

Write your name here

Surname	Other names
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**Pearson** Centre Number Candidate Number

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**Edexcel GCE**

**A level Mathematics**

**Practice Paper**

**Pure Mathematics - Algebra and functions**

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

Total Marks
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### 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

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

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

$$f : x \rightarrow 7x - 1, \quad x \in \mathbb{R},$$

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

(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

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

sketch on separate axes the graphs of

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

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

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

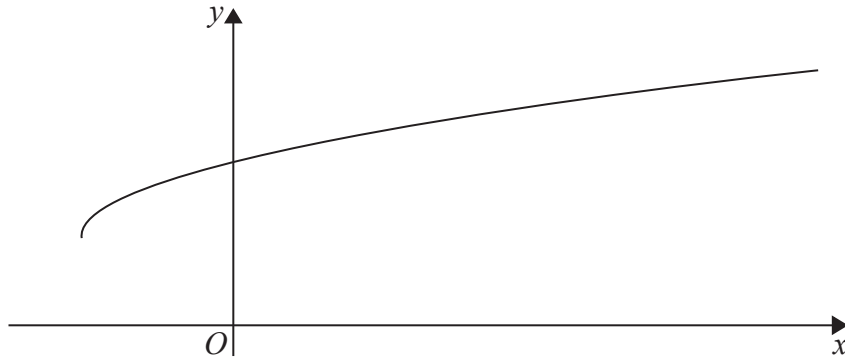
Show, on each diagram, the point where the graph meets or crosses the  $x$ -axis.

In each case, state the equation of the asymptote.

**(Total 7 marks)**

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7.



**Figure 1**

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

$$g(x) = 3 + \sqrt{x+2}, \quad x \geq -2$$

(a) State the range of  $g$ . **(1)**

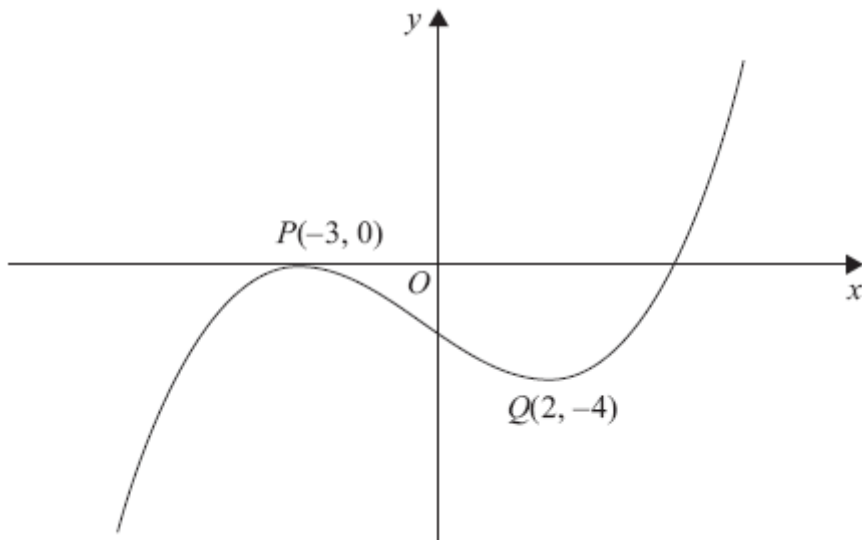
(b) Find  $g^{-1}(x)$  and state its domain. **(3)**

(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  $y = f(x)$ .

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

Sketch, on separate diagrams, the graphs of

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

**(3)**

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

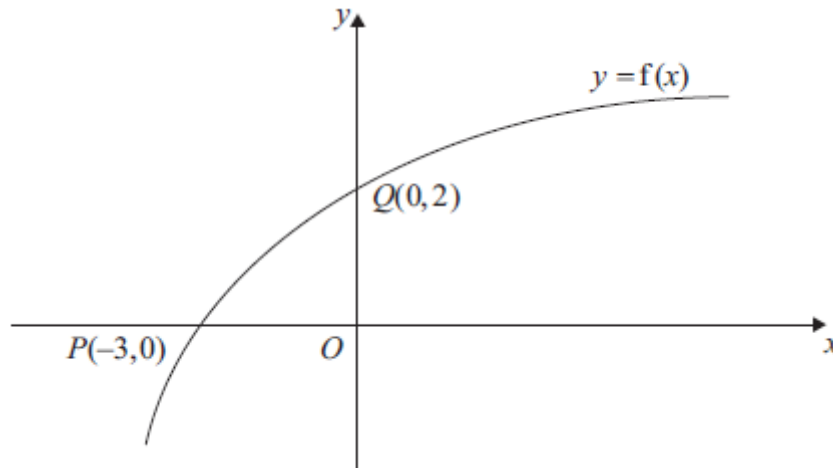
**(3)**

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

**(Total 6 marks)**

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9.



**Figure 3**

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

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

(a) Find the value of  $ff(-3)$ . (2)

On separate diagrams, sketch the curve with equation

(b)  $y = f^{-1}(x)$ , (2)

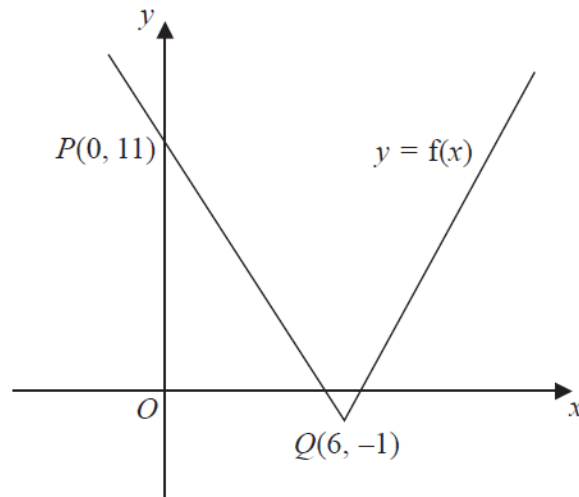
(c)  $y = f(|x|) - 2$ , (2)

(d)  $y = 2f\left(\frac{1}{2}x\right)$ . (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  $y = f(x)$ ,  $x \in \mathbb{R}$ .

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)  $y = |f(x)|$  (2)

(b)  $y = 2f(-x) + 3$  (3)

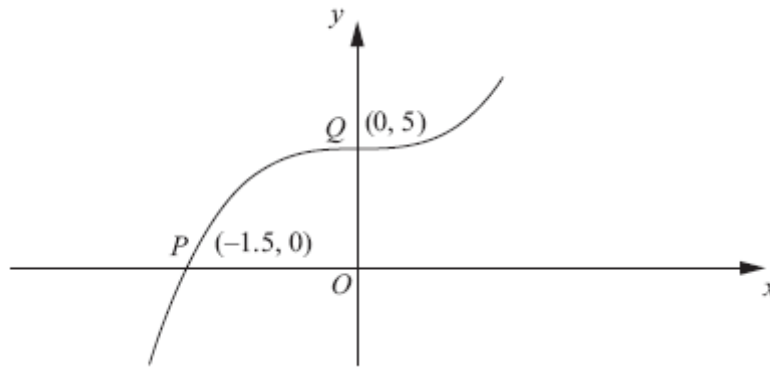
On each diagram, show the coordinates of the points corresponding to  $P$  and  $Q$ .

Given that  $f(x) = a|x - b| - 1$ , 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)**

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

(a) Show that  $g(x) = \frac{x+1}{x-2}, \quad x > 3$

(4)

(b) Find the range of  $g$ .

(2)

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

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

(Total 4 marks)

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**TOTAL FOR PAPER: 100 MARKS**