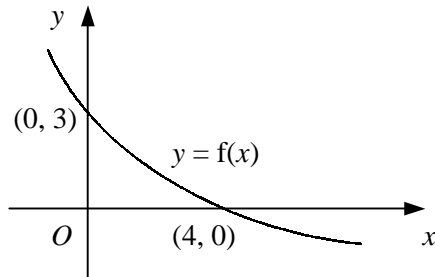


1 Describe how the graph of $y = f(x)$ is transformed to give the graph of

- a** $y = f(x - 1)$ **b** $y = f(x) - 3$ **c** $y = 2f(x)$ **d** $y = f(4x)$
e $y = -f(x)$ **f** $y = \frac{1}{5}f(x)$ **g** $y = f(-x)$ **h** $y = f(\frac{2}{3}x)$

2



The diagram shows the curve with equation $y = f(x)$ which crosses the coordinate axes at the points $(0, 3)$ and $(4, 0)$.

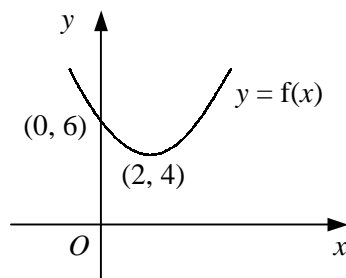
Showing the coordinates of any points of intersection with the axes, sketch on separate diagrams the graphs of

- a** $y = 3f(x)$ **b** $y = f(x + 4)$ **c** $y = -f(x)$ **d** $y = f(\frac{1}{2}x)$

3 Find and simplify an equation of the graph obtained when

- a** the graph of $y = 2x + 5$ is translated by 1 unit in the positive y -direction,
b the graph of $y = 1 - 4x$ is stretched by a factor of 3 in the y -direction, about the x -axis,
c the graph of $y = 3x + 1$ is translated by 4 units in the negative x -direction,
d the graph of $y = 4x - 7$ is reflected in the x -axis.

4



The diagram shows the curve with equation $y = f(x)$ which has a turning point at $(2, 4)$ and crosses the y -axis at the point $(0, 6)$.

Showing the coordinates of the turning point and of any points of intersection with the axes, sketch on separate diagrams the graphs of

- a** $y = f(x) - 3$ **b** $y = f(x + 2)$ **c** $y = f(2x)$ **d** $y = \frac{1}{2}f(x)$

5 Describe a single transformation that would map the graph of $y = x^3$ onto the graph of

- a** $y = 4x^3$ **b** $y = (x - 2)^3$ **c** $y = -x^3$ **d** $y = x^3 + 5$

6 Describe a single transformation that would map the graph of $y = x^2 + 2$ onto the graph of

- a** $y = 2x^2 + 4$ **b** $y = x^2 - 5$ **c** $y = \frac{1}{9}x^2 + 2$ **d** $y = x^2 + 4x + 6$

- 7 Find and simplify an equation of the graph obtained when
- the graph of $y = x^2 + 2x$ is translated by 1 unit in the positive x -direction,
 - the graph of $y = x^2 - 4x + 5$ is stretched by a factor of $\frac{1}{3}$ in the x -direction, about the y -axis.
 - the graph of $y = x^2 + x - 6$ is reflected in the y -axis,
 - the graph of $y = 2x^2 - 3x$ is stretched by a factor of 2 in the x -direction, about the y -axis.

8 $f(x) \equiv x^2 - 4x.$

- Find the coordinates of the turning point of the graph $y = f(x).$
- Sketch each pair of graphs on the same set of axes showing the coordinates of the turning point of each graph.
 - $y = f(x)$ and $y = 3 + f(x)$
 - $y = f(x)$ and $y = f(x - 2)$
 - $y = f(x)$ and $y = f(2x)$

- 9 Sketch each pair of graphs on the same set of axes.

a $y = x^2$ and $y = (x + 3)^2$ b $y = x^3$ and $y = x^3 + 4$

c $y = \frac{1}{x}$ and $y = \frac{1}{x-2}$ d $y = \sqrt{x}$ and $y = \sqrt{2x}$

- 10 a Describe two different transformations, each of which would map the graph of $y = \frac{1}{x}$ onto the graph of $y = \frac{1}{3x}$.
- b Describe two different transformations, each of which would map the graph of $y = x^2$ onto the graph of $y = 4x^2$.

11 $f(x) \equiv (x + 4)(x + 2)(x - 1).$

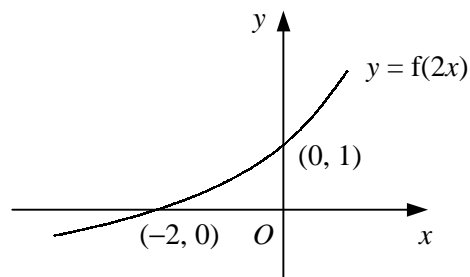
Showing the coordinates of any points of intersection with the axes, sketch on separate diagrams the graphs of

a $y = f(x)$ b $y = f(x - 4)$ c $y = f(-x)$ d $y = f(2x)$

- 12 The curve $y = f(x)$ is a parabola and the coordinates of its turning point are (a, b) . Write down, in terms of a and b , the coordinates of the turning point of the graph

a $y = 3f(x)$ b $y = 4 + f(x)$ c $y = f(x + 1)$ d $y = f(\frac{1}{3}x)$

13



The diagram shows the curve with equation $y = f(2x)$ which crosses the coordinate axes at the points $(-2, 0)$ and $(0, 1)$.

Showing the coordinates of any points of intersection with the coordinate axes, sketch on separate diagrams the curves

a $y = 3f(2x)$ b $y = f(x)$