

Surname	
Other Names	
Candidate Signature	

Centre Number						Candidate Number				
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Examiner Comments	

Total Marks

# MATHEMATICS

## A LEVEL QUESTION COMPILATION

# CM

Questions on: Functions

### Instructions to candidates:

- In the boxes above, write your centre number, candidate number, your surname, other names and signature.
- Answer ALL of the questions.
- You must write your answer for each question in the spaces provided.
- You may use a calculator.

### Information to candidates:

- Full marks may only be obtained for answers to ALL of the questions.
- The marks for individual questions and parts of the questions are shown in round brackets.
- There are 5 questions in this question paper. The total mark for this paper is 40.

### Advice to candidates:

- You should ensure your answers to parts of the question are clearly labelled.
- You should show sufficient working to make your workings clear to the Examiner.
- Answers without working may not gain full credit.



1 The function  $f$  is defined such that

$$f : x \mapsto \frac{3(x-2)}{x^2+2x-8} - \frac{1}{x+4}, \quad x > 2$$

- (a) Show that  $f(x) = \frac{2}{x+4}$ ,  $x > 2$ . (2)
- (b) Find the range of  $f$ . (1)
- (c) Find  $f^{-1}(x)$  **and** state its domain and range. (4)





2 The function  $f$  is defined such that

$$f : x \mapsto \frac{1}{2x-1}, \quad x \in \mathbb{R}, x > \frac{1}{2}$$

(a) Find  $f^{-1}(x)$ . (2)

(b) Find the domain and range of  $f^{-1}(x)$ . (2)

The function  $g$  is defined such that

$$g(x) = \ln(x+1), \quad x > -1$$

(c) Find the solution to  $fg(x) = 4$ , giving your answer as an exact value. (3)

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**Question 2 continued**

Lined writing area for the answer to Question 2.

**TOTAL 7 MARKS**



3 The functions  $f$  and  $g$  are defined by

$$f : x \mapsto 3e^x - 1, \quad x > 0$$

$$g : x \mapsto \ln x, \quad x > 0$$

- (a) Find the range of  $f$ . (1)
- (b) Find  $fg(x)$ , giving your answer in its simplest form. (2)
- (c) Find  $f^{-1}$ , the inverse function of  $f$ , stating its domain. (3)





4

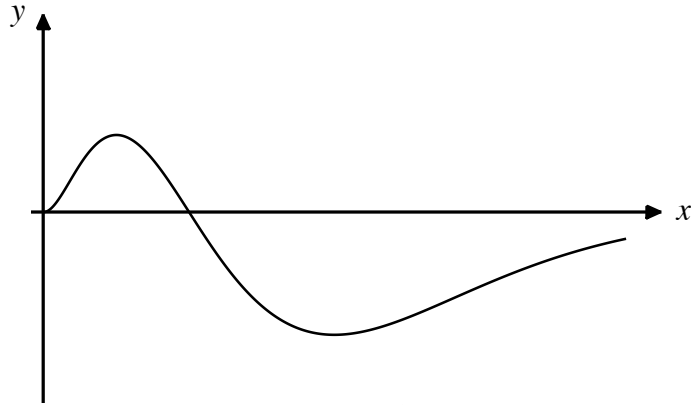


Figure 1

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

$$g(x) = 2x^2(1 - 2x)e^{-4x}, \quad x \geq 0$$

- (a) Show that  $g'(x) = f(x)e^{-4x}$ , where  $f(x)$  is a cubic function to be found. (3)
- (b) Hence, find the range of  $g$ . (6)
- (c) State a reason why the inverse function of  $g$  does not exist. (1)





**Question 4 continued**

**TOTAL 10 MARKS**

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1 5 3 3 2 2 1 1 8 0 0 0 4



5 The function  $f$  is defined such that

$$f : x \mapsto 3x^2 - 12x + 5, \quad 0 \leq x \leq A$$

(a) Express  $f(x)$  in the form  $a(x + b)^2 + c$ , where  $a$ ,  $b$  and  $c$  are integers to be found. (3)

(b) State the value of  $A$  for which the graph of  $y = f(x)$  has a line of symmetry. (1)

(c) For your value of  $A$  found in part (b), find the range of  $f$ . (2)

The function  $g$  is defined such that

$$g : x \mapsto 3x^2 - 12x + 5, \quad x \geq 5$$

(d) Explain why  $g$  has an inverse. (1)

(e) Find  $g^{-1}(x)$  **and** state its domain and range. (4)



**Question 5 continued**

**TOTAL 10 MARKS**

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1 5 3 3 2 2 1 1 8 0 0 0 4

