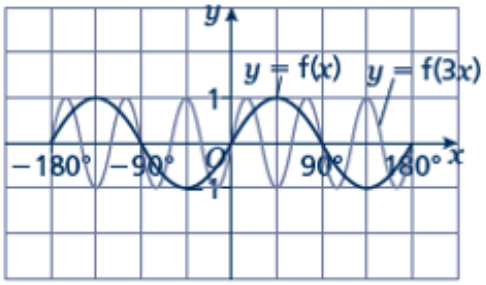
Transforming trigonometric graphs

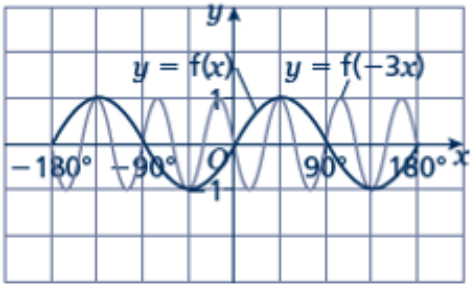
A LEVEL LINKS
Scheme of work: 4a. Trigonometric ratios and graphs

Key points

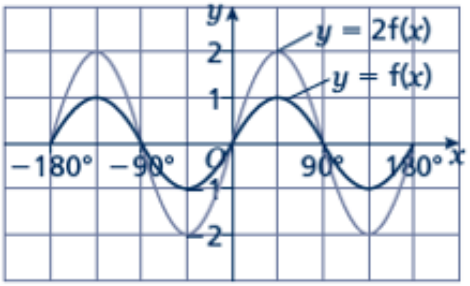
- The transformation $y = f(ax)$ is a horizontal stretch of $y = f(x)$ with scale factor $\frac{1}{a}$ parallel to the x-axis.



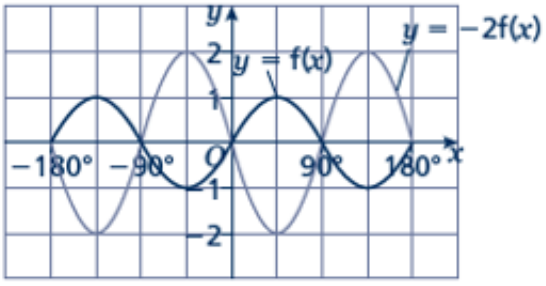
- The transformation $y = f(-ax)$ is a horizontal stretch of $y = f(x)$ with scale factor $\frac{1}{a}$ parallel to the x-axis and then a reflection in the y-axis.



- 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.

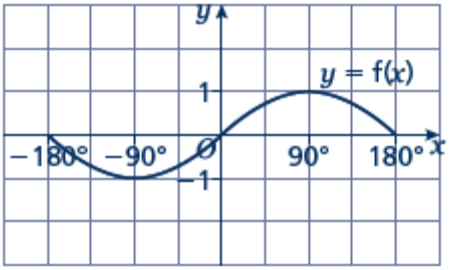


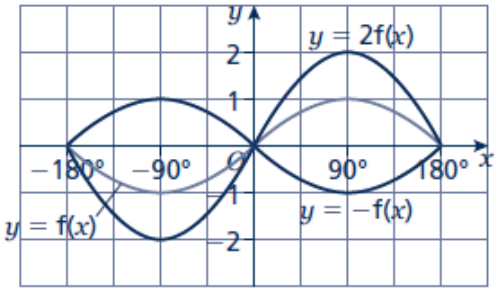
Pearson
Edexcel

Examples

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

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



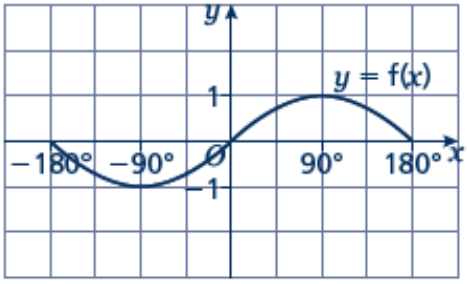


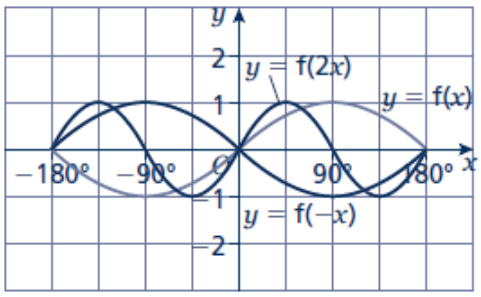
The function $y = 2f(x)$ is a vertical stretch of $y = f(x)$ with scale factor 2 parallel to the y-axis.

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 $y = f(-x)$.





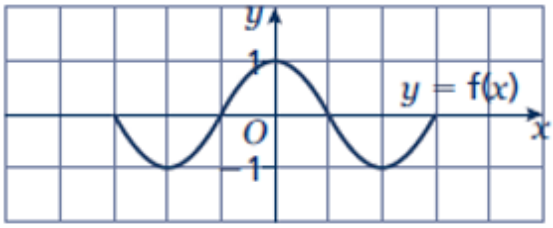
The function $y = f(2x)$ is a horizontal stretch of $y = f(x)$ with scale factor $\frac{1}{2}$ parallel to the x-axis.

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

Pearson
Edexcel

Practice questions

1 The graph shows the function $y = f(x)$.
Copy the graph and, on the same axes, sketch the graph of $y = -f(2x)$.



2 On the same diagram, draw a sketch of the graph of $y = \sin 4x$, $-180 \leq x \leq 180$

3 On the same diagram, draw a sketch of the graph of $y = \cos\left(\frac{\theta}{2}\right)$, $0 \leq x \leq 1080$

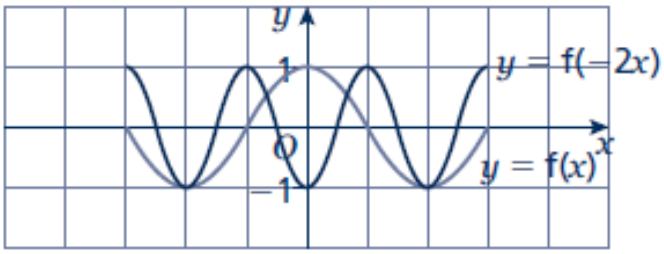
4 On the same diagram, draw a sketch of the graph of $y = -\cos x$, $0 \leq x \leq 360$

5 On the same diagram, draw a sketch of the graph of $y = \sin(-2x)$, $0 \leq x \leq 360$

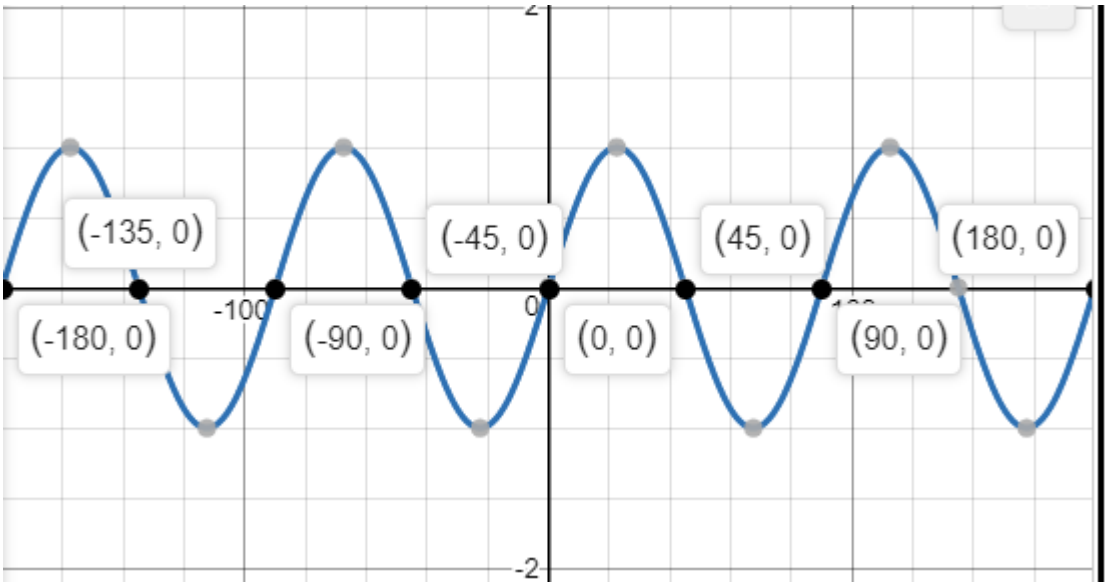
Pearson
Edexcel

Answers

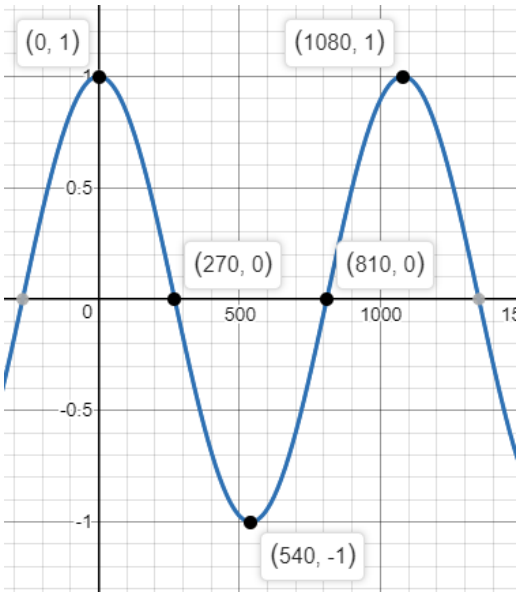
1



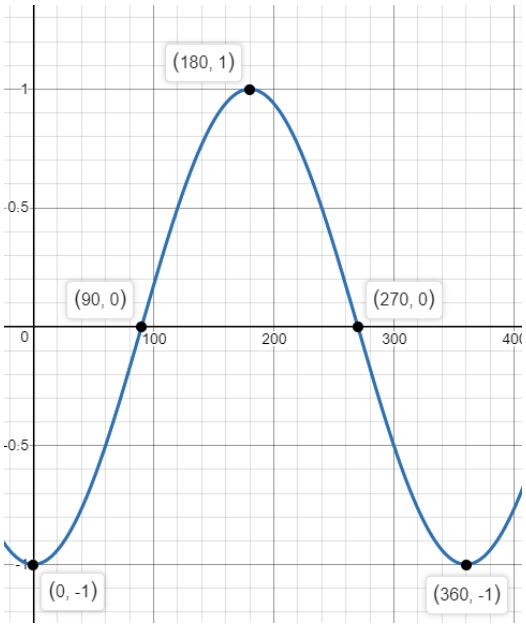
2



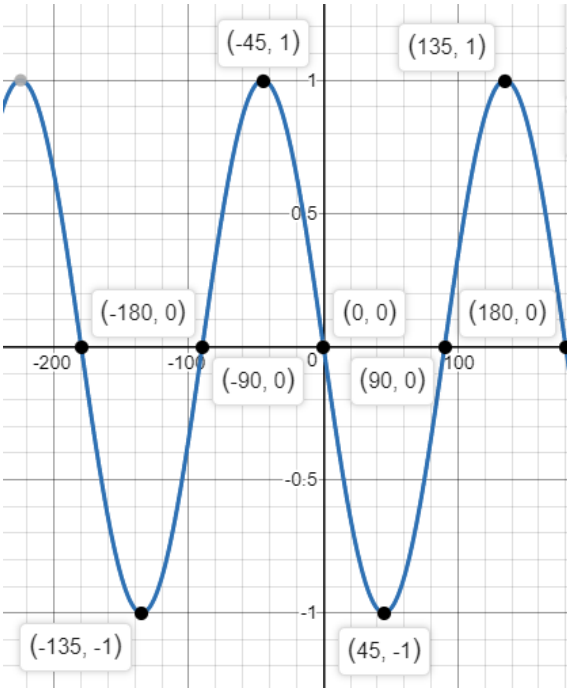
3



4


(180, 1)
1
0.5
(90, 0)
(270, 0)
0
100
200
300
-0.5
(0, -1)
(360, -1)

5


(-45, 1)
(135, 1)
1
0.5
(-180, 0)
(0, 0)
(180, 0)
-200
-100
0
100
(-90, 0)
(90, 0)
-0.5
-1
(-135, -1)
(45, -1)