1. Consider $f(x) = 2kx^2 - 4kx + 1$, for $k \neq 0$. The equation $f(x) = 0$ has two equal roots.

(a) Find the value of k.

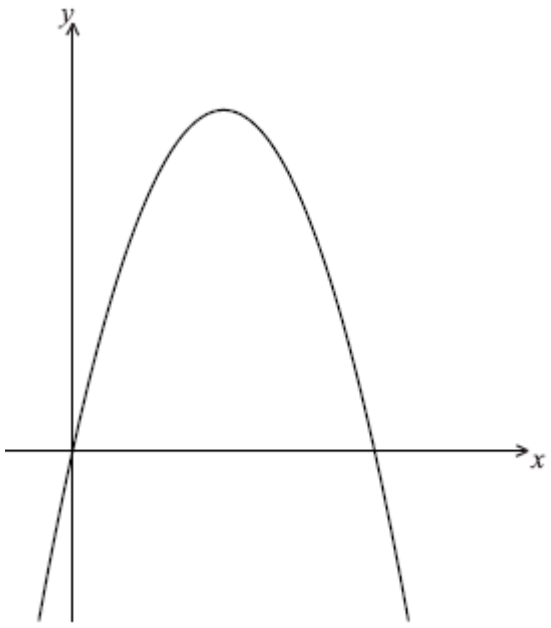
(5)

(b) The line $y = p$ intersects the graph of f. Find all possible values of p.

(2)

(Total 7 marks)

2. Let $f(x) = 8x - 2x^2$. Part of the graph of f is shown below.



(a) Find the x-intercepts of the graph.

(4)

(b) (i) Write down the equation of the axis of symmetry.

(ii) Find the y-coordinate of the vertex.

(3)

(Total 7 marks)

3. Let $f(x) = a(x - 4)^2 + 8$.

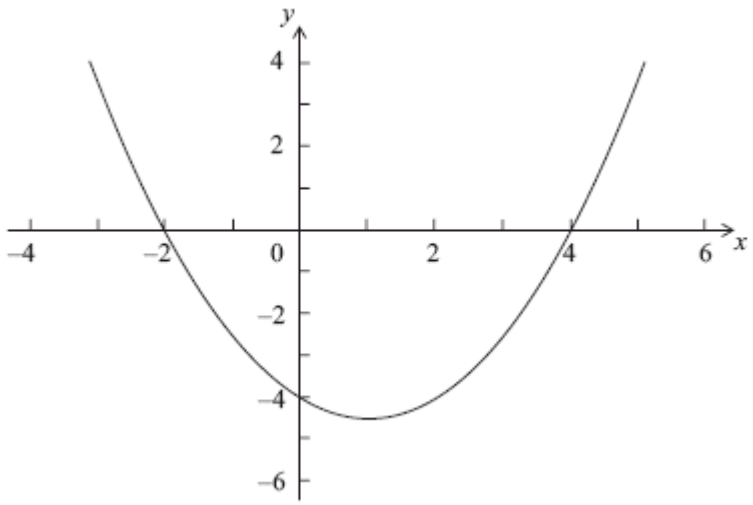
(a) Write down the coordinates of the vertex of the curve of f.

(b) Given that $f(7) = -10$, find the value of a.

(c) Hence find the y-intercept of the curve of f.

(Total 6 marks)

4. Let $f(x) = p(x - q)(x - r)$. Part of the graph of f is shown below.



The graph passes through the points (–2, 0), (0, –4) and (4, 0).

(a) Write down the value of q and of r.

(2)

(b) Write down the **equation** of the axis of symmetry.

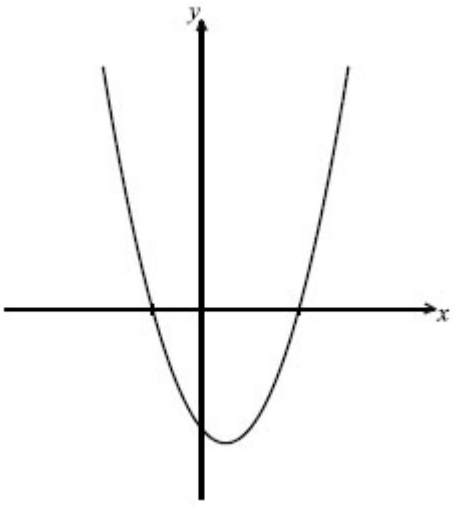
(1)

(c) Find the value of p.

(3)

(Total 6 marks)

5. The following diagram shows part of the graph of f, where $f(x) = x^2 - x - 2$.



(a) Find both x-intercepts.

(4)

(b) Find the x-coordinate of the vertex.

(2)

(Total 6 marks)

6. Let $f(x) = 2x^2 + 4x - 6$.

(a) Express $f(x)$ in the form $f(x) = 2(x - h)^2 + k$.

(3)

(b) Write down the equation of the axis of symmetry of the graph of f.

(1)

(c) Express $f(x)$ in the form $f(x) = 2(x - p)(x - q)$.

(2)

(Total 6 marks)

7. Let $f(x) = 2x^2 - 12x + 5$.

(a) Express $f(x)$ in the form $f(x) = 2(x - h)^2 - k$.

(3)

(b) Write down the vertex of the graph of f.

(2)

(c) Write down the equation of the axis of symmetry of the graph of f.

(1)

(d) Find the y-intercept of the graph of f.

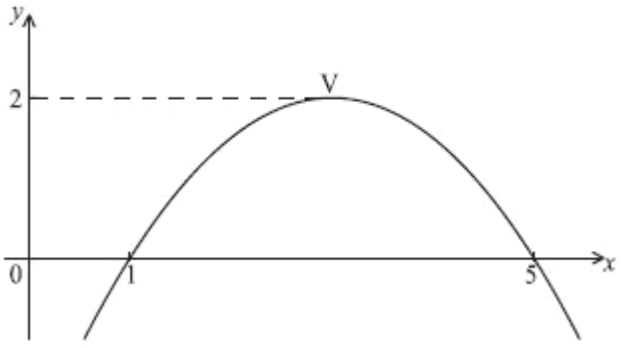
(2)

(e) The x-intercepts of f can be written as $\frac{p \pm \sqrt{q}}{r}$, where $p, q, r \in \mathbb{Z}$.
Find the value of p, of q, and of r.

(7)

(Total 15 marks)

8. Part of the graph of the function $y = d(x - m)^2 + p$ is given in the diagram below.
The x-intercepts are (1, 0) and (5, 0). The vertex is V(m, 2).



(a) Write down the value of

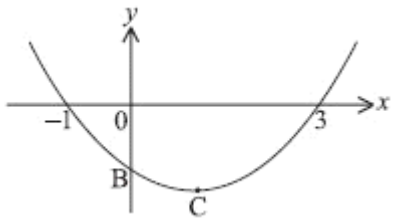
(i) m;

(ii) p.

(b) Find d.

(Total 6 marks)

9. Part of the graph of $f(x) = (x - p)(x - q)$ is shown below.



The vertex is at C. The graph crosses the y-axis at B.

(a) Write down the value of p and of q.

(b) Find the coordinates of C.

(c) Write down the y-coordinate of B.

(Total 6 marks)

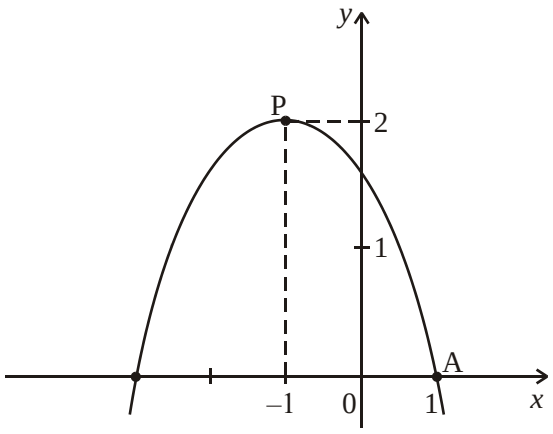
10. The equation $x^2 - 2kx + 1 = 0$ has two distinct real roots. Find the set of all possible values of k.

(Total 6 marks)

11. The equation $kx^2 + 3x + 1 = 0$ has exactly one solution. Find the value of k.

(Total 6 marks)

12. The diagram shows part of the graph of $y = a(x - h)^2 + k$. The graph has its vertex at P, and passes through the point A with coordinates (1, 0).



(a) Write down the value of

(i) h;

(ii) k.

(b) Calculate the value of a.

(Total 6 marks)

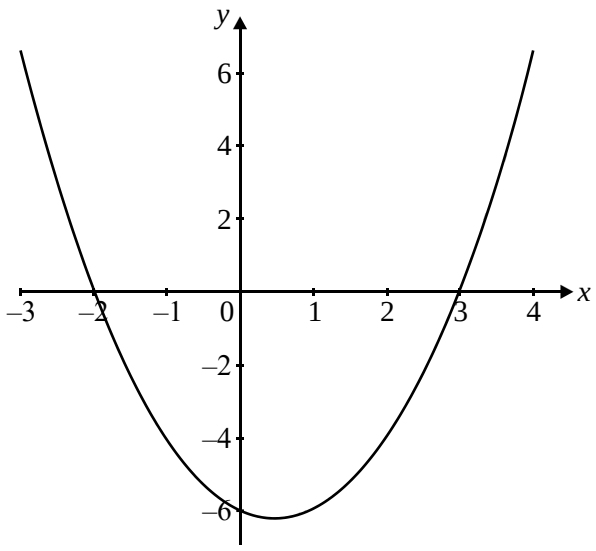
13. Consider the function $f(x) = 2x^2 - 8x + 5$.

(a) Express $f(x)$ in the form $a(x - p)^2 + q$, where $a, p, q \in \mathbb{Z}$.

(b) Find the minimum value of $f(x)$.

(Total 6 marks)

14. The diagram shows part of the graph with equation $y = x^2 + px + q$. The graph cuts the x-axis at -2 and 3.



Find the value of

(a) p;

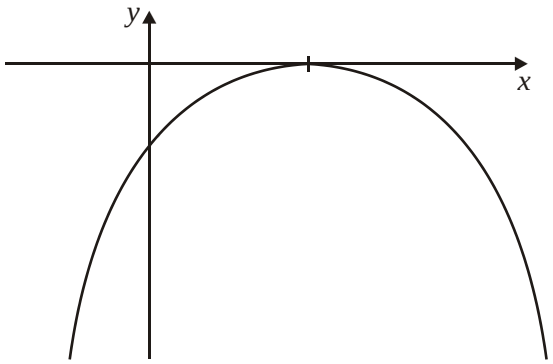
(b) q.

(Total 4 marks)

15. The quadratic equation $4x^2 + 4kx + 9 = 0$, $k > 0$ has exactly one solution for x.
Find the value of k.

(Total 4 marks)

16. The diagram shows the graph of the function $y = ax^2 + bx + c$.



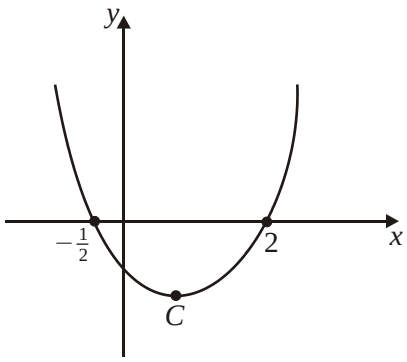
Complete the table below to show whether each expression is positive, negative or zero.

Expression	positive	negative	zero
a			
c			
$b^2 - 4ac$			
b			

(Total 4 marks)

17. The diagram represents the graph of the function

$$f : x \mapsto (x - p)(x - q).$$



(a) Write down the values of p and q.

(b) The function has a minimum value at the point C. Find the x-coordinate of C.

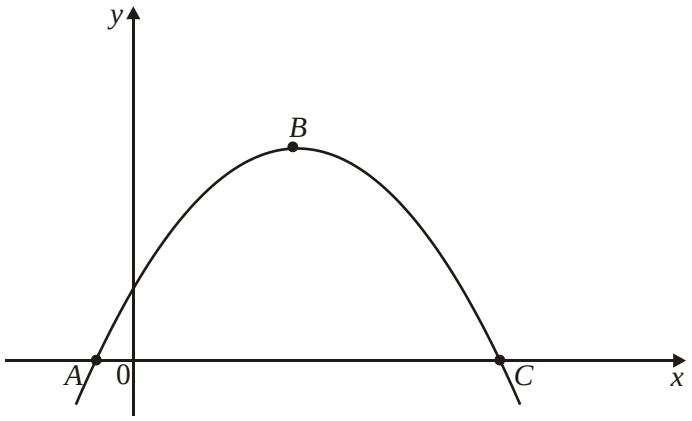
(Total 4 marks)

18. (a) Factorize $x^2 - 3x - 10$.

(b) Solve the equation $x^2 - 3x - 10 = 0$.

(Total 4 marks)

19. The diagram shows the parabola $y = (7 - x)(1 + x)$. The points A and C are the x-intercepts and the point B is the maximum point.



Find the coordinates of A, B and C.

(Total 4 marks)