Write your name here

Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Mathematics

Year 11 to Year 12 Transition Paper

Graphs and Transformations

You must have:
Mathematical Formulae and Statistical Tables, calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

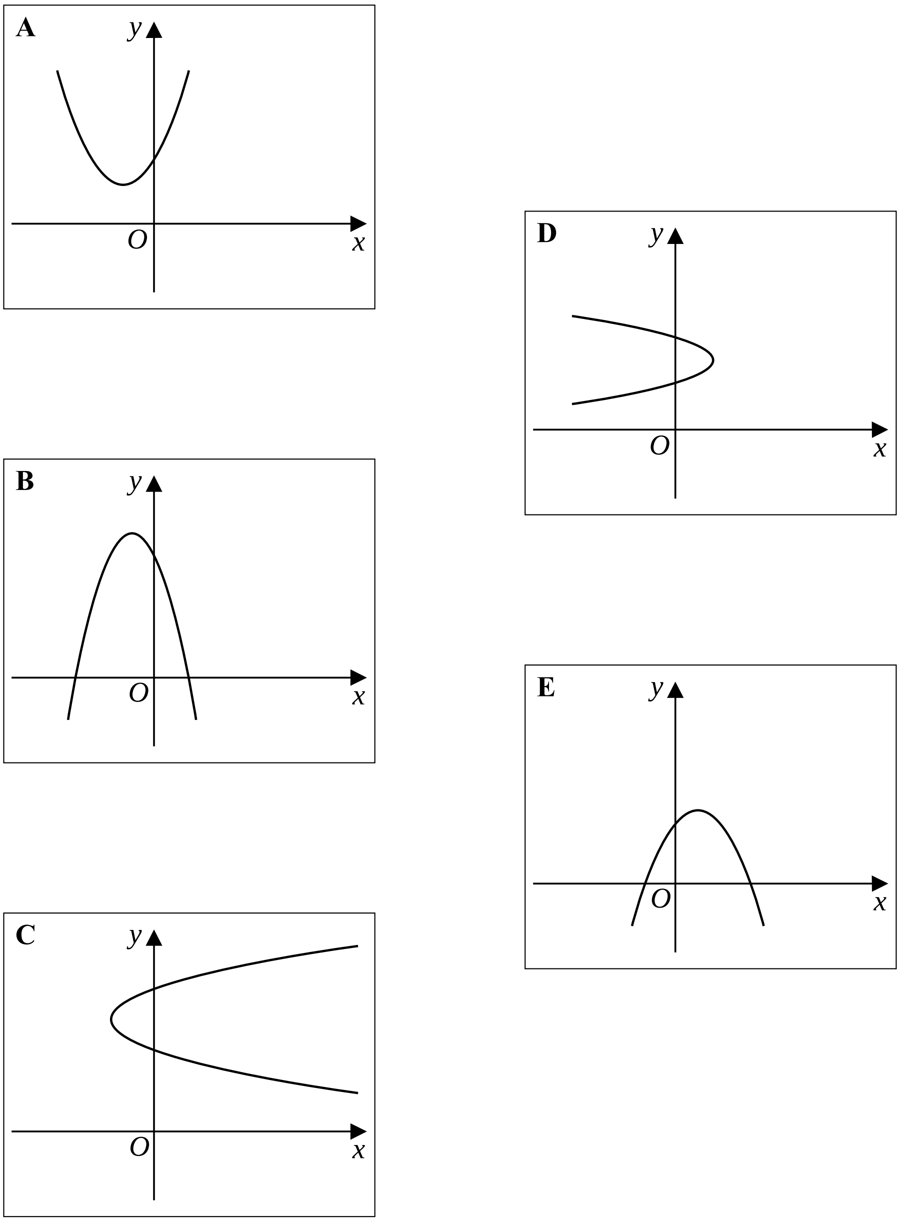
- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer cross it out and put your new answer and any working out underneath.

Turn over ▶

Pearson

Calculators may NOT be used to answer these questions unless a symbol is shown next to the question.

1. Here are some sketch graphs.

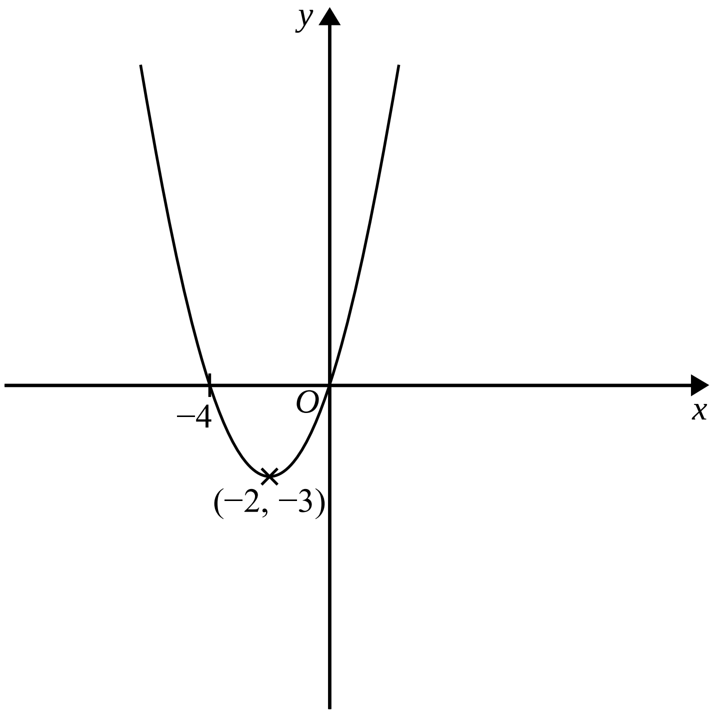


The equation for one of these sketch graphs is $y = 5 - x^2 - 4x$

Write down the letter of this sketch.

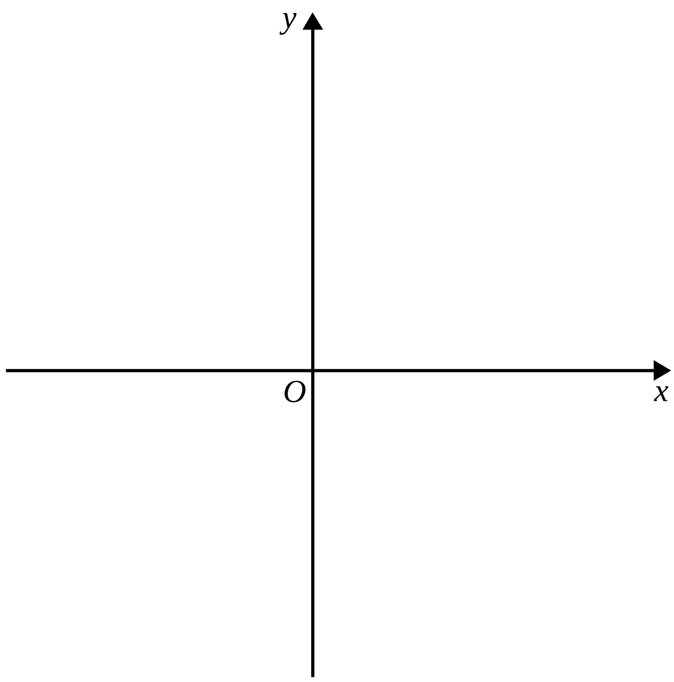
(Total for Question 1 is 1 mark)

2. Here is the graph of $y = f(x)$



(a) On the axes below, sketch the graph of $y = -f(x)$

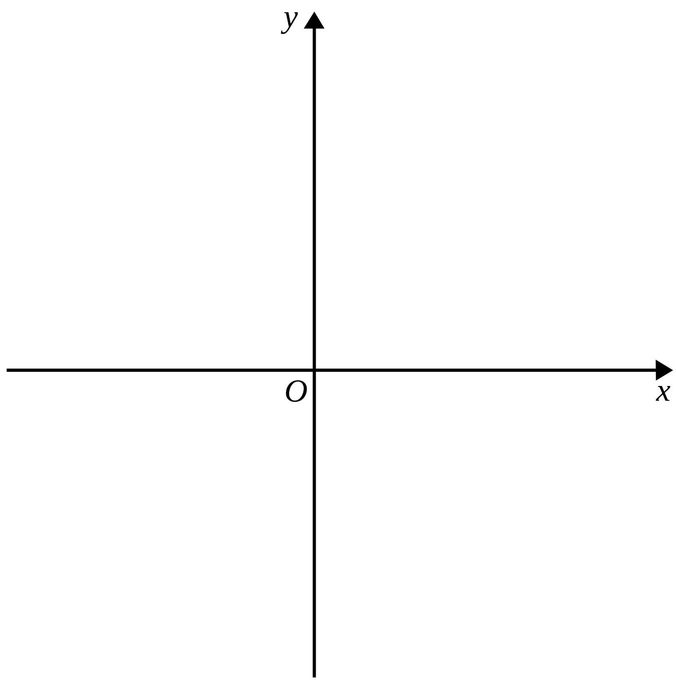
On your sketch, show the coordinates of any points where the graph intersects the x-axis and show the coordinates of any turning points.



(2)

(*b*) On the axes below, sketch the graph of $y = \frac{1}{2}\text{f}(x)$

On your sketch, show the coordinates of any points where the graph intersects the *x*-axis and show the coordinates of any turning points.



(2)

(Total for Question 2 is 4 marks)

3.

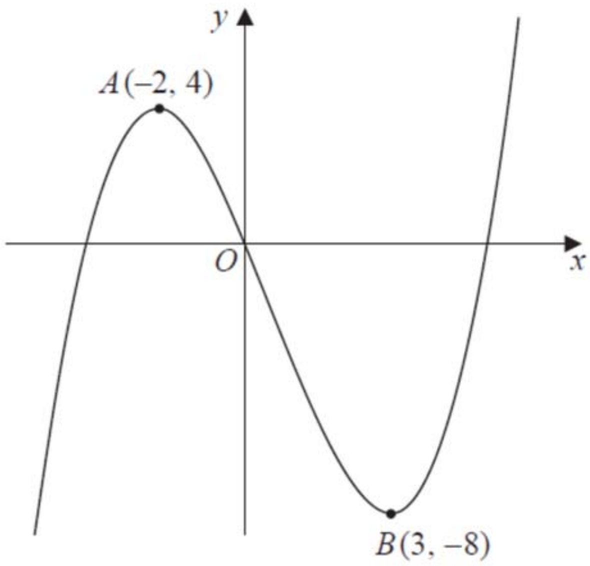


Figure 1

Figure 1 shows a sketch of part of the curve with equation $y = \mathrm{f}(x)$. 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*) $y = 3\mathrm{f}(x)$,

(2)

(*b*) $y = \mathrm{f}(x) - 4$.

(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.

(Total for Question 3 is 5 marks)

4. (*a*) Factorise completely $9x - 4x^3$.

(3)

(*b*) Sketch the curve C with equation

$$y = 9x - 4x^3.$$

Show on your sketch the coordinates at which the curve meets the x-axis.

(3)

The points A and B lie on C and have x coordinates of –2 and 1 respectively.

(*c*) Show that the length of AB is $k\sqrt{10}$, where k is a constant to be found.

(4)

(Total for Question 4 is 10 marks)

5.

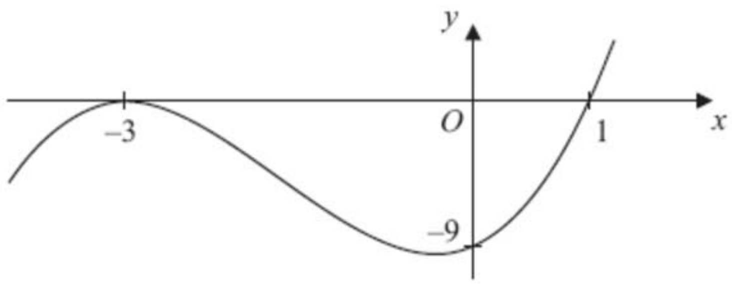


Figure 2

Figure 2 shows a sketch of the curve with equation $y = \text{f}(x)$ where

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

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 $y = \text{f}(x + 2)$ 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)

(Total for Question 5 is 6 marks)

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6. $$f(x) = x^2 - 8x + 19$$

(*a*) Express f(x) in the form $(x + a)^2 + b$, where a and b are constants.

(2)

The curve C with equation $y = f(x)$ crosses the y-axis at the point P and has a minimum point at the point Q.

(*b*) Sketch the graph of C showing the coordinates of point P and the coordinates of point Q.

(3)

(*c*) Find the distance PQ, writing your answer as a simplified surd.

(3)

(Total for Question 6 is 8 marks)

7.

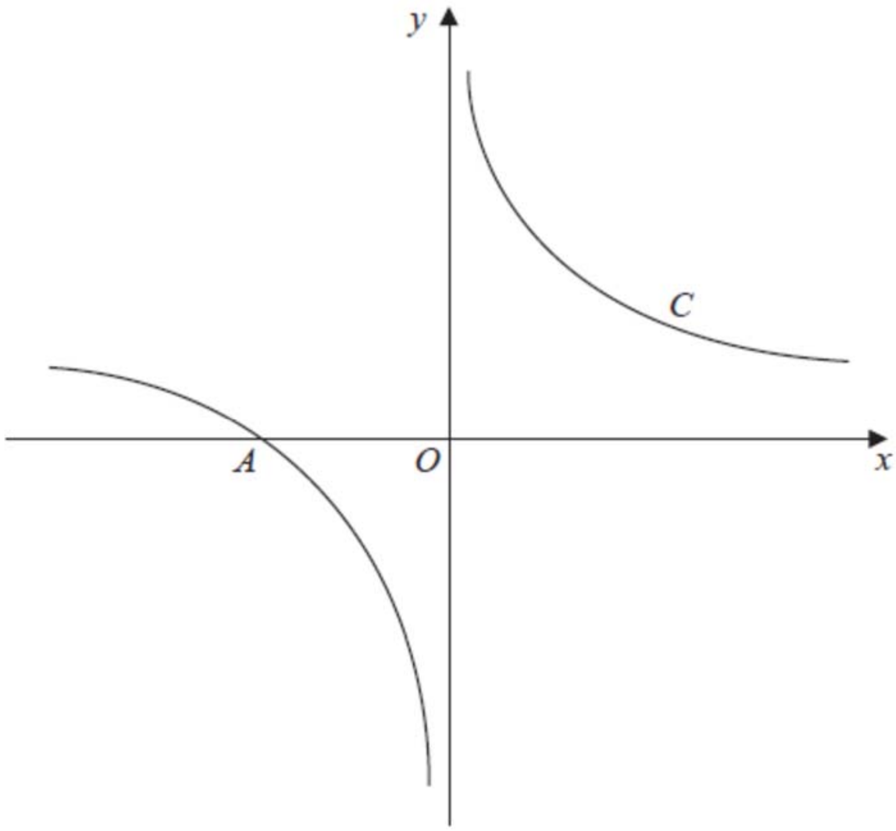

Figure 3

Figure 3 shows a sketch of the curve C with equation

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

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)

(Total for Question 7 is 5 marks)

8.

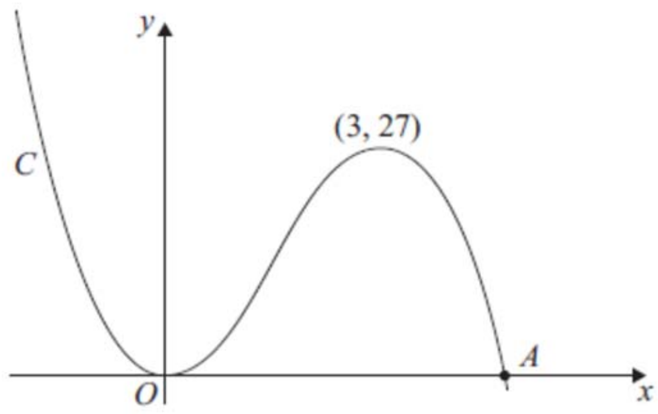

Figure 4

Figure 4 shows a sketch of the curve C with equation $y = \text{f}(x)$, where

$$\text{f}(x) = x^2(9 - 2x).$$

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) $y = \text{f}(x + 3)$,

(ii) $y = \text{f}(3x)$.

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 $y = \text{f}(x) + k$, where k is a constant, has a maximum point at (3, 10).

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

(1)

(Total for Question 8 is 8 marks)

9.

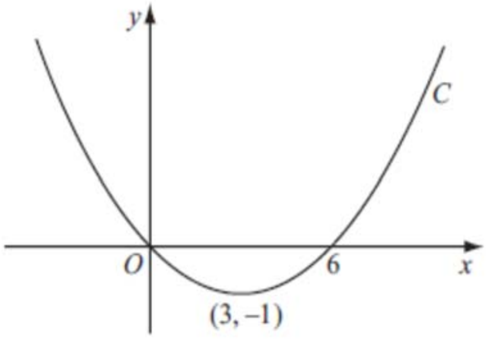

Figure 5

Figure 5 shows a sketch of the curve C with equation $y = \mathrm{f}(x)$.

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*) $y = \mathrm{f}(2x)$,

(3)

(*b*) $y = -\mathrm{f}(x)$,

(3)

(*c*) $y = \mathrm{f}(x + p)$, 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.

(Total for Question 9 is 10 marks)

10.

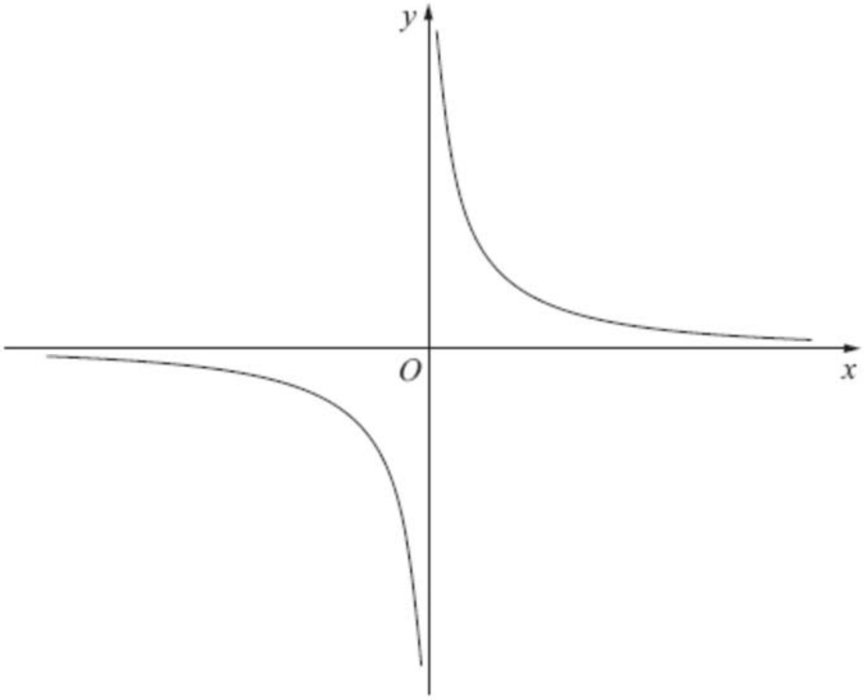

Figure 6

Figure 6 shows a sketch of the curve with equation $y = \dfrac{2}{x}$, $x \neq 0$.

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

(5)

(Total for Question 10 is 12 marks)

11. (*a*) On separate axes sketch the graphs of

(i) $y = -3x + c$, where c is a positive constant,

(ii) $y = \dfrac{1}{x} + 5$

On each sketch show the coordinates of any point at which the graph crosses the y-axis and the equation of any horizontal asymptote.

(4)

Given that $y = -3x + c$, where c is a positive constant, meets the curve $y = \dfrac{1}{x} + 5$ at two distinct points,

(*b*) show that $(5 - c)^2 > 12$

(3)

(*c*) Hence find the range of possible values for c.

(4)

(Total for Question 11 is 11 marks)

12. The curve C has equation $y = x(5 - x)$ and the line L has equation $2y = 5x + 4$.

(*a*) Use algebra to show that C and L do not intersect.

(4)

(*b*) Sketch C and L on the same diagram, showing the coordinates of the points at which C and L meet the axes.

(4)

(Total for Question 12 is 8 marks)

13.

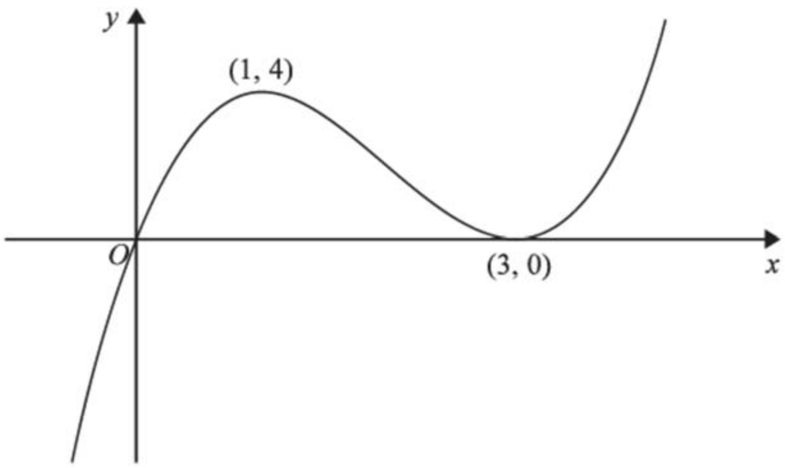

Figure 7

Figure 7 shows a sketch of the curve with equation $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = x(3-x)^2 \qquad x \in \mathbb{R}$$

The curve passes through the origin and touches the x-axis at the point (3, 0).

There is a maximum point at (1,4) and a minimum point at (3,0).

(a) On separate diagrams, sketch the curve with equation

(i) $y = \mathrm{f}(\frac{1}{2}x)$,

(ii) $y = \mathrm{f}(x + 2)$.

On each sketch indicate clearly the coordinates of

- any points where the curve crosses or touches the x-axis,
- the point where the curve crosses the y-axis,
- any maximum or minimum points.

(6)

The curve with equation $y = \mathrm{f}(x) + k$, where k is a non-zero constant, has a maximum point at (a, 0).

(b) Write down the values of a and k.

(2)

(Total for Question 13 is 8 marks)

14.

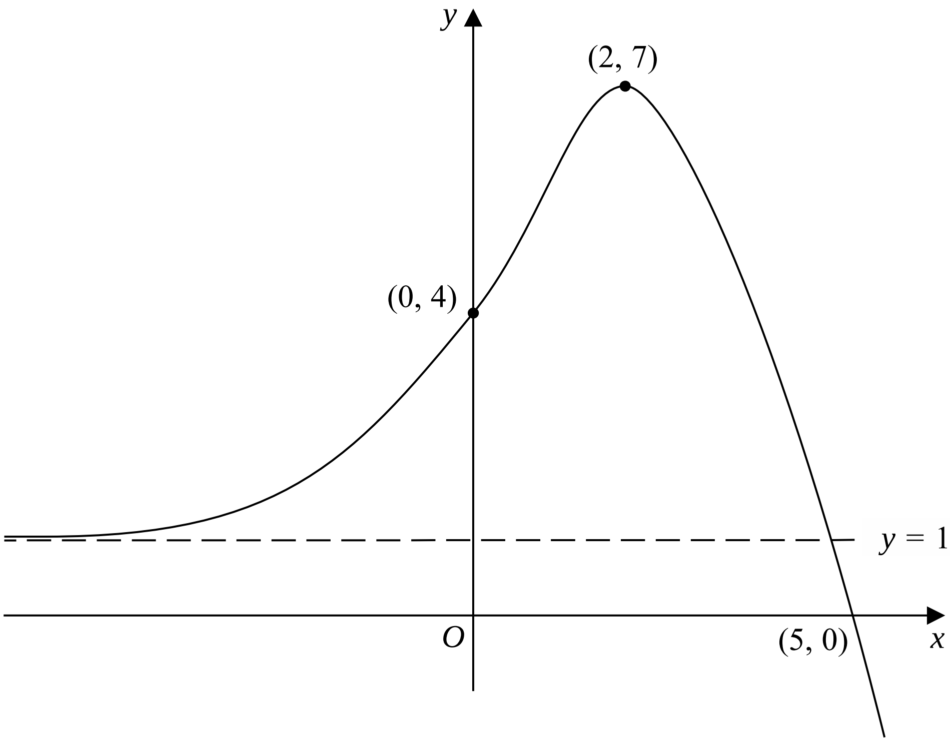

Figure 8

Figure 8 shows the sketch of a curve with equation $y = \mathrm{f}(x)$, $x \in \mathbb{R}$.

The curve crosses the y-axis at (0, 4) and crosses the x-axis at (5, 0).

The curve has a single turning point, a maximum, at (2, 7).

The line with equation $y = 1$ is the only asymptote to the curve.

(*a*) State the coordinates of the turning point on the curve with equation $y = \mathrm{f}(x - 2)$.

(1)

(*b*) State the solution of the equation $\mathrm{f}(2x) = 0$

(1)

(*c*) State the equation of the asymptote to the curve with equation $y = \mathrm{f}(-x)$.

(1)

Given that the line with equation $y = k$, where k is a constant, meets the curve $y = \mathrm{f}(x)$ at only one point,

(*d*) state the set of possible values for k.

(2)

(Total for Question 14 is 5 marks)

15.

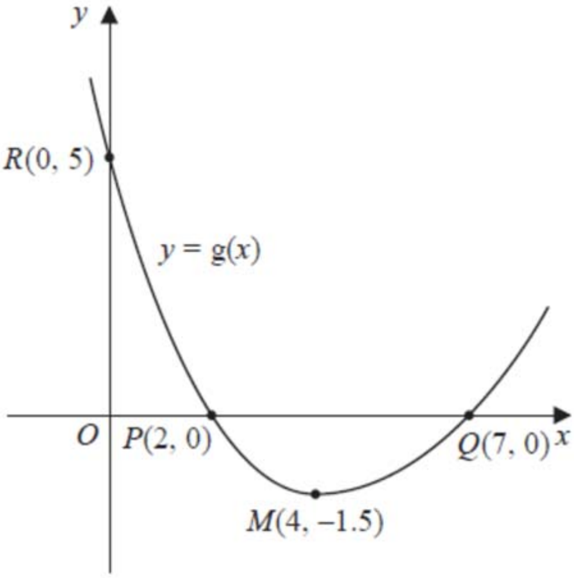

Figure 9

Figure 9 shows a sketch of the curve with equation $y = \mathrm{g}(x)$.

The curve has a single turning point, a minimum, at the point $M(4, -1.5)$.

The curve crosses the x-axis at two points, $P(2, 0)$ and $Q(7, 0)$.

The curve crosses the y-axis at a single point $R(0, 5)$.

(*a*) State the coordinates of the turning point on the curve with equation $y = 2\mathrm{g}(x)$.

(1)

(*b*) State the largest root of the equation $\mathrm{g}(x + 1) = 0$.

(1)

(*c*) State the range of values of x for which $\mathrm{g}'(x) \leq 0$.

(1)

Given that the equation $\mathrm{g}(x) + k = 0$, where k is a constant, has no real roots,

(*d*) state the range of possible values for k.

(1)

(Total for Question 15 is 4 marks)