

1

$$f(x) = (x + 3)(x + 2)(x - 1)$$

- (a) Sketch the curve $y = f(x)$, showing the points of intersection with the coordinate axis.

(3)

- (bi) Showing the coordinates of the points of intersection with the coordinate axis, sketch the curve $y = f(x - 3)$.

(2)

- (bii) Showing the coordinates of the points of intersection with the coordinate axis, sketch the curve $y = f(-x)$.

(2)

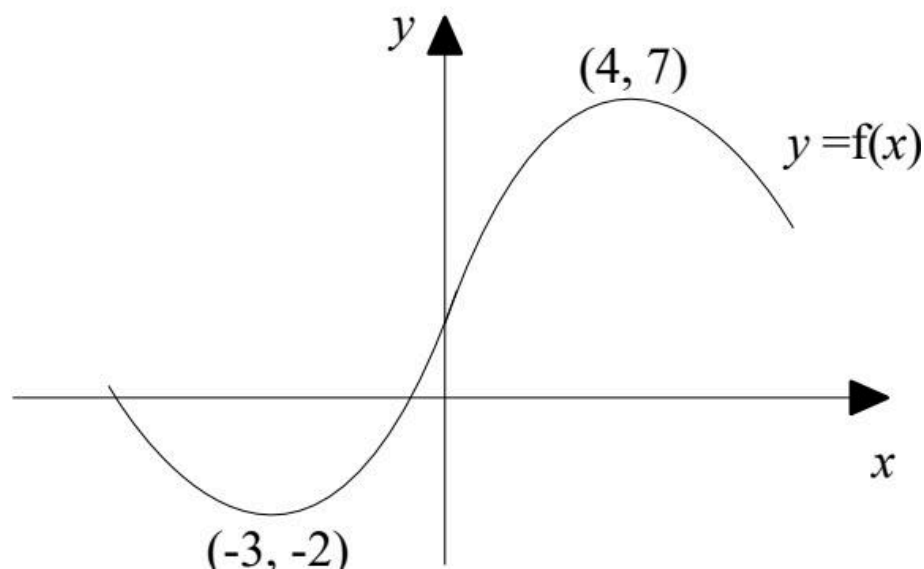
(Total for question 1 is 7 marks)

- 2**
- (a) Sketch on the same diagram the curves $y = x^2 + 5x$ and $y = -\frac{1}{x}$
- (4)**
- (b) State, giving a reason, the number of real solutions to the equation $x^2 + 5x + \frac{1}{x} = 0$

(2)

(Total for question 2 is 6 marks)

- 3 The sketch shows the graph of $y = f(x)$. The curve has a minimum at $(-3, -2)$ and a maximum at $(4, 7)$.



- (i) Showing the coordinates of the points of intersection with the coordinate axis, sketch the curve $y = f(x) + 2$.

(2)

- (ii) Showing the coordinates of the points of intersection with the coordinate axis, sketch the curve $y = -f(x)$.

(2)

(Total for question 3 is 4 marks)

4

$$f(x) = x^2 + 4x + 5$$

- (a) Express $f(x)$ in the form $(x + a)^2 + b$, and state the coordinates of the minimum point of $y = f(x)$.

(3)

- (b) Sketch the graph of $y = f(x)$ showing the coordinates of intersection with the coordinate axis.

(3)

(ci) Find the minimum point of the curve $y = 2f(x)$.

(2)

(cii) Find the minimum point of the curve $y = f(2x)$.

(2)

(Total for question 4 is 10 marks)

$$f(x) = x^3 + 4x^2 - 5x$$

- (a) Sketch the curve $y = f(x)$, showing the points of intersection with the coordinate axis.

(3)

- (bi) Showing the coordinates of the points of intersection with the coordinate axis, sketch the curve $y = f(x + 1)$.

(2)

- (bii) Showing the coordinates of the points of intersection with the coordinate axis, sketch the curve $y = f(2x)$.

(2)

(Total for question 5 is 7 marks)

- 6 Sketch graph of $y = \frac{1}{x} + 2$, showing the points of intersection with the coordinate axis and stating the equations of any asymptotes.

(Total for question 6 is 3 marks)

$$f(x) = (x + 4)(x - 1)(2 - x)$$

- (a) Sketch the curve $y = f(x)$, showing the points of intersection with the coordinate axis.

(3)

- (bi) Showing the coordinates of the points of intersection with the coordinate axis, sketch the curve $y = f(x + 2)$.

(2)

- (bii) Showing the coordinates of the points of intersection with the coordinate axis, sketch the curve $y = -f(x)$.

(2)

8

$$f(x) = (x + 3)(x - 1)^2$$

- (a) Sketch the curve $y = f(x)$, showing the points of intersection with the coordinate axis.

(3)

- (b) Find the equation of $y = f(x + 2)$ in the form $y = (x + a)(x + b)^2$

(2)

(Total for question 8 is 5 marks)

- 9**
- (a) The curve $y = \frac{2}{x-1}$ is translated by four units in the positive x -direction. State the equation of the curve after it has been translated.

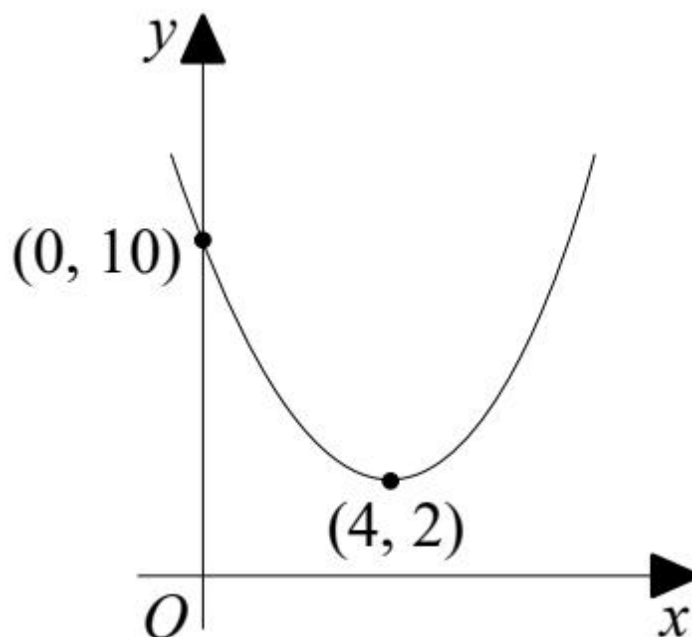
(2)

- (b) Describe fully the single transformation that transforms the curve $y = \frac{2}{x-1}$ to $y = \frac{3}{x-1}$

(2)

(Total for question 9 is 4 marks)

10 Figure 1 shows $y = f(x)$



(a) Which figure shows $y = 2f(x)$?

(1)

(b) Which figure shows $y = f(2x)$?

(1)

(Total for question 10 is 2 marks)

- 11** Given that $f(x) = 10$ when $x = 4$, which statement must be correct?
Tick (✓) one box.

(Total for question 11 is 1 mark)

- 12** Curve C has equation $y = x^2$. C is translated by $\begin{bmatrix} 2 \\ 0 \end{bmatrix}$ to give the equation C_1 . Line L has equation $y = x$. L is stretched by scale factor 3 parallel to the x -axis to give the line L_1 .
Find the exact distance between the two intersection points of C_1 and L_1

(Total for question 12 is 6 marks)

13 The graph $y = \frac{1}{x}$ is translated by the vector $\begin{bmatrix} 2 \\ 0 \end{bmatrix}$

(a) Write down the equation of the transformed graph.

(1)

(b) State the equations of the asymptotes of the transformed graph.

(2)

(Total for question 13 is 3 marks)

14 The graph $y = \frac{1}{x}$ is translated by the vector $\begin{bmatrix} 0 \\ 2 \end{bmatrix}$

(a) Write down the equation of the transformed graph.

(1)

(b) State the equations of the asymptotes of the transformed graph.

(2)

(Total for question 14 is 3 marks)

15

- (a) Sketch the curve $y = (x - a)(5 - x)^2$ where $0 < a < 5$ indicating the coordinates of the points where the curve and the axes meet.

(3)

- (b) Hence solve, $(x - a)(5 - x)^2 > 0$ giving your answer in set notation form.

(2)

(Total for question 15 is 5 marks)

16

(a) Sketch the curve $y = \frac{3}{x^2}$

(2)

(b) Sketch the curve $y = x^3 - 8x^2 + 16x$

(5)

(Total for question 16 is 7 marks)

17

- (a) Sketch the curve $y = \frac{-2}{x}$

(1)

- (b) The curve $y = \frac{-2}{x}$ is translated by 2 units in the positive x -direction. State the equation of the curve after it has been translated.

(2)

- (c) The curve $y = \frac{-2}{x}$ is stretched parallel to the y -axis with scale factor 2 and, as a result, the point $(2, -1)$ on the curve is transformed to the point P . State the coordinates of P .

(2)

(Total for question 17 is 5 marks)

- 18** $f(x) = (x - a)(x - 3a)(x + b)$ where a and b are positive integers.
Sketch the curve $y = f(x)$ and mark, in terms of a and b , the points where the curve meets the axes.

(Total for question 18 is 4 marks)

- 19** The curve $y = (x - 2)^2$ maps onto the curve C_1 following a stretch scale factor $\frac{1}{2}$ in the x -direction.
Find the equation of the curve C_1 .

(Total for question 19 is 2 marks)

20

- (a) Sketch the curve $y = (x + 5)(x + 2)(3 - x)$ indicating the coordinates of the points where the curve and the axes meet.

(4)

- (b) The curve $y = (x + 5)(x + 2)(3 - x)$ is translated by the vector $\begin{bmatrix} 2 \\ 0 \end{bmatrix}$. Write down the equation of the transformed graph.

(2)

(Total for question 20 is 6 marks)

21 $f(x) = (x + 1)(x - 2)^2$

- (a) Sketch the curve $y = f(x)$ indicating the coordinates of the points where the curve and the axes meet.

(3)

- (b) Hence solve $f(x) \leq 0$

(2)

(Total for question 21 is 5 marks)

22 $f(x) = (x + 4)(2x - 5)^2$

(a) Sketch the curve $y = f(x)$, showing the points of intersection with the coordinate axis.

(3)

(bi) Deduce the values of x for which $f(x) \geq 0$

(1)

(bii) Deduce the values of x for which $f(2x) = 0$

(2)

(Total for question 22 is 6 marks)

23 The curve C has equation $y = \frac{k^2}{x} - 2$, $x \in \mathbb{R}$, $x \neq 0$ where k is a constant.

(a) Sketch C , stating the equation of the horizontal asymptote

(3)

(b) The line l has equation $y = -3x + 4$. Show that the x coordinate of any point of intersection of l with C is given by a solution of the equation $3x^2 - 6x + k^2 = 0$

(2)

(c) Hence find the exact values of k for which l is a tangent to C .

(3)

24 $f(x) = (x + 2)(x - 3)^2$

- (a) Sketch the curve $y = f(x)$, showing the points of intersection with the coordinate axis.

(3)

- (b) Given that k is a constant and the curve with equation $y = f(x + k)$ passes through the origin, find the two possible values of k .

(2)

(Total for question 24 is 5 marks)

25

- (a) Using algebra, find all the solutions to the equation $3x^3 - 11x^2 + 6x = 0$

(3)

- (b) Hence find all the real solutions of $3(y + 2)^6 - 11(y + 2)^4 + 6(y + 2)^2 = 0$

(3)

(Total for question 25 is 6 marks)
