IBSL Practice Function Questions

1. The functions f and g are defined by $f: \mapsto 3x,\ g: x \mapsto x + 2$.

(a) Find an expression for $(f \circ g)(x)$.

(b) Show that $f^{-1}(18) + g^{-1}(18) = 22$.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total 6 marks)

2. Let $f(x) = \sqrt{x+4}$, $x \geq -4$ and $g(x) = x^2$, $x \in$ ×.

(a) Find $(g \circ f)(3)$.

(b) Find $f^{-1}(x)$.

(c) Write down the domain of f^{-1}.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total 6 marks)

3. Let $g(x) = 3x - 2$, $h(x) = \frac{5x}{x-4}$, $x \neq 4$.

(a) Find an expression for $(h \circ g)(x)$. Simplify your answer.

(b) Solve the equation $(h \circ g)(x) = 0$.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total 6 marks)

4. Let $f(x) = x^3 - 4$ and $g(x) = 2x$.

(a) Find $(g \circ f)(-2)$.

(b) Find $f^{-1}(x)$.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total 6 marks)

5. Two functions f, g are defined as follows:

$$f : x \to 3x + 5$$
$$g : x \to 2(1 - x)$$

Find

(a) $f^{-1}(2)$;

(b) $(g \circ f)(-4)$.

Working:

Answers:

(a) .....

(b) .....

(Total 4 marks)

6. Consider the functions $f(x) = 2x$ and $g(x) = \frac{1}{x-3}$, $x \neq 3$.

(a) Calculate $(f \circ g)(4)$.

(b) Find $g^{-1}(x)$.

(c) Write down the domain of g^{-1}.

Working:

Answers:

(a) .....

(b) .....

(c) .....

(Total 6 marks)

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

Working:

Answer:

……..

(Total 6 marks)

9. Consider two different quadratic functions of the form $f(x) = 4x^2 - qx + 25$. The graph of each function has its vertex on the x-axis.

(a) Find both values of q.

(b) For the greater value of q, solve $f(x) = 0$.

(c) Find the coordinates of the point of intersection of the two graphs.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total 6 marks)

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

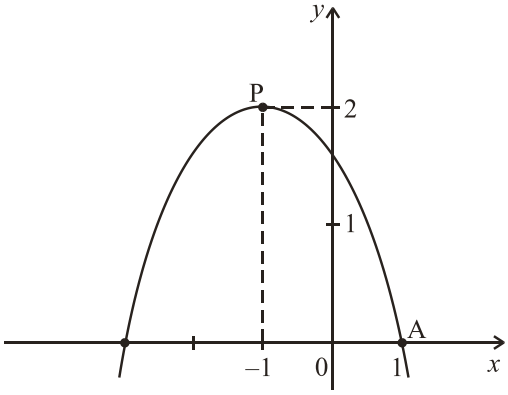
Working:

Answer:

.....

(Total 6 marks)

11. 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.

Working:

Answers:

(a) (i) .....

(ii) .....

(b) .....

(Total 6 marks)

12. 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)

13. The function f is given by $f(x) = x^2 - 6x + 13$, for $x \geq 3$.

(a) Write $f(x)$ in the form $(x - a)^2 + b$.

(b) Find the inverse function f^{-1}.

(c) State the domain of f^{-1}.

Working:

Answers:

(a) .....

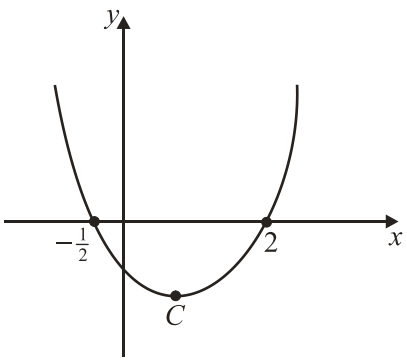
(b) .....

(c) .....

(Total 6 marks)

14. 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.

Working:

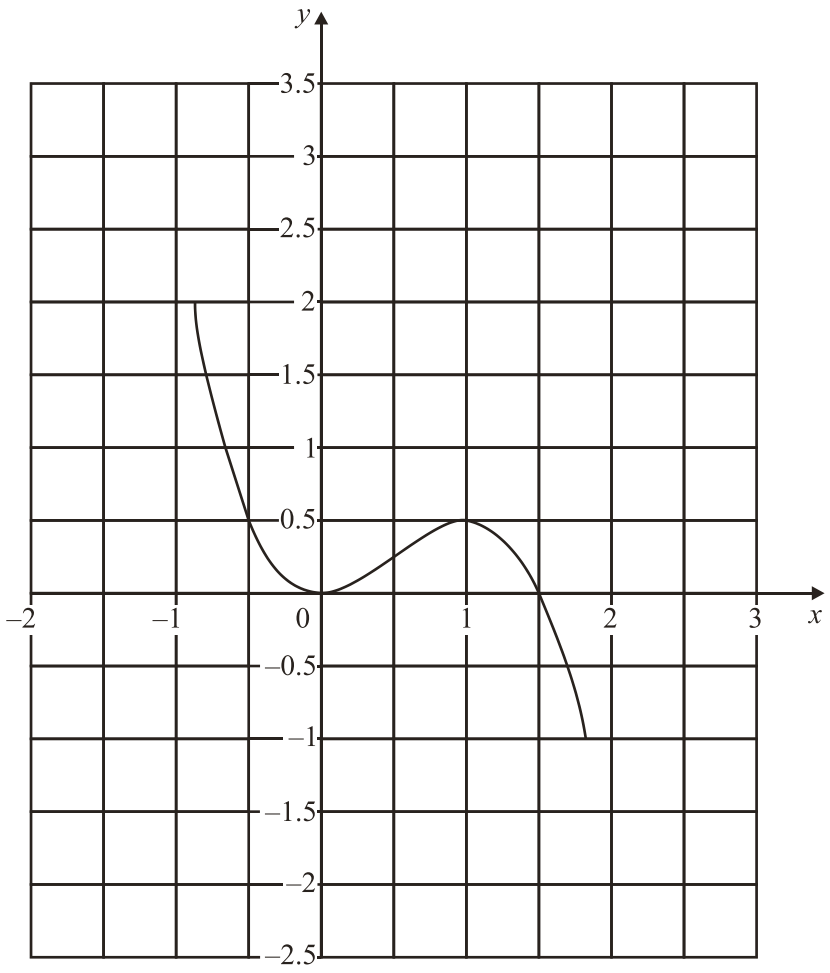
Answers:

(a) .....

(b) .....

(Total 4 marks)

15. The following diagram shows the graph of $y = f(x)$. It has minimum and maximum points at (0, 0) and $(1, -\frac{1}{2})$.



(a) On the same diagram, draw the graph of $y = f(x-1) + \frac{3}{2}$.

(b) What are the coordinates of the minimum and maximum points of $y = f(x-1) + \frac{3}{2}$?

Working:

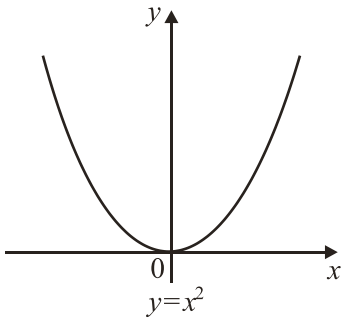
Answer:

(b) .....

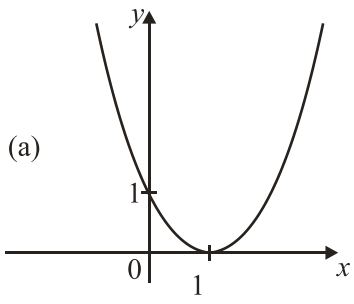
(Total 4 marks)

16. The diagrams show how the graph of $y = x^2$ is transformed to the graph of $y = f(x)$ in three steps.

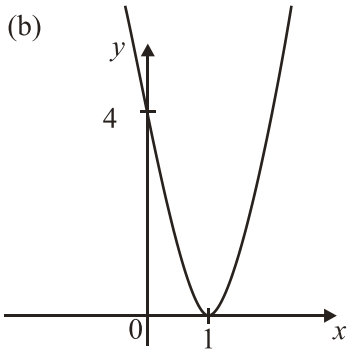
For each diagram give the equation of the curve.



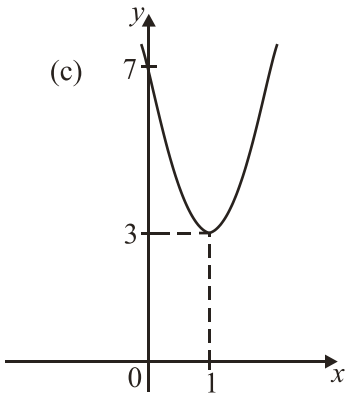
(a)



(b)



(c)



Working:

Answers:

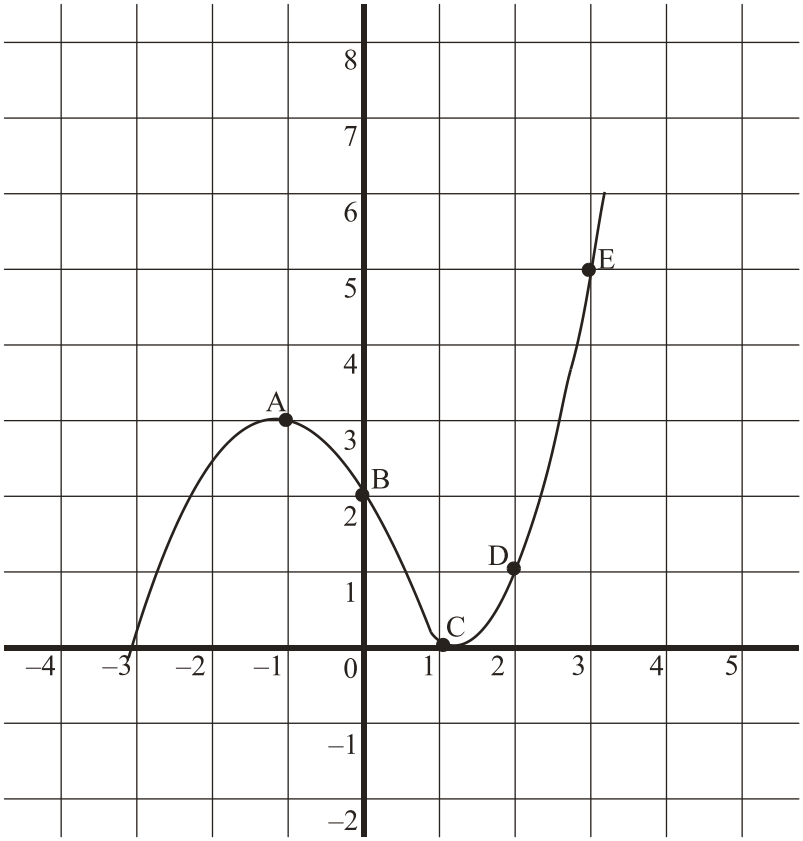
(a) .....

(b) .....

(c) .....

(Total 4 marks)

17. The sketch shows part of the graph of $y = f(x)$ which passes through the points A(–1, 3), B(0, 2), C(l, 0), D(2, 1) and E(3, 5).



A second function is defined by $g(x) = 2f(x - 1)$.

(a) Calculate $g(0)$, $g(1)$, $g(2)$ and $g(3)$.

(b) On the same axes, sketch the graph of the function $g(x)$.

Working:

Answers:

(a) .....

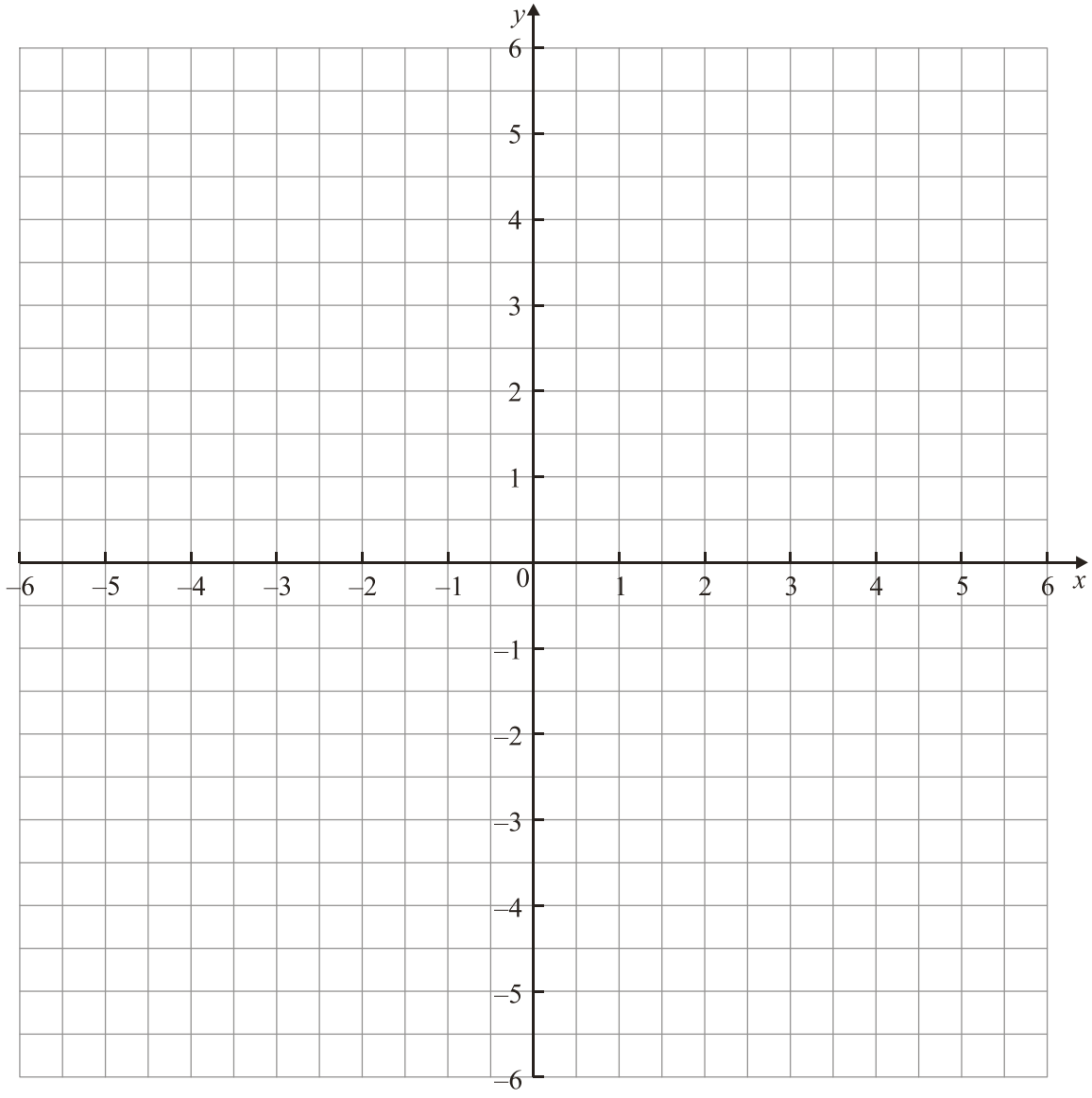
.....

(Total 6 marks)

18. Let $f(x) = 2x + 1$.

(a) On the grid below draw the graph of $f(x)$ for $0 \leq x \leq 2$.

(b) Let $g(x) = f(x + 3) - 2$. On the grid below draw the graph of $g(x)$ for $-3 \leq x \leq -1$.



Working:

(Total 6 marks)

19. Let $f(x) = 3x - e^{x-2} - 4$, for $-1 \leq x \leq 5$.

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

.....

.....

.....

.....

.....

.....

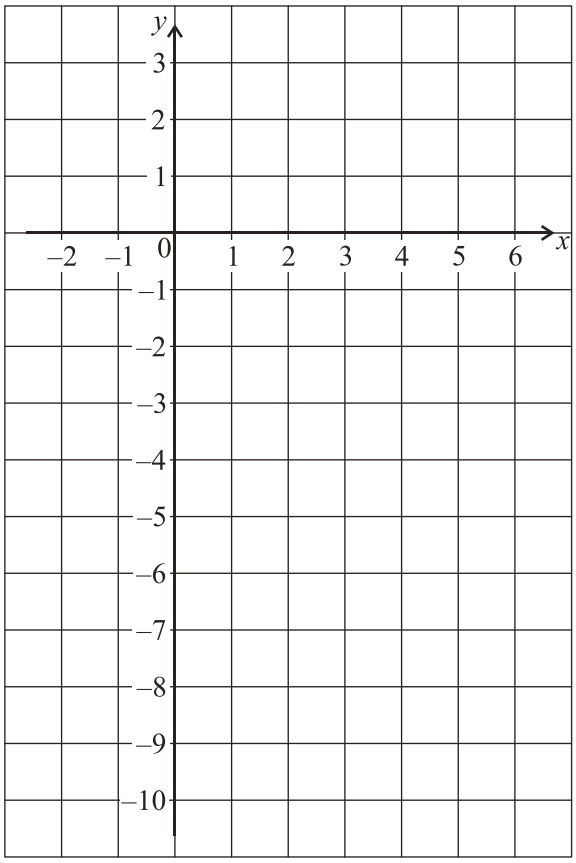
.....

.....

.....

(3)

(b) On the grid below, sketch the graph of f.



(3)

(Total 6 marks)

20. The quadratic function f is defined by $f(x) = 3x^2 - 12x + 11$.

(a) Write f in the form $f(x) = 3(x - h)^2 - k$.

(b) The graph of f is translated 3 units in the positive x-direction and 5 units in the positive y-direction. Find the function g for the translated graph, giving your answer in the form $g(x) = 3(x - p)^2 + q$.

.....

.....

.....

.....

.....

.....

.....

.....

.....

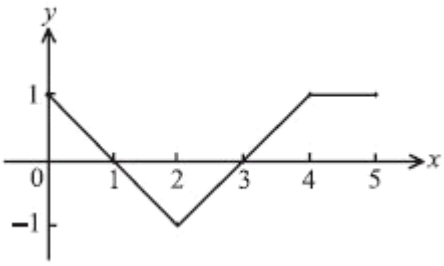
.....

.....

.....

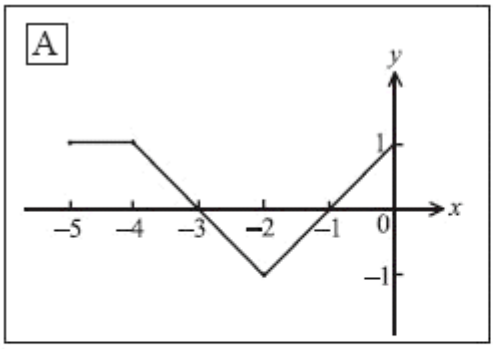
(Total 6 marks)

21. The following diagram shows part of the graph of $f(x)$.

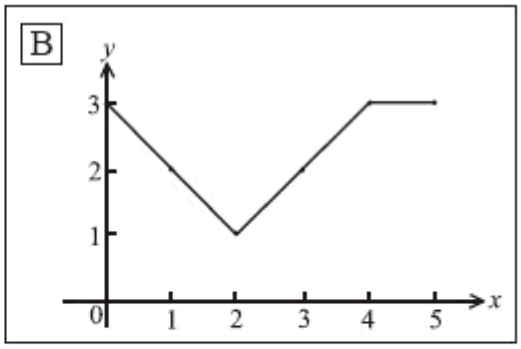


Consider the five graphs in the diagrams labelled A, B, C, D, E below.

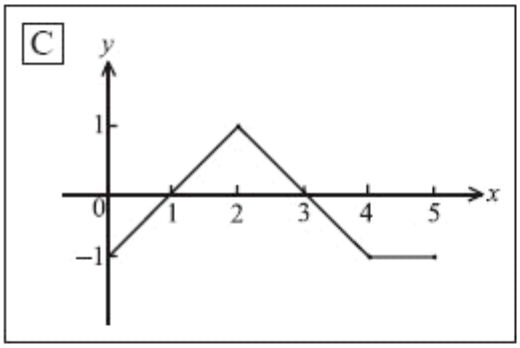
A



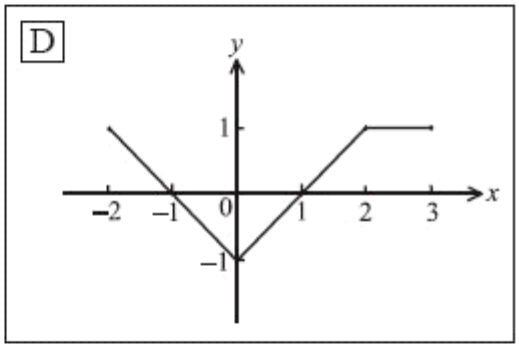
B



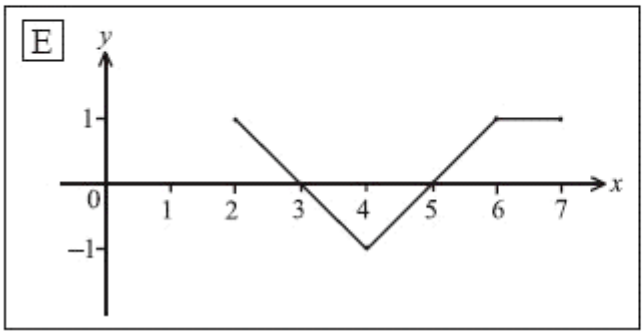
C



D



E



(a) Which diagram is the graph of $f(x + 2)$?

(b) Which diagram is the graph of $-f(x)$?

(c) Which diagram is the graph of $f(-x)$

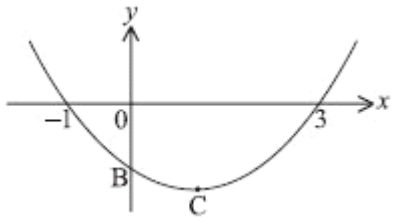
.....

.....

.....

(Total 6 marks)

22. 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.

Working:

Answers:

(a) .....

(b) .....

(c) .....

(Total 6 marks)

23. (a) Express $y = 2x^2 - 12x + 23$ in the form $y = 2(x - c)^2 + d$.

The graph of $y = x^2$ is transformed into the graph of $y = 2x^2 - 12x + 23$ by the transformations

a vertical stretch with scale factor k **followed by**
a horizontal translation of p units **followed by**
a vertical translation of q units.

(b) Write down the value of

(i) k;

(ii) p;

(iii) q.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

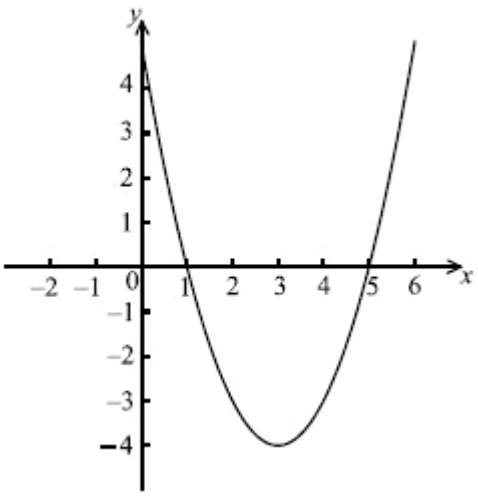
.....

.....

.....

(Total 6 marks)

24. The following diagram shows part of the graph of a quadratic function, with equation in the form $y = (x - p)(x - q)$, where $p, q \in \boxtimes$.



(a) Write down

(i) the value of p and of q;

(ii) the equation of the axis of symmetry of the curve.

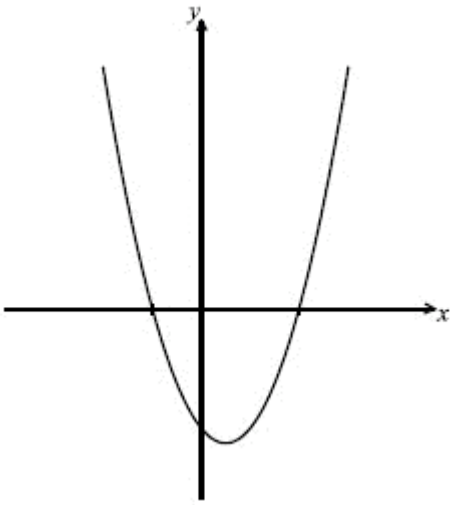
(3)

(b) Find the equation of the function in the form $y = (x - h)^2 + k$, where $h, k \in \boxtimes$.

(3)

(Total 6 marks)

25. 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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

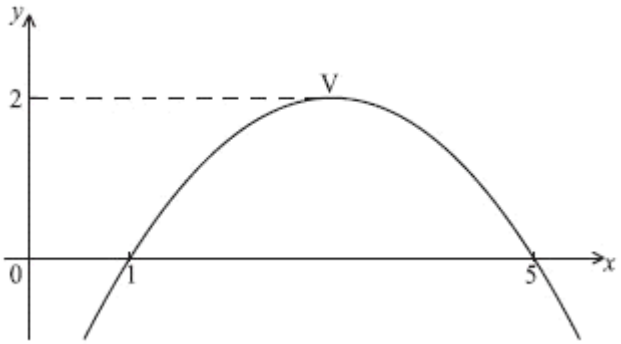
.....

.....

.....

(2)
(Total 6 marks)

26. 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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

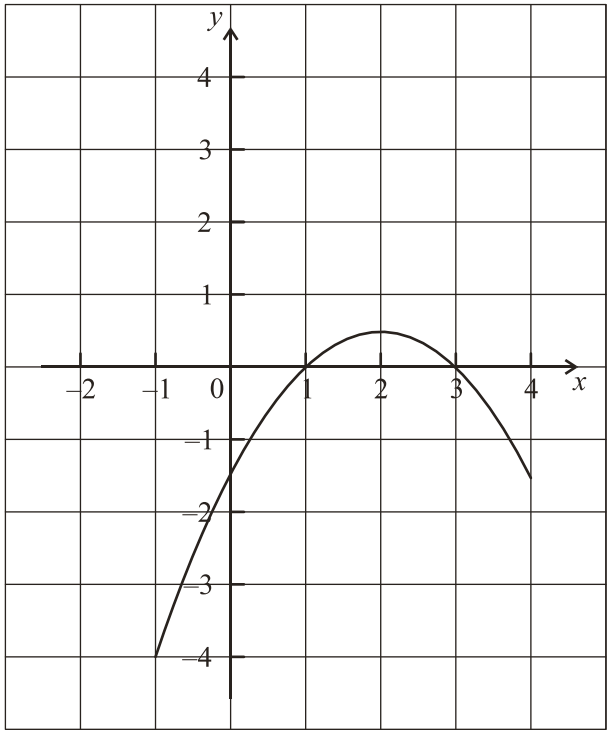
.....

.....

.....

(Total 6 marks)

27. Part of the graph of a function f is shown in the diagram below.



(a) On the same diagram sketch the graph of $y = -f(x)$.

(2)

(b) Let $g(x) = f(x + 3)$.

(i) Find $g(-3)$.

(ii) Describe **fully** the transformation that maps the graph of f to the graph of g.

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)
(Total 6 marks)