IBSL Functions Past Paper Questions

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

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

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

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

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(Total 6 marks)

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

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

Find

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

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

Working:

Answers:

(a)   ....

(b)   ....

(Total 4 marks)

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

(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)

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

Working:

Answer:

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(Total 6 marks)

5. 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.

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(Total 6 marks)

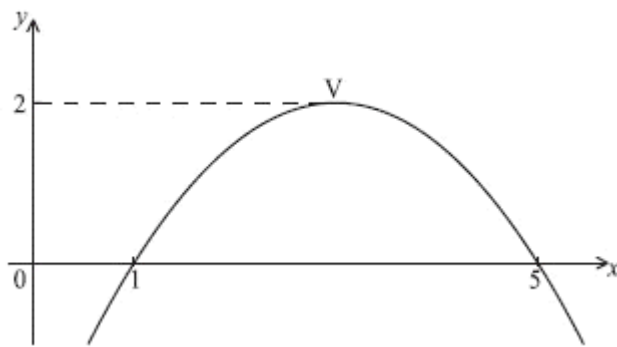**6.** The equation $kx^2 + 3x + 1 = 0$ has exactly one solution. Find the value of k.

Working:

Answer:

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(Total 6 marks)

7. 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.

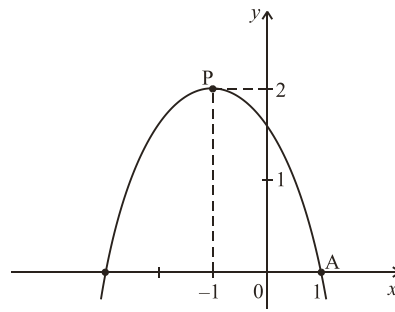(b) Find d.

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(Total 6 marks)

8. 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)

9. 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)

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10. The diagram represents the graph of the function

$$f : x \mapsto (x - p)(x - q).$$
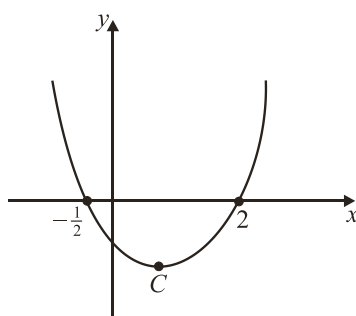
(a) Write down the values of p and q.

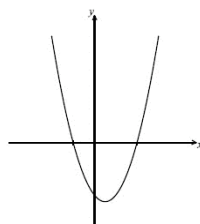(b) The function has a minimum value at the point C. Find the x-coordinate of C.

Working:

Answers:

(a) ....

(b) ....

(Total 4 marks)

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

(a) Find both x-intercepts.

(4)

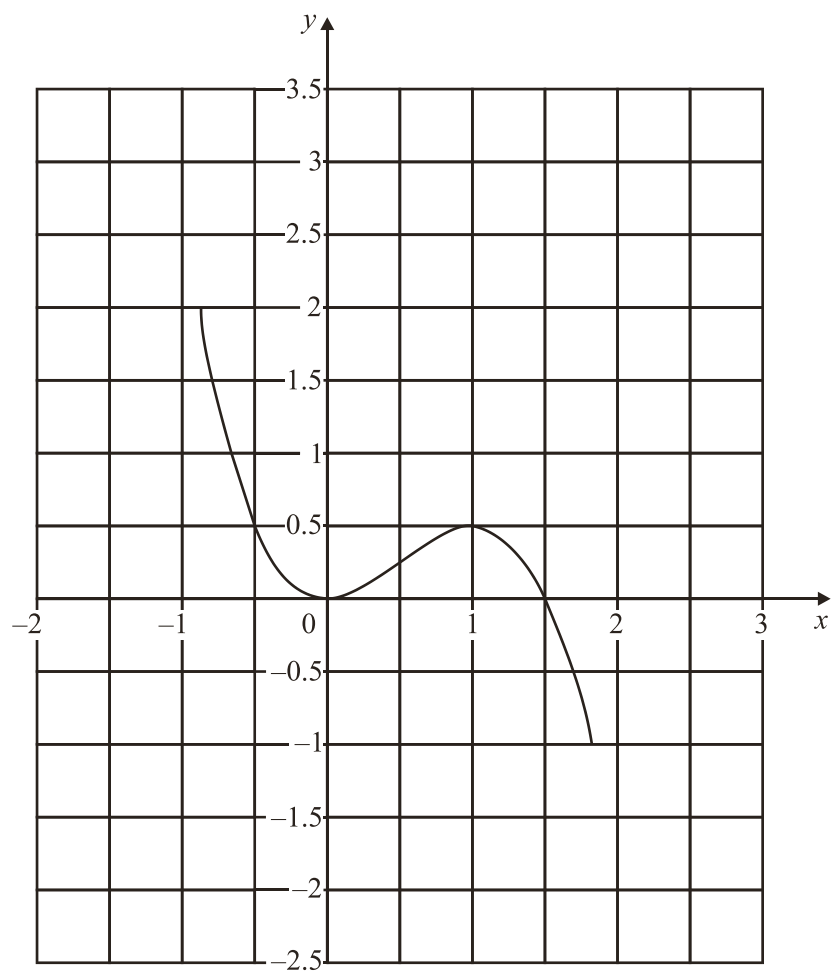(b) Find the x-coordinate of the vertex.

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(2)

(Total 6 marks)

12. 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
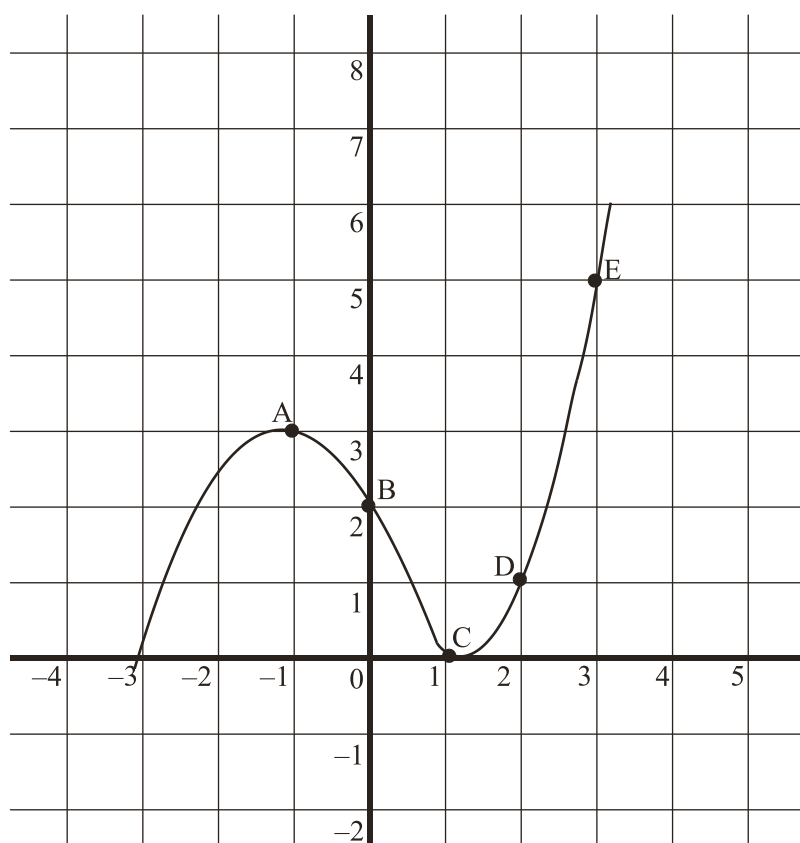$y = f(x-1) + \frac{3}{2}$?

Working:

Answer:

(b) ....

(Total 4 marks)

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13. 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 $g(3)$.

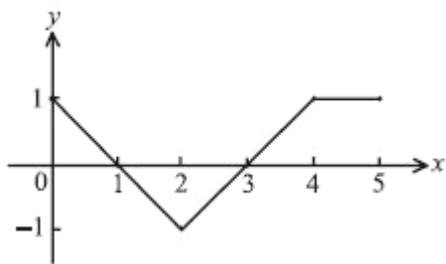(b)   On the same axes, sketch the graph of the function $g(x)$.
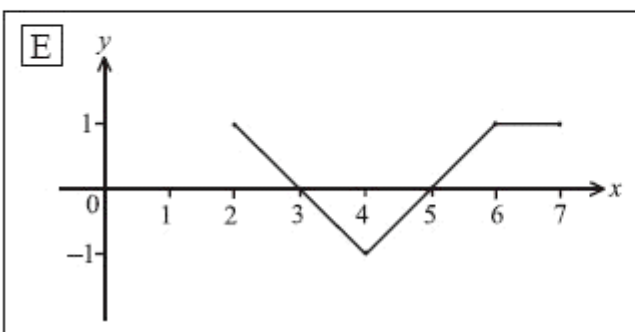
Working:

Answers:

(a)   ....

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(Total 6 marks)

14. 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.
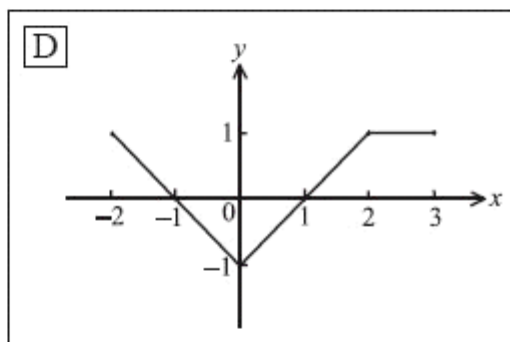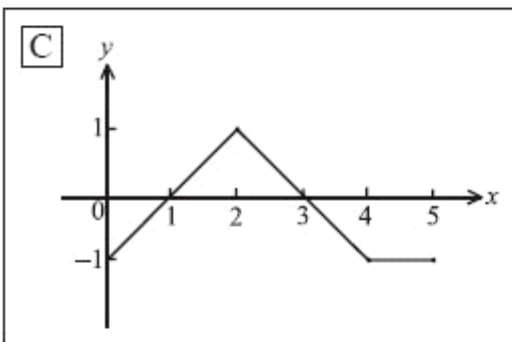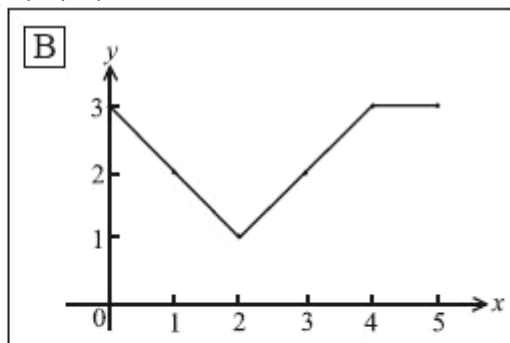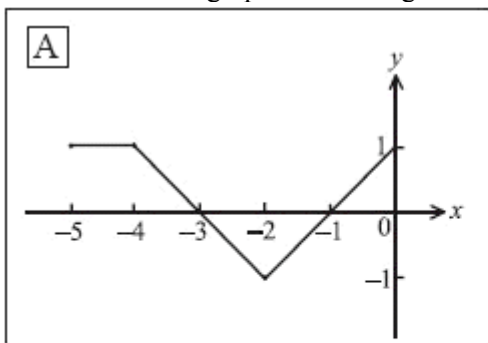
(a)   Which diagram is the graph of $f(x+2)$?

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

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

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(Total 6 marks)

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

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

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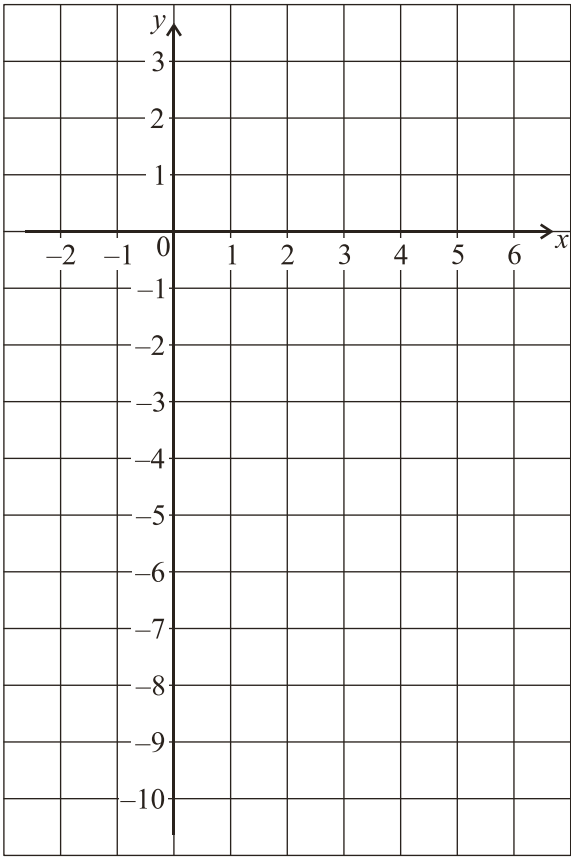
(3)

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

(3)

(Total 6 marks)

16. 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 $g(x) = 3(x - p)^2 + q$.

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(Total 6 marks)

17. (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.

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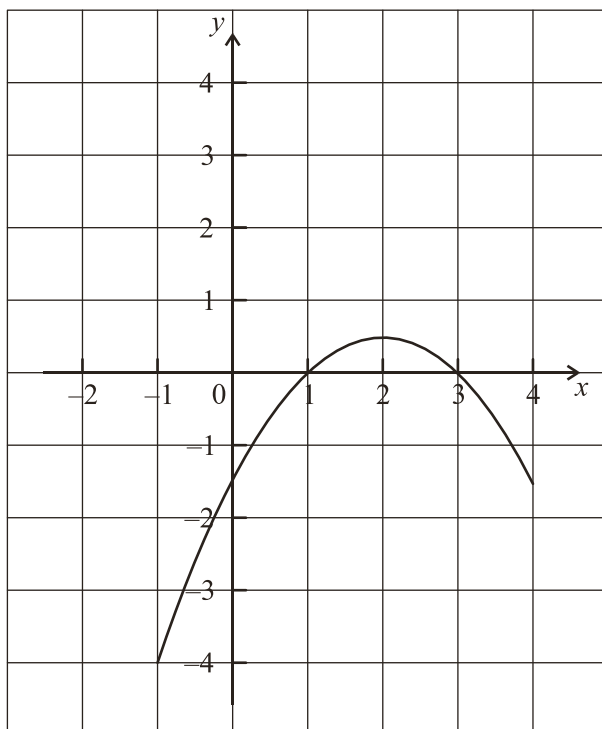
(Total 6 marks)

18. 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.

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(Total 6 marks)