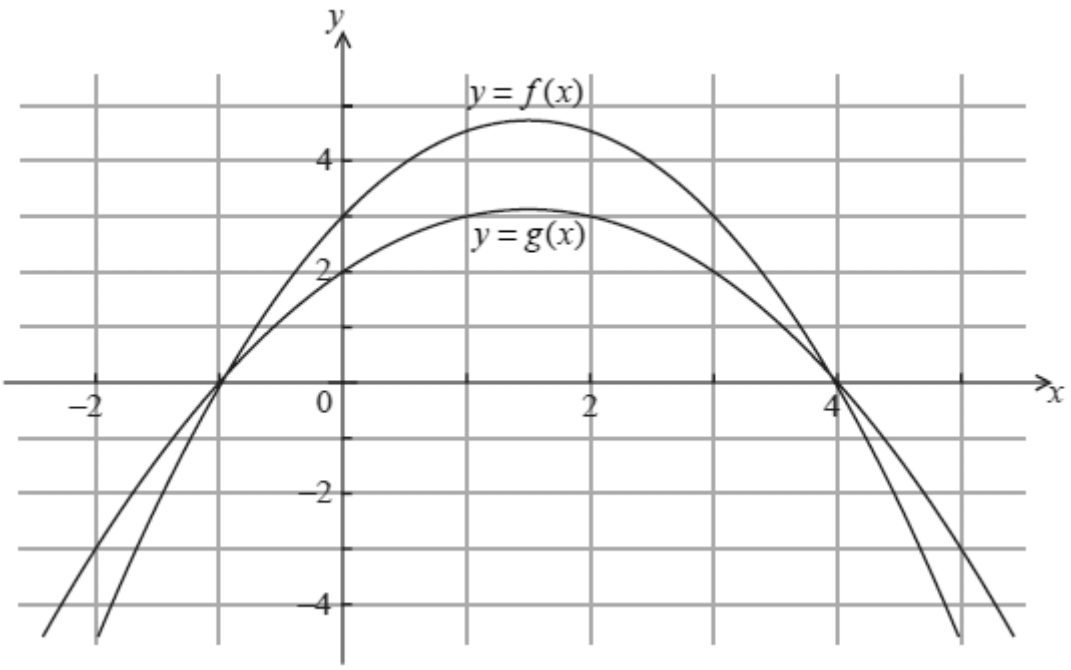
1. Shown below are the graphs of $y = f(x)$ and $y = g(x)$.



If $(f \circ g)(x) = 3$, find all possible values of x.

(Total 4 marks)

2. Consider the functions given below.

$$f(x) = 2x + 3$$
$$g(x) = \frac{1}{x},\ x \neq 0$$

(a) (i) Find $(g \circ f)(x)$ and write down the domain of the function.

(ii) Find $(f \circ g)(x)$ and write down the domain of the function.

(2)

(b) Find the coordinates of the point where the graph of $y = f(x)$ and the graph of $y = (g^{-1} \circ f \circ g)(x)$ intersect.

(4)
(Total 6 marks)

3. Let $f(x) = \frac{4}{x+2}, x \neq -2$ and $g(x) = x - 1$.

If $h = g \circ f$, find

(a) $h(x)$;

(2)

(b) $h^{-1}(x)$, where h^{-1} is the inverse of h.

(4)
(Total 6 marks)

4. A function f is defined by $f(x) = \frac{2x-3}{x-1}, x \neq 1$.

(a) Find an expression for $f^{-1}(x)$.

(3)

(b) Solve the equation $\left| f^{-1}(x) \right| = 1 + f^{-1}(x)$.

(3)
(Total 6 marks)

5. The real root of the equation $x^3 - x + 4 = 0$ is -1.796 to three decimal places.
Determine the real root for each of the following.

(a) $(x-1)^3 - (x-1) + 4 = 0$

(2)

(b) $8x^3 - 2x + 4 = 0$

(3)
(Total 5 marks)

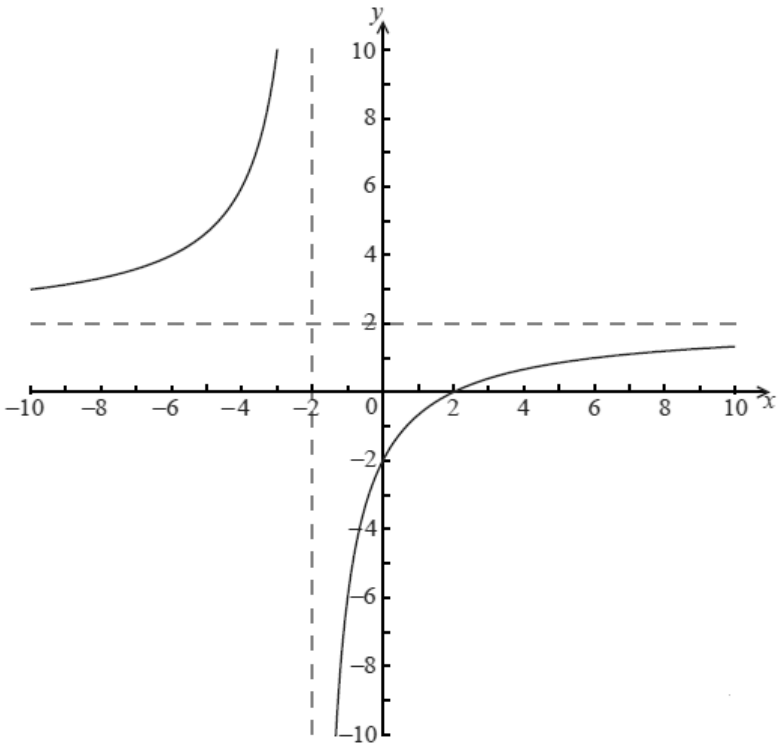
6. (a) Express the quadratic $3x^2 - 6x + 5$ in the form $a(x+b)^2 + c$, where $a, b, c \in \mathbb{Z}$.

(3)

(b) Describe a sequence of transformations that transforms the graph of $y = x^2$ to the graph of $y = 3x^2 - 6x + 5$.

(3)
(Total 6 marks)

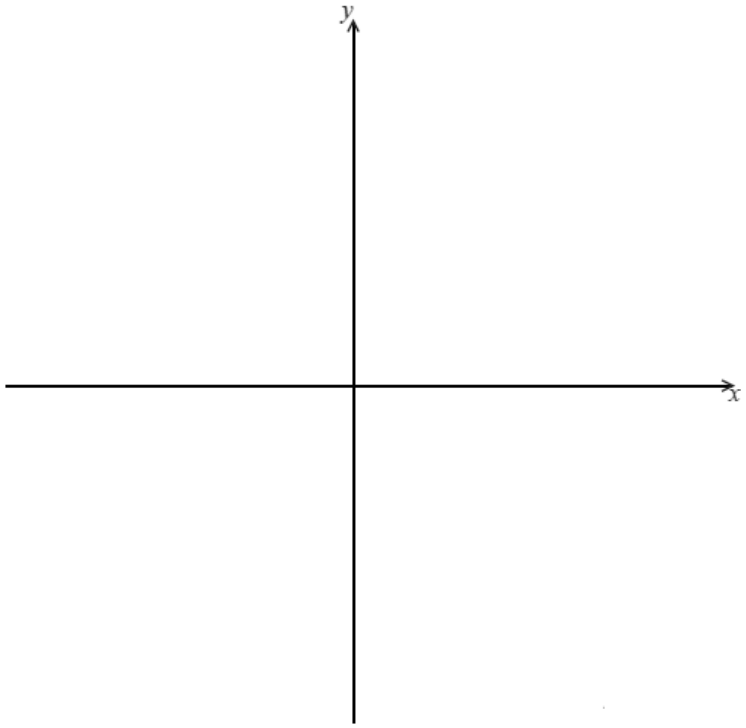
7. The graph of $y = \dfrac{a+x}{b+cx}$ is drawn below.



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

(4)

(b) Using the values of a, b and c found in part (a), sketch the graph of $y = \left|\dfrac{b+cx}{a+x}\right|$ on the axes below, showing clearly all intercepts and asymptotes.



(4)
(Total 8 marks)

8. The quadratic function $f(x) = p + qx - x^2$ has a maximum value of 5 when $x = 3$.

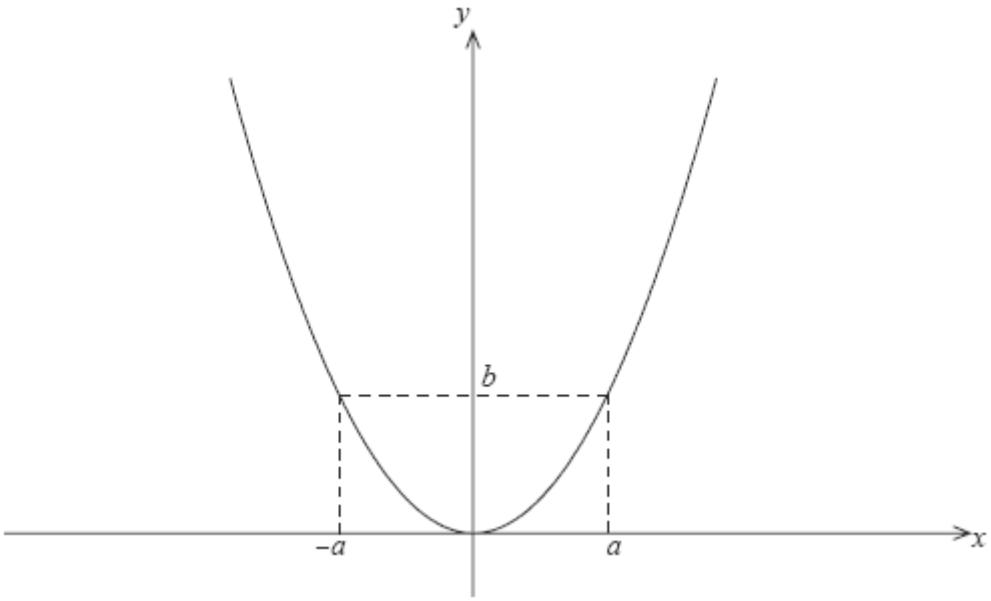
(a) Find the value of p and the value of q.

(4)

(b) The graph of $f(x)$ is translated 3 units in the positive direction parallel to the x-axis. Determine the equation of the new graph.

(2)
(Total 6 marks)

9. The diagram below shows the graph of the function $y = f(x)$, defined for all $x \in \mathbb{R}$, where $b > a > 0$.

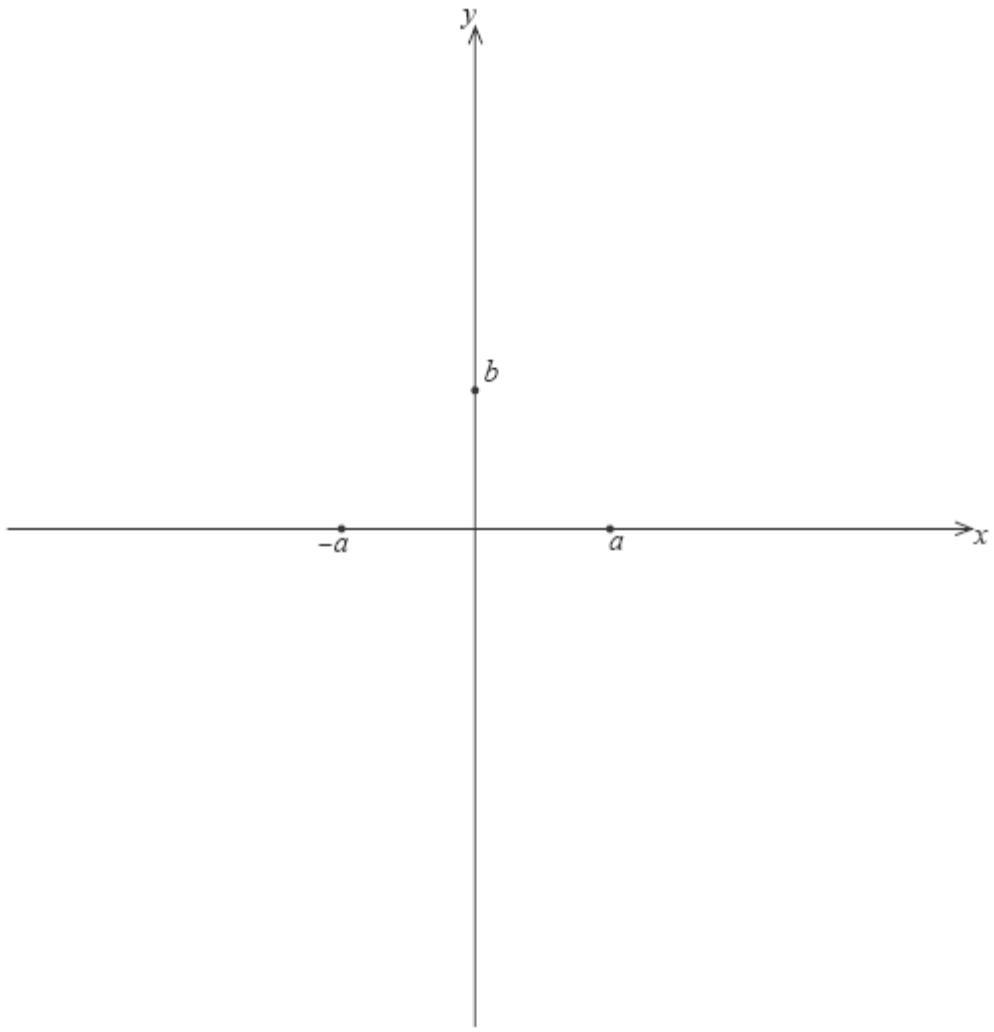


Consider the function $g(x) = \dfrac{1}{f(x-a)-b}$.

(a) Find the largest possible domain of the function g.

(2)

(b) On the axes below, sketch the graph of $y = g(x)$. On the graph, indicate any asymptotes and local maxima or minima, and write down their equations and coordinates.



(6)
(Total 8 marks)