Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number	Candidate Number

A level Mathematics

Practice Paper
Pure Mathematics - Algebra and functions

You must have:
Mathematical Formulae and Statistical Tables (Pink)

Total Marks

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 the 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.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 16 questions in this question paper. The total mark for this paper is 100.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- Calculators must not be used for questions marked with a * sign.

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 underneath.

1. Given that

$$\frac{3x^4 - 2x^3 - 5x^2 - 4}{x^2 - 4} \equiv ax^2 + bx + c + \frac{dx + e}{x^2 - 4}, \qquad x \neq \pm 2$$

find the values of the constants a, b, c, d and e.

(Total 4 marks)

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2. Express $\frac{4x}{x^2 - 9} - \frac{2}{x + 3}$ as a single fraction in its simplest form.

(Total 4 marks)

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3. Express

$$\frac{3}{2x + 3} - \frac{1}{2x - 3} + \frac{6}{4x^2 - 9}$$

as a single fraction in its simplest form.

(Total 4 marks)

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4. Express

$$\frac{2(3x + 2)}{9x^2 - 4} - \frac{2}{3x + 1}$$

as a single fraction in its simplest form.

(Total 4 marks)

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5. The functions f and g are defined by

$$f : x \to 7x - 1, \qquad x \in \mathbb{R},$$

$$g : x \to \frac{4}{x-2}, \qquad x \neq 2, x \in \mathbb{R},$$

(*a*) Solve the equation $fg(x) = x$.

(4)

(*b*) Hence, or otherwise, find the largest value of a such that $g(a) = f^{-1}(a)$.

(1)

(Total 5 marks)

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6. Given that

$$f(x) = \ln x, \qquad x > 0$$

sketch on separate axes the graphs of

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

(ii) $y = |f(x)|$,

(iii) $y = -f(x - 4)$.

Show, on each diagram, the point where the graph meets or crosses the x-axis.
In each case, state the equation of the asymptote.

(Total 7 marks)

7.

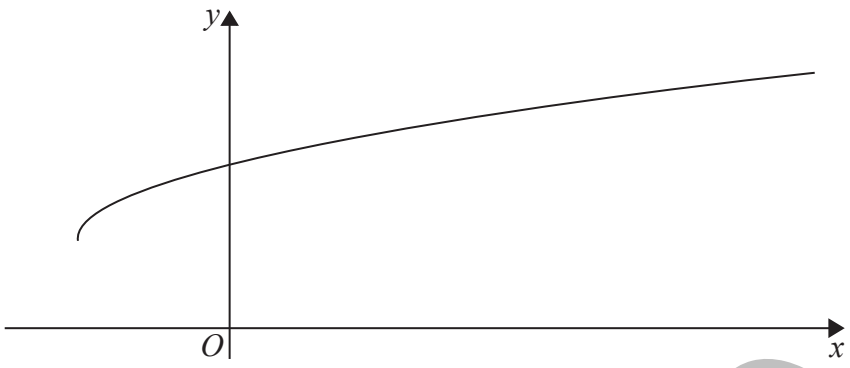

Figure 1

Figure 1 shows a sketch of part of the graph of $y = g(x)$, where

$$g(x) = 3 + \sqrt{x+2}\,, \qquad x \geqslant -2$$

(*a*) State the range of g.

(1)

(*b*) Find $g^{-1}(x)$ and state its domain.

(3)

(*c*) Find the exact value of x for which

$$g(x) = x$$

(4)

(*d*) Hence state the value of a for which

$$g(a) = g^{-1}(a)$$

(1)

(Total 9 marks)

8.

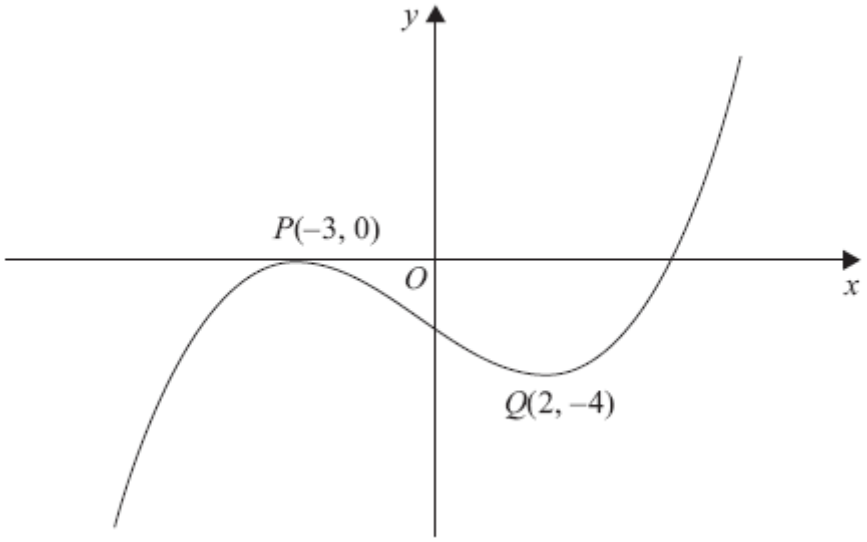

Figure 2

Figure 2 shows the graph of equation $y = \mathrm{f}(x)$.

The points $P(-3, 0)$ and $Q(2, -4)$ are stationary points on the graph.

Sketch, on separate diagrams, the graphs of

(*a*) $y = 3\mathrm{f}(x + 2)$,

(3)

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

(3)

On each diagram, show the coordinates of any stationary points.

(Total 6 marks)

9.

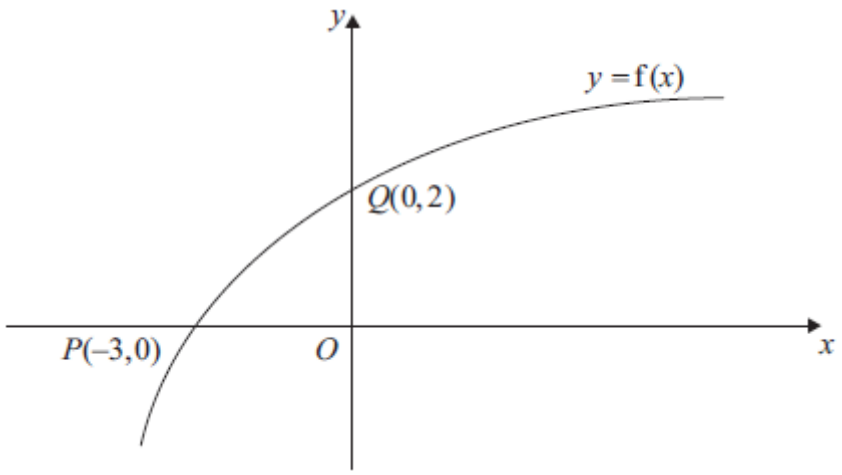

Figure 3

Figure 3 shows part of the curve with equation $y = \mathrm{f}(x)$, $x \in \mathbb{R}$.

The curve passes through the points $Q(0, 2)$ and $P(-3, 0)$ as shown.

(*a*) Find the value of $\mathrm{ff}(-3)$.

(2)

On separate diagrams, sketch the curve with equation

(*b*) $y = \mathrm{f}^{-1}(x)$,

(2)

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

(2)

(*d*) $y = 2\mathrm{f}\left(\frac{1}{2}x\right)$.

(3)

Indicate clearly on each sketch the coordinates of the points at which the curve crosses or meets the axes.

(Total 9 marks)

10.

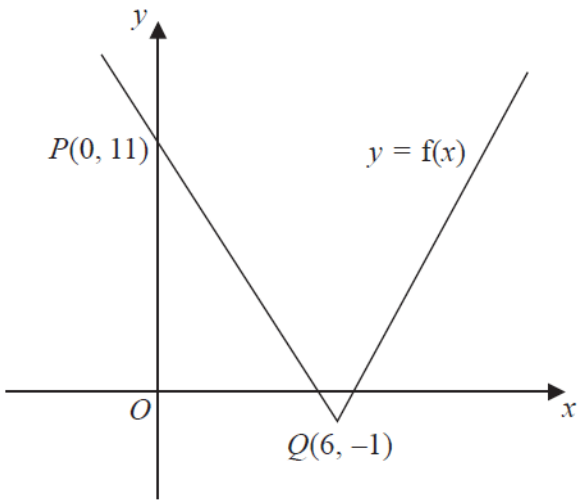

Figure 4

Figure 4 shows part of the graph with equation $y = \text{f}(x)$, $x \in \mathbb{R}$.

The graph consists of two line segments that meet at the point $Q(6, -1)$.

The graph crosses the y-axis at the point $P(0, 11)$.

Sketch, on separate diagrams, the graphs of

(*a*) $y = |\text{f}(x)|$

(2)

(*b*) $y = 2\text{f}(-x) + 3$

(3)

On each diagram, show the coordinates of the points corresponding to P and Q.

Given that $\text{f}(x) = a|x - b| - 1$, where a and b are constants,

(*c*) state the value of a and the value of b.

(2)

(Total 7 marks)

11.

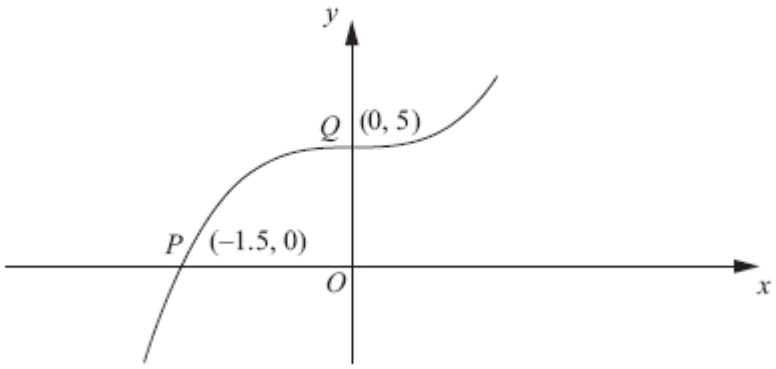

Figure 5

Figure 5 shows part of the curve with equation $y = f(x)$.
The curve passes through the points $P(-1.5, 0)$and $Q(0, 5)$ as shown.

On separate diagrams, sketch the curve with equation

(*a*) $y = |f(x)|$

(2)

(*b*) $y = f(|x|)$

(2)

(*c*) $y = 2f(3x)$

(3)

Indicate clearly on each sketch the coordinates of the points at which the curve crosses or meets the axes.

(Total 7 marks)

12. (*a*) Sketch the graph with equation

$$y = |4x - 3|$$

stating the coordinates of any points where the graph cuts or meets the axes.

(2)

Find the complete set of values of x for which

(*b*)

$$|4x - 3| > 2 - 2x$$

(4)

(*c*)

$$|4x - 3| > \frac{3}{2} - 2x$$

(2)

(Total 8 marks)

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13. $\mathrm{g}(x) = \dfrac{x}{x+3} + \dfrac{3(2x+1)}{x^2+x-6}, \quad x > 3$

(*a*) Show that $\mathrm{g}(x) = \dfrac{x+1}{x-2}, \ x > 3$

(4)

(*b*) Find the range of g.

(2)

(*c*) Find the exact value of a for which $\mathrm{g}(a) = \mathrm{g}^{-1}(a)$.

(4)

(Total 10 marks)

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14. Given that a and b are positive constants,

(a) on separate diagrams, sketch the graph with equation

(i) $y = |2x - a|$

(ii) $y = |2x - a| + b$

Show, on each sketch, the coordinates of each point at which the graph crosses or meets the axes.

(4)

Given that the equation

$$|2x - a| + b = \frac{3}{2}x + 8$$

has a solution at $x = 0$ and a solution at $x = c$,

(b) find c in terms of a.

(4)

(Total 8 marks)

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15. $$\frac{9x^2}{(x-1)^2(2x+1)} = \frac{A}{(x-1)} + \frac{B}{(x-1)^2} + \frac{C}{(2x+1)}.$$

Find the values of the constants A, B and C.

(Total 4 marks)

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16. Express $\dfrac{9x^2 + 20x - 10}{(x+2)(3x-1)}$ in partial fractions.

(Total 4 marks)

TOTAL FOR PAPER: 100 MARKS