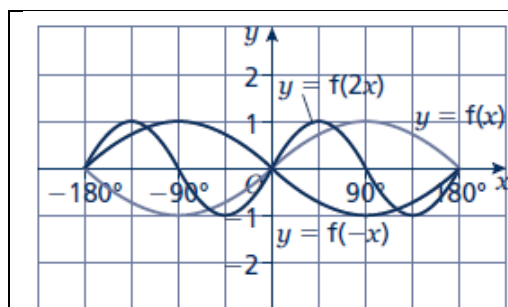
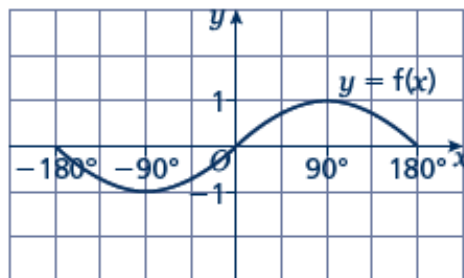


The function $y = 2f(x)$ is a vertical stretch of $y = f(x)$ with scale factor 2 parallel to the y -axis.

The function $y = -f(x)$ is a reflection of $y = f(x)$ in the x -axis.

Example 2 The graph shows the function $y = f(x)$.

Sketch and label the graphs of $y = f(2x)$ and $y = f(-x)$.

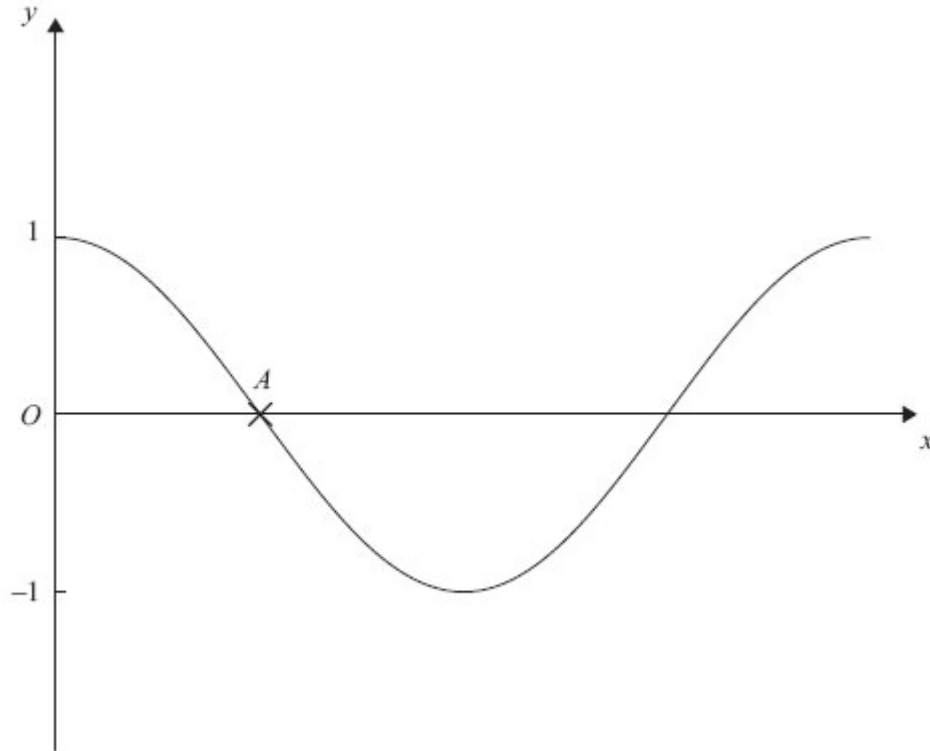


The function $y = f(2x)$ is a horizontal stretch of $y = f(x)$ with scale factor $\frac{1}{2}$ parallel to the x -axis.

The function $y = f(-x)$ is a reflection of $y = f(x)$ in the y -axis.

Practice questions

- 1 The diagram shows a sketch of the graph of $y = \cos x^\circ$

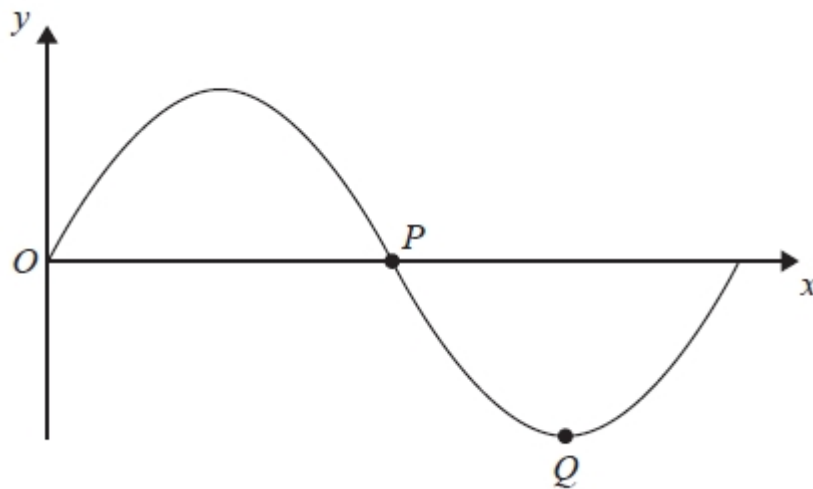


- (a) Write down the coordinates of the point A .

.....

- (b) On the same diagram, draw a sketch of the graph of $y = 2 \cos x^\circ$

2 The diagram shows part of a sketch of the curve $y = \sin x^\circ$.



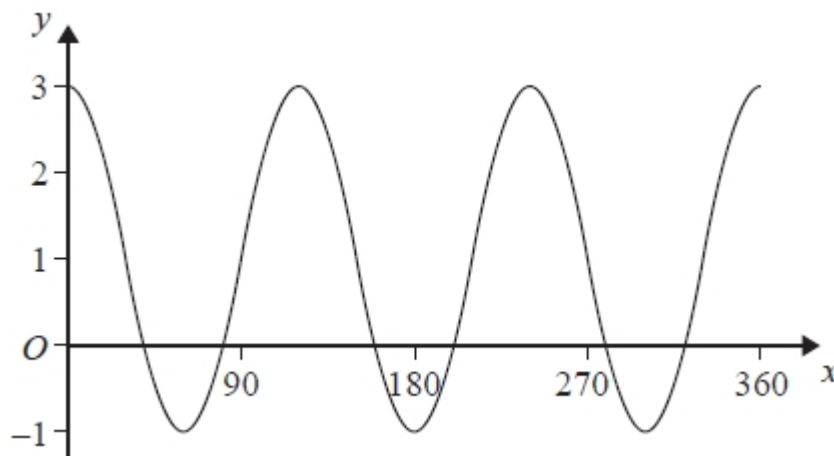
(a) Write down the coordinates of the point P .

(.....,))

(b) Write down the coordinates of the point Q .

(.....,))

Here is a sketch of the curve $y = a \cos bx^\circ + c$, $0 \leq x \leq 360$



(c) Find the values of a , b and c .

$a =$

$b =$

$c =$

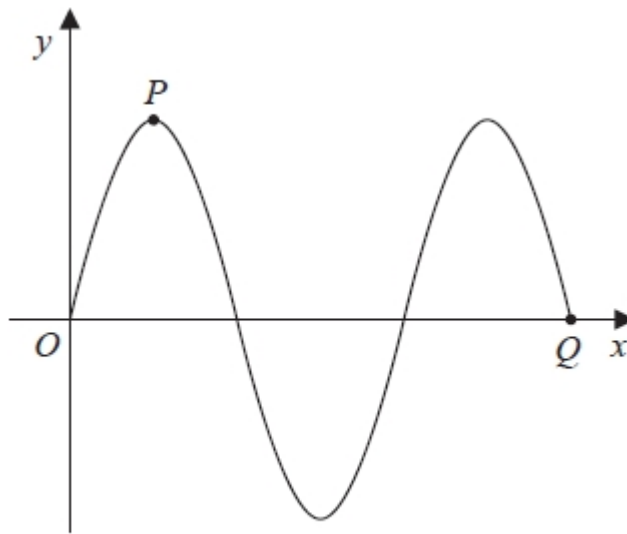


Figure 3

Figure 3 shows part of the curve C_1 with equation $y = 3\sin x$, where x is measured in degrees.

The point P and the point Q lie on C_1 and are shown in Figure 3.

(a) State

- (i) the coordinates of P ,
- (ii) the coordinates of Q .

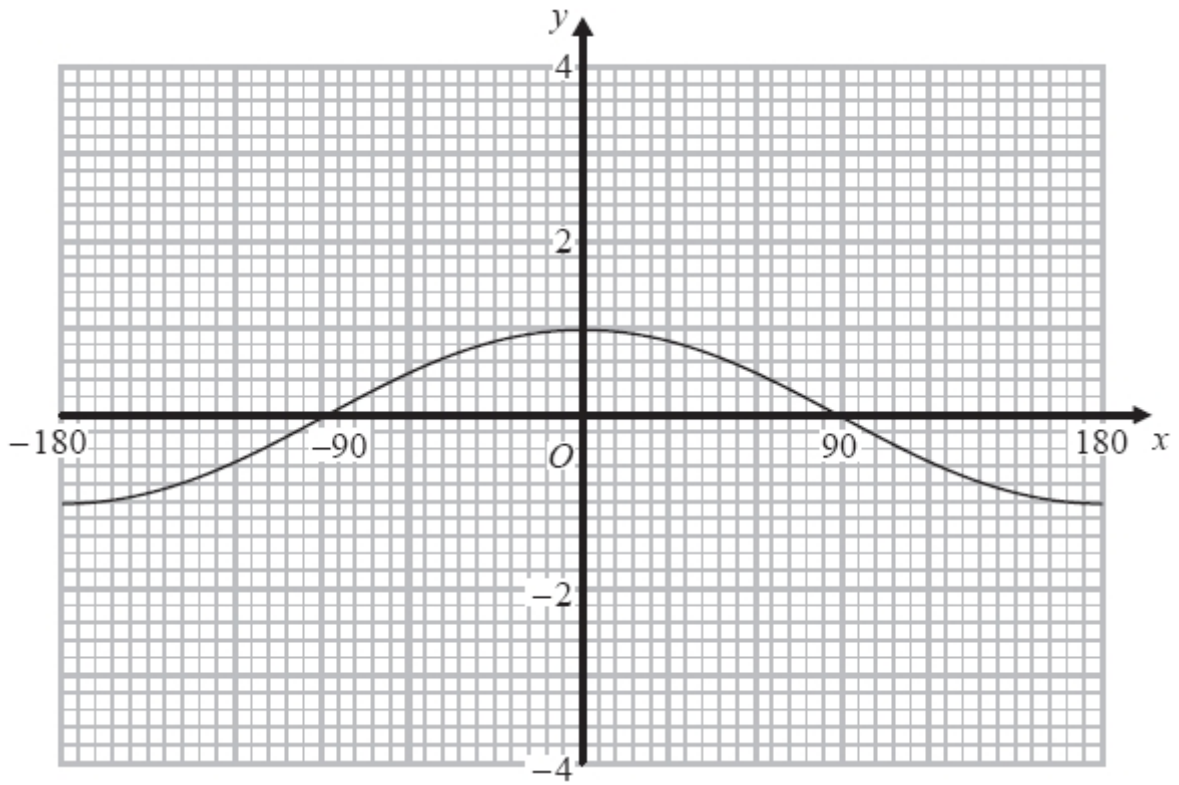
A different curve C_2 has equation $y = 3 \sin x + k$, where k is a constant.

The curve C_2 has a maximum y value of 10

The point R is the minimum point on C_2 with the smallest positive x coordinate.

(b) State the coordinates of R .

4



On the grid above, sketch the graph of $y = -2 \cos x^\circ$ for $-180 \leq x \leq 180$

Answers

- 1 (a) $(90, 0)$
- (b) Correct graph, points through $(0, 2)$ $(90, 0)$ $(180, -2)$ $(270, 0)$ $(360, 2)$
- 2 (a) $180, 0$
- (b) $270, -1$
- (c) $a = 2$
 $b = 3$
 $c = 1$
- 3 (a)(i) $P = (90^\circ, 3)$
- (ii) $Q = (540^\circ, 0)$
- (b) $(270^\circ, 4)$

4

