4.

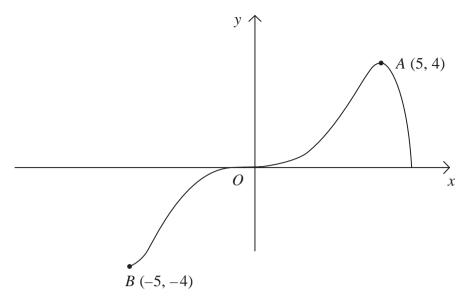


Figure 1

Figure 1 shows a sketch of the curve with equation y = f(x). The curve passes through the origin O and the points A(5, 4) and B(-5, -4).

In separate diagrams, sketch the graph with equation

(a) 
$$y = |\mathbf{f}(x)|$$
, (3)

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

(c) 
$$y = 2f(x+1)$$
. (4)

On each sketch, show the coordinates of the points corresponding to A and B.

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Question 4 continued	



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**8.** The functions f and g are defined by

$$f: x \mapsto 1 - 2x^3, \ x \in \mathbb{R}$$

$$g: x \mapsto \frac{3}{x} - 4, \ x > 0, \ x \in \mathbb{R}$$

(a) Find the inverse function  $f^{-1}$ .

**(2)** 

(b) Show that the composite function gf is

$$gf: x \mapsto \frac{8x^3 - 1}{1 - 2x^3}.$$

**(4)** 

(c) Solve gf(x) = 0.

**(2)** 

(d) Use calculus to find the coordinates of the stationary point on the graph of y = gf(x).

**(5)** 

Question 8 continued	
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(Total 13 marks)	
TOTAL FOR PAPER: 75 MARKS END	

**3.** 

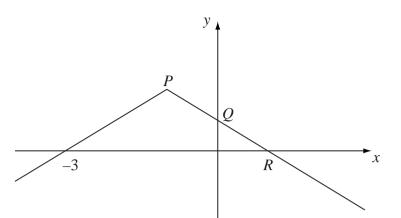


Figure 1

Figure 1 shows the graph of y = f(x),  $x \in \mathbb{R}$ .

The graph consists of two line segments that meet at the point P.

The graph cuts the y-axis at the point Q and the x-axis at the points (-3, 0) and R. Sketch, on separate diagrams, the graphs of

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

**(2)** 

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

**(2)** 

Given that f(x) = 2 - |x+1|,

(c) find the coordinates of the points P, Q and R,

**(3)** 

(d) solve 
$$f(x) = \frac{1}{2}x$$
.

**(5)** 

Question 3 continued	blank



The function f is defined by

$$f: x \mapsto \frac{2(x-1)}{x^2 - 2x - 3} - \frac{1}{x-3}, \quad x > 3.$$

(a) Show that  $f(x) = \frac{1}{x+1}$ , x > 3.

**(4)** 

(b) Find the range of f.

**(2)** 

(c) Find  $f^{-1}(x)$ . State the domain of this inverse function.

**(3)** 

The function g is defined by

$$g: x \mapsto 2x^2 - 3, \quad x \in \mathbb{R}.$$

(d) Solve  $fg(x) = \frac{1}{8}$ .

**(3)** 

Question 4 continued	blank



**3.** 

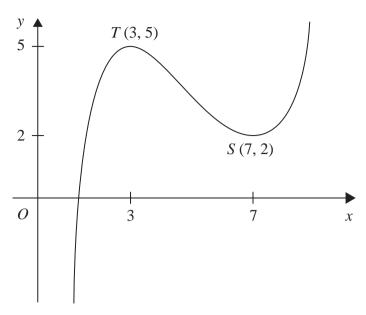


Figure 1

Figure 1 shows the graph of y = f(x), 1 < x < 9. The points T(3, 5) and S(7, 2) are turning points on the graph.

Sketch, on separate diagrams, the graphs of

(a) 
$$y = 2f(x) - 4$$
, (3)

(b) 
$$y = |f(x)|$$
. (3)

Indicate on each diagram the coordinates of any turning points on your sketch.

5. The functions f and g are defined by

$$f: x \mapsto 3x + \ln x, \quad x > 0, \quad x \in \mathbb{R}$$
  
 $g: x \mapsto e^{x^2}, \quad x \in \mathbb{R}$ 

(a) Write down the range of g.

**(1)** 

(b) Show that the composite function fg is defined by

fg: 
$$x \mapsto x^2 + 3e^{x^2}$$
,  $x \in \mathbb{R}$ .

**(2)** 

(c) Write down the range of fg.

**(1)** 

(d) Solve the equation  $\frac{d}{dx} [fg(x)] = x(xe^{x^2} + 2)$ .

**(6)** 




Question 5 continued	blank



**(1)** 

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5.

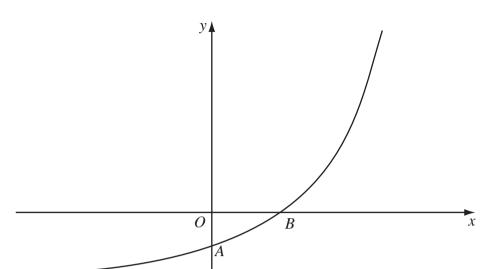


Figure 2

Figure 2 shows a sketch of part of the curve with equation y = f(x),  $x \in \mathbb{R}$ . The curve meets the coordinate axes at the points A(0,1-k) and  $B(\frac{1}{2}\ln k,0)$ , where k is a constant and k > 1, as shown in Figure 2.

On separate diagrams, sketch the curve with equation

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

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

Show on each sketch the coordinates, in terms of k, of each point at which the curve meets or cuts the axes.

Given that  $f(x) = e^{2x} - k$ ,

(c) state the range of f,

(d) find  $f^{-1}(x)$ , (3)

(e) write down the domain of  $f^{-1}$ . (1)

Question 5 continued	Leave blank
Question 5 continued	



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5.	Sketch the graph of $y = \ln  x $ , stating the coordinates of any points of intersection with the axes.	
	(3)	

6.

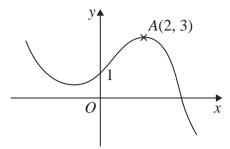


Figure 1

Figure 1 shows a sketch of the graph of y = f(x).

The graph intersects the y-axis at the point (0, 1) and the point A(2, 3) is the maximum turning point.

Sketch, on separate axes, the graphs of

- (i) y = f(-x) + 1,
- (ii) y = f(x + 2) + 3,
- (iii) y = 2f(2x).

On each sketch, show the coordinates of the point at which your graph intersects the *y*-axis and the coordinates of the point to which *A* is transformed.

**(9)** 

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Question 6 continued	Junk



- **9.** (i) Find the exact solutions to the equations
  - (a) ln(3x-7) = 5

**(3)** 

(b)  $3^x e^{7x+2} = 15$ 

**(5)** 

(ii) The functions f and g are defined by

$$f(x) = e^{2x} + 3,$$

$$x \in \mathbb{R}$$

$$g(x) = \ln(x - 1), \qquad x \in \mathbb{R}, \ x > 1$$

(a) Find  $f^{-1}$  and state its domain.

**(4)** 

(b) Find fg and state its range.

**(3)** 


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Question 9 continued	
	Q9
(Total 15 marks)	
TOTAL FOR PAPER: 75 MARKS	
END	

The function f is defined by

$$f: x \mapsto |2x-5|, x \in \mathbb{R}$$

(a) Sketch the graph with equation y = f(x), showing the coordinates of the points where the graph cuts or meets the axes.

**(2)** 

(b) Solve f(x) = 15 + x.

**(3)** 

The function g is defined by

$$g: x \mapsto x^2 - 4x + 1, \quad x \in \mathbb{R}, \quad 0 \leqslant x \leqslant 5$$

(c) Find fg(2).

**(2)** 

(d) Find the range of g.

**(3)** 

Question 4 continued	blank
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6.

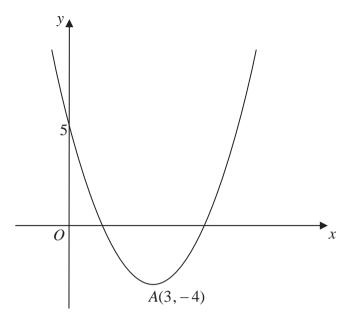


Figure 2

Figure 2 shows a sketch of the curve with the equation y = f(x),  $x \in \mathbb{R}$ . The curve has a turning point at A(3, -4) and also passes through the point (0, 5).

- (a) Write down the coordinates of the point to which A is transformed on the curve with equation
  - (i) y = |f(x)|,

(ii) 
$$y = 2f(\frac{1}{2}x)$$
. (4)

(b) Sketch the curve with equation

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

On your sketch show the coordinates of all turning points and the coordinates of the point at which the curve cuts the *y*-axis.

**(3)** 

The curve with equation y = f(x) is a translation of the curve with equation  $y = x^2$ .

(c) Find f(x).

**(2)** 

(d) Explain why the function f does not have an inverse.

**(1)** 



Question 6 continued	Leave blank

