

Functions – transformation of graphs

1Q

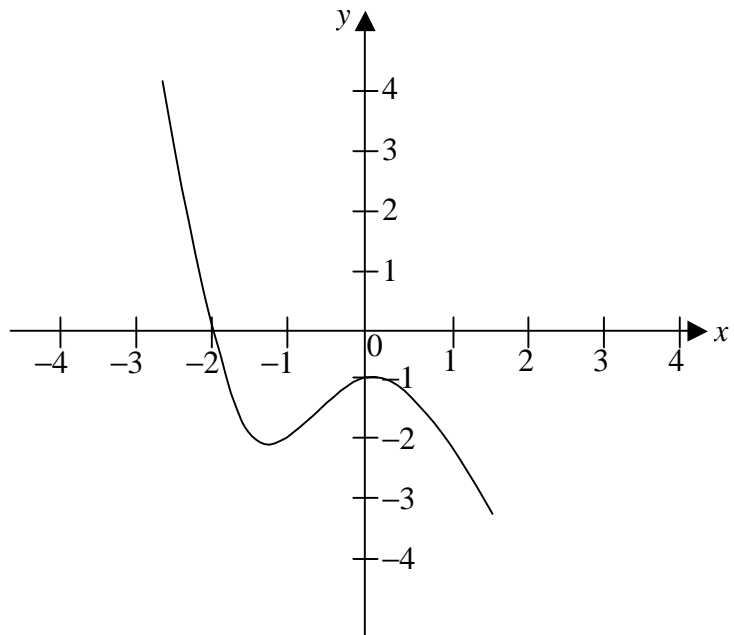
The figure below shows a sketch graph of $y = f(x)$

Copy the axes and sketch the graphs of

(a) $y = f(x - 2)$ [3]

(b) $y = 2f(x)$ [3]

(c) $y = f(-x)$ [3]

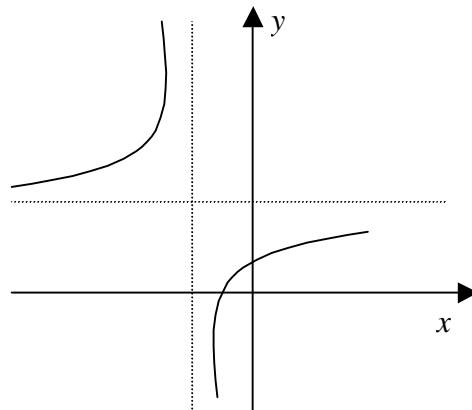


2Q

You are given the function $f(x)$ which is defined as follows:

$$f(x) = \frac{a - bx}{c - x} \quad x \neq c$$

The graph of $y = f(x)$ is shown below.



Find values of a , b and c if the graph of $y = f(x)$ has been obtained from the graph of $y = \frac{1}{x}$ by the following transformation

A reflection in the y axis, followed by

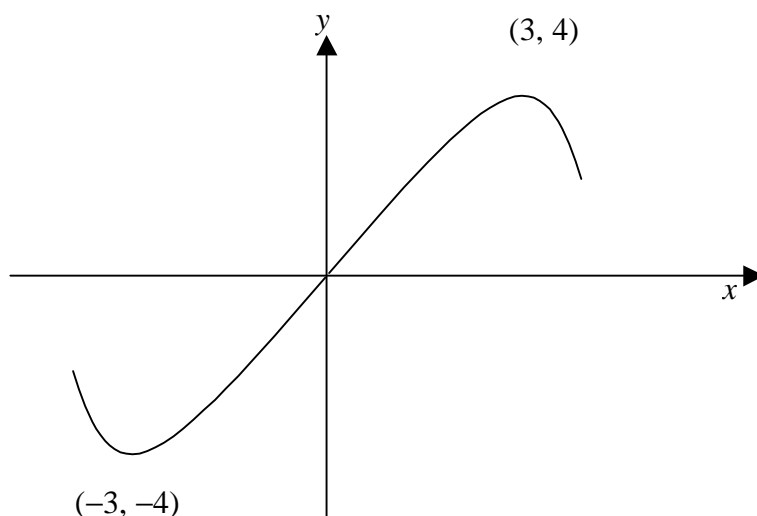
A translation of -3 units parallel to the x axis followed by

A translation of 4 units parallel to the y axis

[5]

3Q

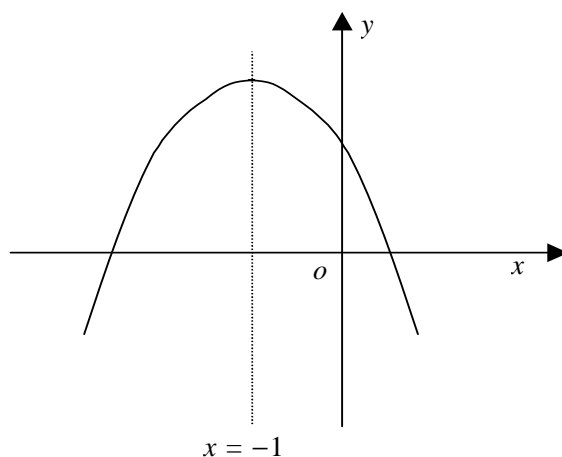
The figure below shows a sketch graph of $y = f(x)$



The graph has a maximum point at $(3, 4)$ and a minimum point at $(-3, -4)$. Sketch the following graphs, using a separate set of axes for each graph. In each case state the co-ordinates of the maximum and minimum points.

- | | | | | | |
|-----|----------------|-----|-----|----------------------------------|-----|
| (a) | $y = 2f(x)$ | [3] | (b) | $y = f(x - 2)$ | [3] |
| (c) | $y = 3 + f(x)$ | [3] | (d) | $y = -f\left(\frac{x}{2}\right)$ | [3] |

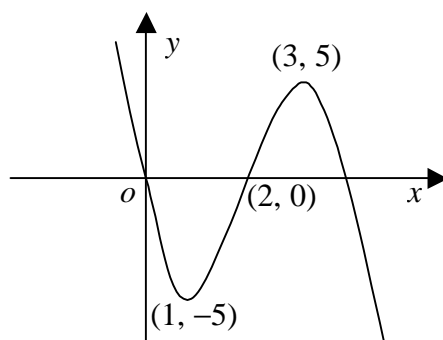
4Q



The sketch shows the curve with equation $y = 2 - 6x - 3x^2$ and its axis of symmetry is $x = -1$.

- Give the co-ordinates of the vertex and the value of y when $x = 0$. [2]
- Find the value of the constants a, b such that $2 - 6x - 3x^2 = a(x + 1)^2 + b$. [3]
- Copy the given sketch and draw in the reflection of the curve with equation $y = 2 - 6x - 3x^2$ in the line $y = 2$. [4]
- Write down the equation of the new curve and give the co-ordinates of its vertex. [4]

5Q



The figure above shows a sketch graph of $y = f(x)$

The curve passes through the origin and has a minimum point at $(1, -5)$ and a maximum point at $(3, 5)$. Sketch, on separate diagrams, the graphs of

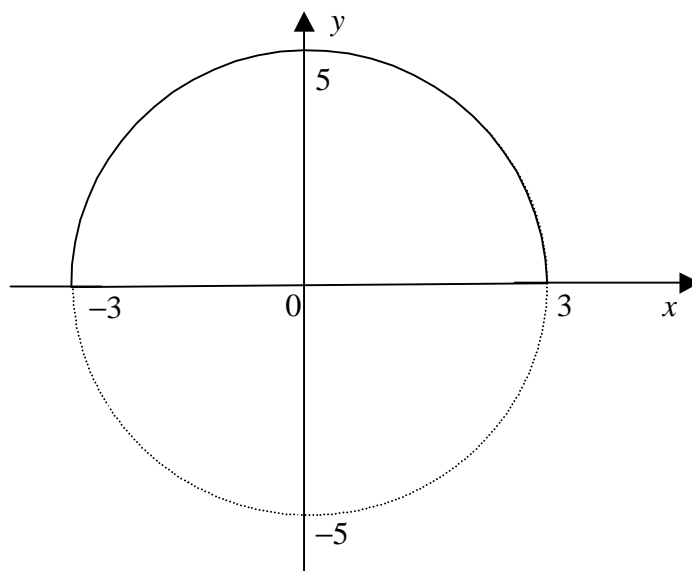
- (a) $y = f(x + 2)$ [3]
- (b) $y = f(2x)$ [3]
- (c) $y = f(-x)$ [3]

In each case, give the co-ordinates of the turning points.

6Q

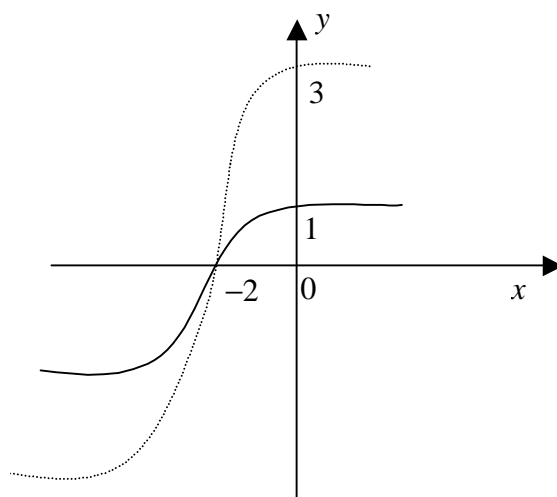
In each of the diagrams below the curve drawn with the dashed line is obtained by a single transformation of the curve $y = f(x)$. In each case write down the equation of the transformed curve (the dashed line) in terms of $f(x)$.

(a)



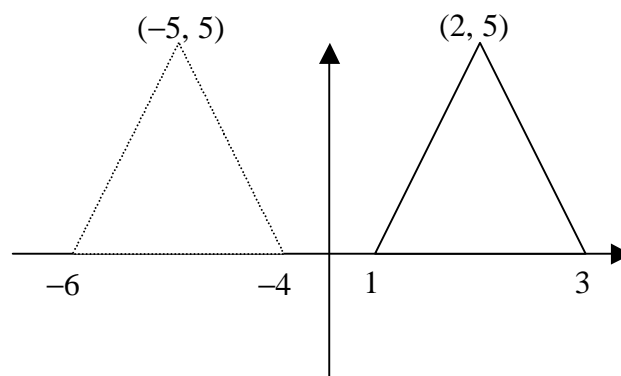
[2]

(b)



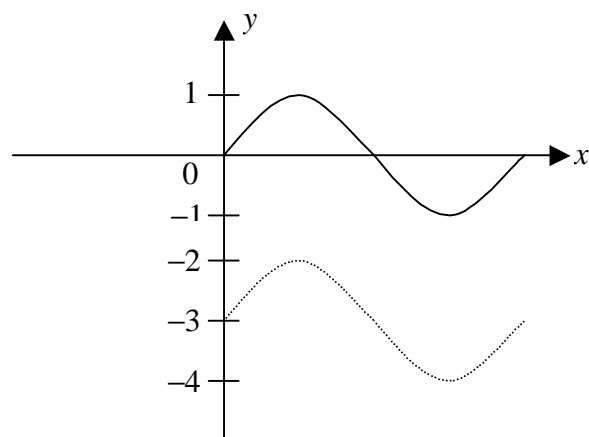
[2]

(c)



[2]

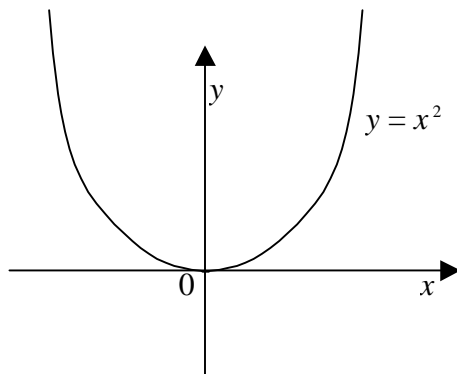
(d)



7Q

The figure below shows a sketch graph of $y = x^2$.

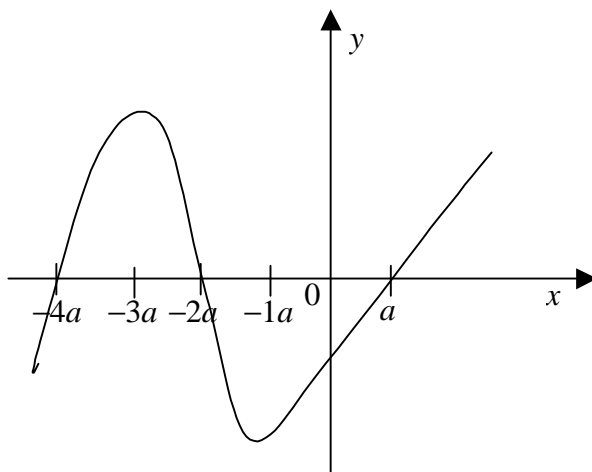
Draw sketches of the graph after the following transformations have been completed. Write down the co-ordinates of the vertices of the curves. Also determine the equations of the curves.



- (a) A translation of 2 units along the x axis followed by a translation of -3 along the y axis. [3]
- (b) A reflection in the x axis followed by a stretch of $\frac{1}{2}$ parallel to the x axis. [3]
- (c) A translation of 2 units parallel to the x axis followed by a translation of 3 units parallel to the y axis, followed by a stretch of 2 units parallel to the y axis. [3]

8Q

The figure below shows a sketch graph of $y = f(x)$ where a is a positive constant.



By drawing separate sets of axes, sketch graphs of the following indicating clearly the points where the curve crosses the x axis [4]

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