Pearson Edexcel

Transforming functions

A LEVEL LINKS
Scheme of work: 1f. Transformations – transforming graphs – f(x) notation

Key points

- The transformation $y = f(x) \pm a$ is a translation of $y = f(x)$ parallel to the y-axis; it is a vertical translation.

  As shown on the graph,
  - $y = f(x) + a$ translates $y = f(x)$ up
  - $y = f(x) - a$ translates $y = f(x)$ down.

- The transformation $y = f(x \pm a)$ is a translation of $y = f(x)$ parallel to the x-axis; it is a horizontal translation.

  As shown on the graph,
  - $y = f(x + a)$ translates $y = f(x)$ to the left
  - $y = f(x - a)$ translates $y = f(x)$ to the right.

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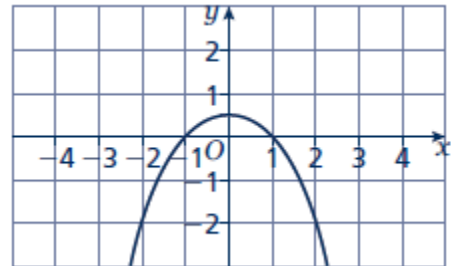
- The transformation $y = af(x)$ is a vertical stretch of $y = f(x)$ with scale factor a parallel to the y-axis.

- 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.
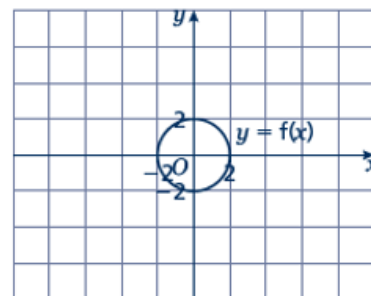
Practice questions

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

    a   Sketch the graph of $y = f(x) + 2$

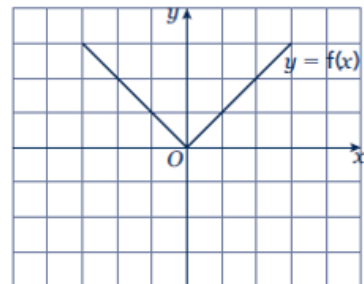   **b**   Sketch the graph of $y = f(x + 2)$

2   The graph shows the function $y = f(x)$.
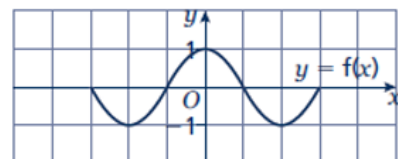
    a   Copy the graph and on the same axes sketch and label the graph of $y = 3f(x)$.

    b   Make another copy of the graph and on the same axes sketch and label the graph of $y = f(2x)$.

3   The graph shows the function $y = f(x)$. Copy the graph and on the same axes sketch and label the graphs of $y = -2f(x)$ and $y = f(3x)$.
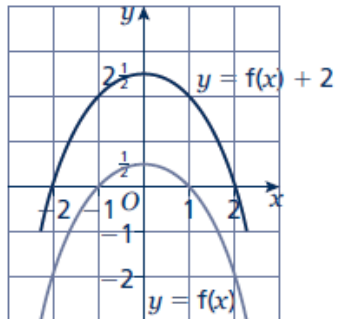

4   The graph shows the function $y = f(x)$. Copy the graph and, on the same axes, sketch the graph of $y = -f(2x)$.
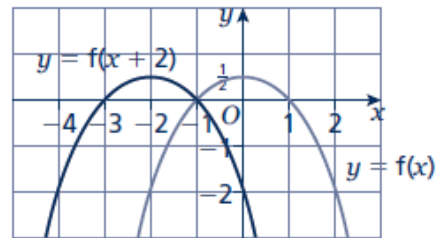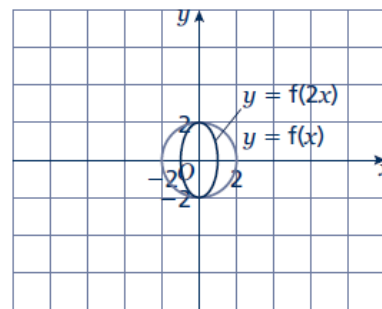
Answers

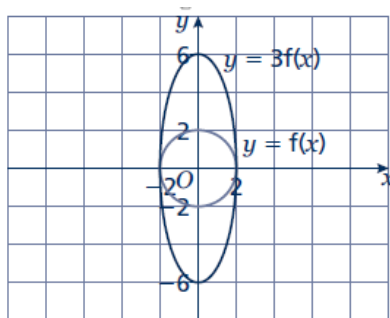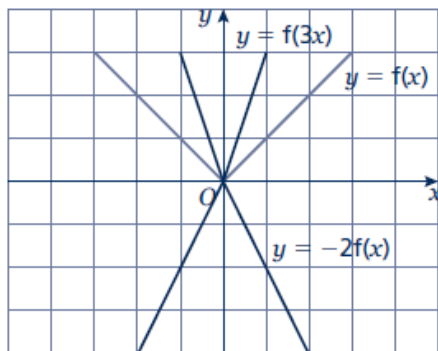**1   a**   **b**

$y = f(x) + 2$

$y = f(x)$

$y = f(x + 2)$

$y = f(x)$

2   a   **b**

$y = 3f(x)$

$y = f(x)$

$y = f(2x)$

$y = f(x)$

3

$y = f(3x)$

$y = f(x)$

$y = -2f(x)$

4

$y = f(-2x)$

$y = f(x)$