

Graphs and Transformations - Questions

May 2016 Mathematics Advanced Paper 1: Pure Mathematics 1

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4.

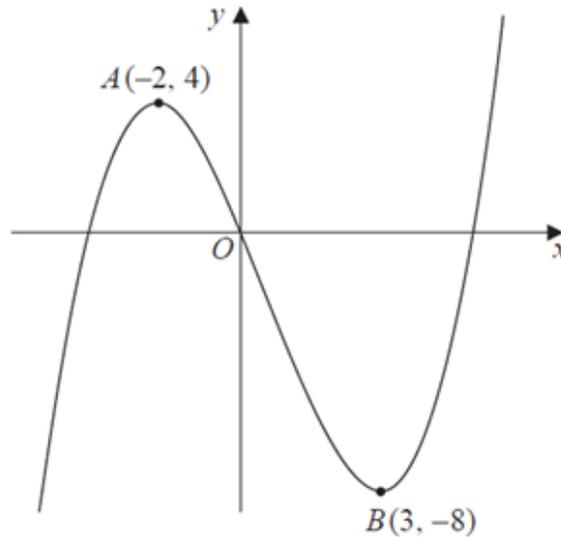


Figure 1

Figure 1 shows a sketch of part of the curve with equation $y = f(x)$. The curve has a maximum point A at $(-2, 4)$ and a minimum point B at $(3, -8)$ and passes through the origin O .

On separate diagrams, sketch the curve with equation

(a) $y = 3f(x)$, (2)

(b) $y = f(x) - 4$. (3)

On each diagram, show clearly the coordinates of the maximum and the minimum points and the coordinates of the point where the curve crosses the y -axis.

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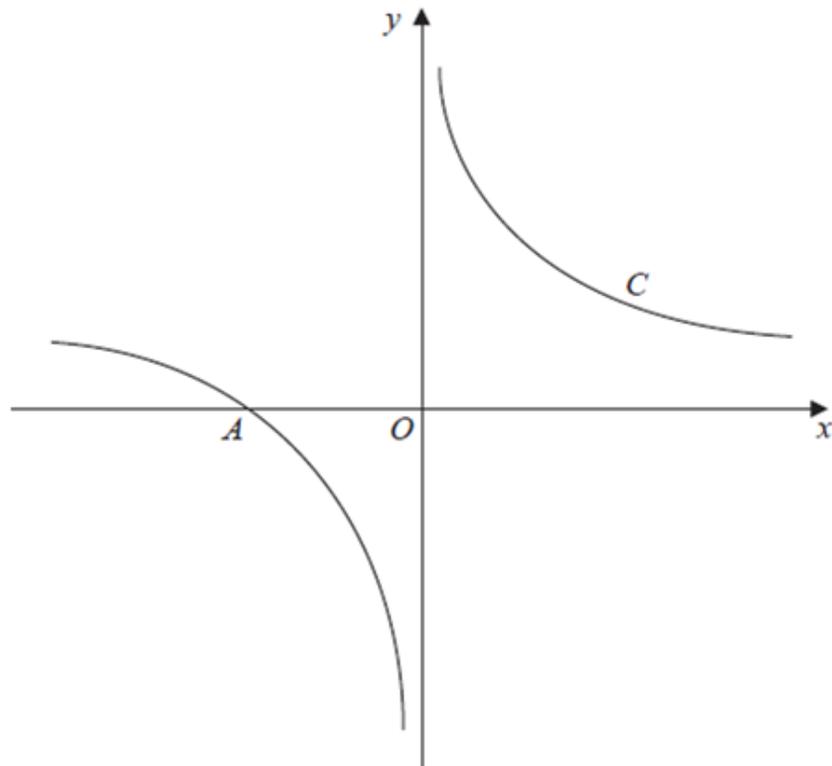


Figure 1

Figure 1 shows a sketch of the curve C with equation

$$y = \frac{1}{x} + 1, \quad x \neq 0.$$

The curve C crosses the x -axis at the point A .

(a) State the x -coordinate of the point A .

(1)

The curve D has equation $y = x^2(x - 2)$, for all real values of x .

(b) On a copy of Figure 1, sketch a graph of curve D . Show the coordinates of each point where the curve D crosses the coordinate axes.

(3)

(c) Using your sketch, state, giving a reason, the number of real solutions to the equation

$$x^2(x - 2) = \frac{1}{x} + 1.$$

(1)

3.

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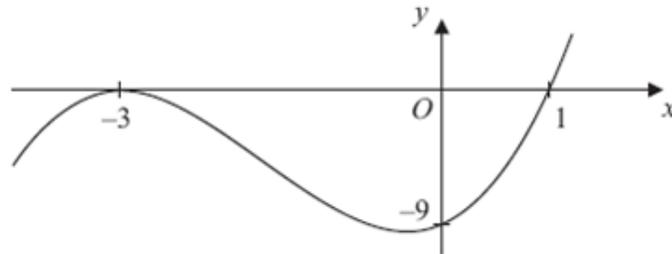


Figure 1

Figure 1 shows a sketch of the curve with equation $y = f(x)$ where

$$f(x) = (x + 3)^2(x - 1), \quad x \in \mathbb{R}.$$

The curve crosses the x -axis at $(1, 0)$, touches it at $(-3, 0)$ and crosses the y -axis at $(0, -9)$.

- (a) Sketch the curve C with equation $y = f(x + 2)$ and state the coordinates of the points where the curve C meets the x -axis. (3)
- (b) Write down an equation of the curve C . (1)
- (c) Use your answer to part (b) to find the coordinates of the point where the curve C meets the y -axis. (2)

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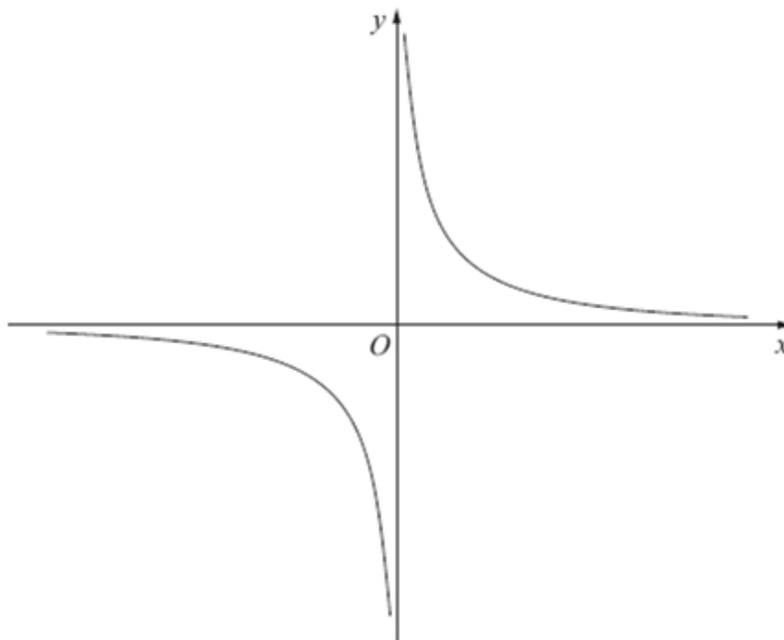


Figure 1

Figure 1 shows a sketch of the curve with equation $y = \frac{2}{x}$, $x \neq 0$.

The curve C has equation $y = \frac{2}{x} - 5$, $x \neq 0$, and the line l has equation $y = 4x + 2$.

(a) Sketch and clearly label the graphs of C and l on a single diagram.

On your diagram, show clearly the coordinates of the points where C and l cross the coordinate axes.

(5)

(b) Write down the equations of the asymptotes of the curve C .

(2)

(c) Find the coordinates of the points of intersection of $y = \frac{2}{x} - 5$ and $y = 4x + 2$.

(5)

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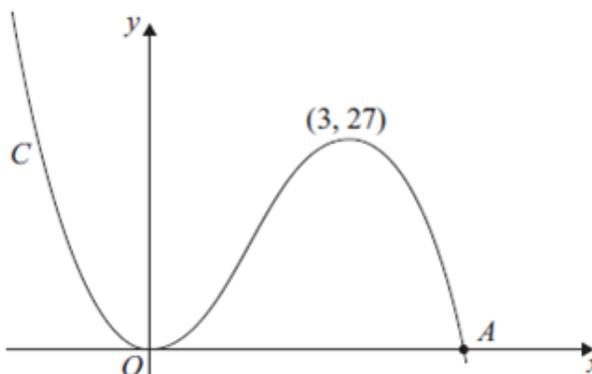


Figure 1

Figure 1 shows a sketch of the curve C with equation $y = f(x)$, where

$$f(x) = x^2(9 - 2x).$$

There is a minimum at the origin, a maximum at the point $(3, 27)$ and C cuts the x -axis at the point A .

(a) Write down the coordinates of the point A . (1)

(b) On separate diagrams sketch the curve with equation

(i) $y = f(x + 3)$,

(ii) $y = f(3x)$.

On each sketch you should indicate clearly the coordinates of the maximum point and any points where the curves cross or meet the coordinate axes. (6)

The curve with equation $y = f(x) + k$, where k is a constant, has a maximum point at $(3, 10)$.

(c) Write down the value of k . (1)

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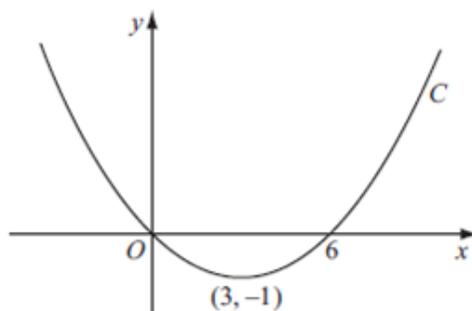


Figure 1

Figure 1 shows a sketch of the curve C with equation $y = f(x)$.
The curve C passes through the origin and through $(6, 0)$.
The curve C has a minimum at the point $(3, -1)$.

On separate diagrams, sketch the curve with equation

(a) $y = f(2x)$, (3)

(b) $y = -f(x)$, (3)

(c) $y = f(x + p)$, where p is a constant and $0 < p < 3$. (4)

On each diagram show the coordinates of any points where the curve intersects the x -axis and of any minimum or maximum points.

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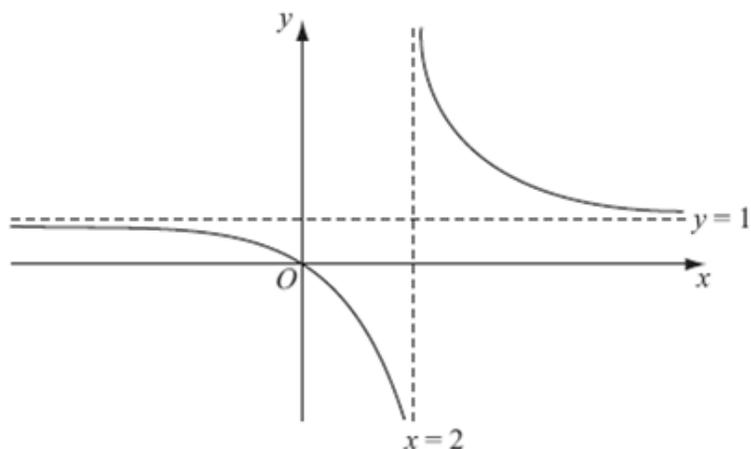


Figure 1

Figure 1 shows a sketch of the curve with equation $y = f(x)$ where

$$f(x) = \frac{x}{x-2}, \quad x \neq 2.$$

The curve passes through the origin and has two asymptotes, with equations $y = 1$ and $x = 2$, as shown in Figure 1.

- (a) In the space below, sketch the curve with equation $y = f(x - 1)$ and state the equations of the asymptotes of this curve. (3)
- (b) Find the coordinates of the points where the curve with equation $y = f(x - 1)$ crosses the coordinate axes. (4)

8.

10. (a) Sketch the graphs of

(i) $y = x(x + 2)(3 - x)$,

(ii) $y = -\frac{2}{x}$.

showing clearly the coordinates of all the points where the curves cross the coordinate axes.

(6)

(b) Using your sketch state, giving a reason, the number of real solutions to the equation

$$x(x + 2)(3 - x) + \frac{2}{x} = 0.$$

(2)

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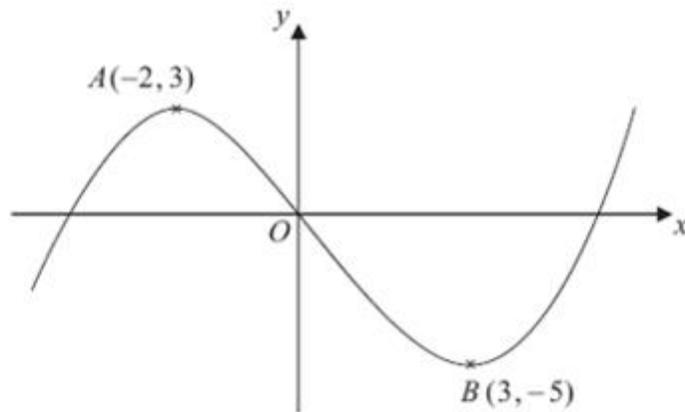


Figure 1

Figure 1 shows a sketch of the curve with equation $y = f(x)$. The curve has a maximum point A at $(-2, 3)$ and a minimum point B at $(3, -5)$.

On separate diagrams sketch the curve with equation

(a) $y = f(x + 3)$,

(3)

(b) $y = 2f(x)$.

(3)

On each diagram show clearly the coordinates of the maximum and minimum points.

The graph of $y = f(x) + a$ has a minimum at $(3, 0)$, where a is a constant.

(c) Write down the value of a .

(1)

10.

10. (a) On the axes below sketch the graphs of

(i) $y = x(4 - x)$,

(ii) $y = x^2(7 - x)$,

showing clearly the coordinates of the points where the curves cross the coordinate axes.

(5)

(b) Show that the x -coordinates of the points of intersection of

$$y = x(4 - x) \quad \text{and} \quad y = x^2(7 - x)$$

are given by the solutions to the equation $x(x^2 - 8x + 4) = 0$.

(3)

The point A lies on both of the curves and the x and y coordinates of A are both positive.

(c) Find the exact coordinates of A , leaving your answer in the form $(p + q\sqrt{3}, r + s\sqrt{3})$, where p, q, r and s are integers.

(7)

11.

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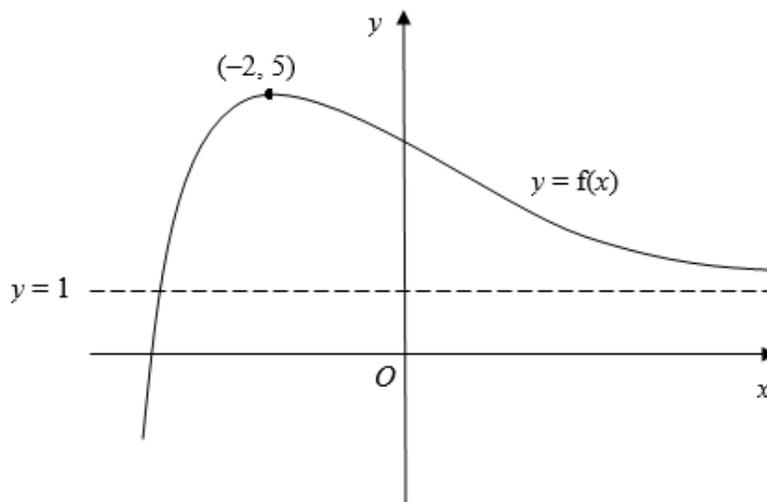


Figure 1

Figure 1 shows a sketch of part of the curve with equation $y = f(x)$.

The curve has a maximum point $(-2, 5)$ and an asymptote $y = 1$, as shown in Figure 1.

On separate diagrams, sketch the curve with equation

(a) $y = f(x) + 2$, (2)

(b) $y = 4f(x)$, (2)

(c) $y = f(x + 1)$. (3)

On each diagram, show clearly the coordinates of the maximum point and the equation of the asymptote.