

**ADVANCED SUBSIDIARY GCE  
MATHEMATICS (MEI)**

Introduction to Advanced Mathematics (C1)

**4751****QUESTION PAPER**

Candidates answer on the Printed Answer Book

**OCR Supplied Materials:**

- Printed Answer Book 4751
- MEI Examination Formulae and Tables (MF2)

**Other Materials Required:**

None

**Monday 11 January 2010  
Morning**
**Duration:** 1 hour 30 minutes**INSTRUCTIONS TO CANDIDATES**

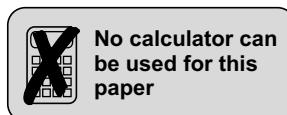
These instructions are the same on the Printed Answer Book and the Question Paper.

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Printed Answer Book.
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- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are **not** permitted to use a calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

**INFORMATION FOR CANDIDATES**

This information is the same on the Printed Answer Book and the Question Paper.

- The number of marks is given in brackets [ ] at the end of each question or part question on the Question Paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.



**Answer all questions on the Printed Answer Book provided.**

**Section A (36 marks)**

1 Rearrange the formula  $c = \sqrt{\frac{a+b}{2}}$  to make  $a$  the subject. [3]

2 Solve the inequality  $\frac{5x-3}{2} < x+5$ . [3]

3 (i) Find the coordinates of the point where the line  $5x + 2y = 20$  intersects the  $x$ -axis. [1]

(ii) Find the coordinates of the point of intersection of the lines  $5x + 2y = 20$  and  $y = 5 - x$ . [3]

4 (i) Describe fully the transformation which maps the curve  $y = x^2$  onto the curve  $y = (x+4)^2$ . [2]

(ii) Sketch the graph of  $y = x^2 - 4$ . [2]

5 (i) Find the value of  $144^{-\frac{1}{2}}$ . [2]

(ii) Simplify  $\frac{1}{5+\sqrt{7}} + \frac{4}{5-\sqrt{7}}$ . Give your answer in the form  $\frac{a+b\sqrt{7}}{c}$ . [3]

6 You are given that  $f(x) = (x+1)^2(2x-5)$ .

(i) Sketch the graph of  $y = f(x)$ . [3]

(ii) Express  $f(x)$  in the form  $ax^3 + bx^2 + cx + d$ . [2]

7 When  $x^3 + 2x^2 + 5x + k$  is divided by  $(x+3)$ , the remainder is 6. Find the value of  $k$ . [3]

8 Find the binomial expansion of  $\left(x + \frac{5}{x}\right)^3$ , simplifying the terms. [4]

9 Prove that the line  $y = 3x - 10$  does not intersect the curve  $y = x^2 - 5x + 7$ . [5]

## Section B (36 marks)

10

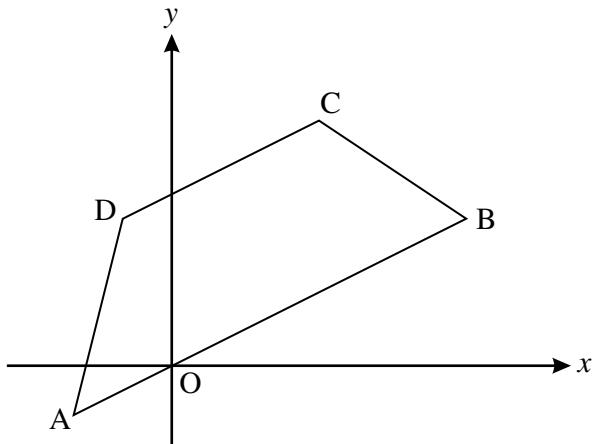


Fig. 10

Fig. 10 shows a trapezium ABCD. The coordinates of its vertices are A (−2, −1), B (6, 3), C (3, 5) and D (−1, 3).

(i) Verify that the lines AB and DC are parallel. [3]

(ii) Prove that the trapezium is not isosceles. [3]

(iii) The diagonals of the trapezium meet at M. Find the exact coordinates of M. [4]

(iv) Show that neither diagonal of the trapezium bisects the other. [3]

11 A circle has equation  $(x - 3)^2 + (y + 2)^2 = 25$ .

(i) State the coordinates of the centre of this circle and its radius. [2]

(ii) Verify that the point A with coordinates (6, −6) lies on this circle. Show also that the point B on the circle for which AB is a diameter has coordinates (0, 2). [3]

(iii) Find the equation of the tangent to the circle at A. [4]

(iv) A second circle touches the original circle at A. Its radius is 10 and its centre is at C, where BAC is a straight line. Find the coordinates of C and hence write down the equation of this second circle. [3]

[Question 12 is printed overleaf.]

12 The curve with equation  $y = \frac{1}{5}x(10 - x)$  is used to model the arch of a bridge over a road, where  $x$  and  $y$  are distances in metres, with the origin as shown in Fig. 12.1. The  $x$ -axis represents the road surface.

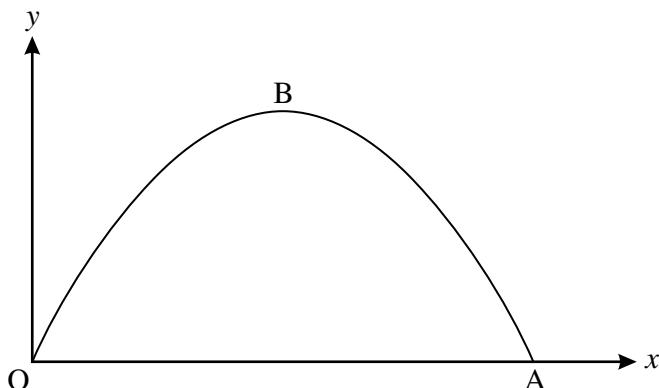


Fig. 12.1

(i) State the value of  $x$  at A, where the arch meets the road. [1]

(ii) Using symmetry, or otherwise, state the value of  $x$  at the maximum point B of the graph.

Hence find the height of the arch. [2]

(iii) Fig. 12.2 shows a lorry which is 4 m high and 3 m wide, with its cross-section modelled as a rectangle. Find the value of  $d$  when the lorry is in the centre of the road. Hence show that the lorry can pass through this arch. [3]

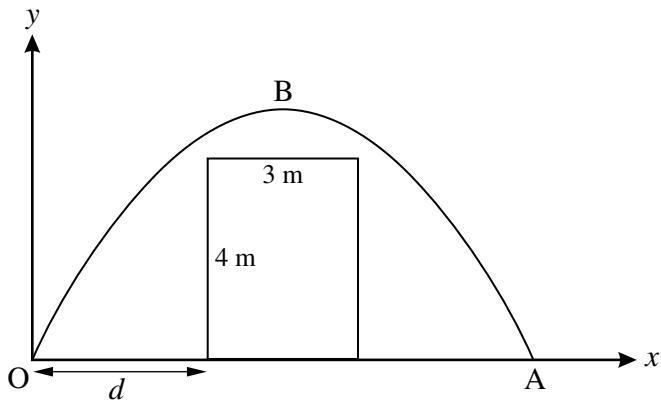


Fig. 12.2

(iv) Another lorry, also modelled as having a rectangular cross-section, has height 4.5 m and just touches the arch when it is in the centre of the road. Find the width of this lorry, giving your answer in surd form. [5]

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## MATHEMATICS (MEI)

Introduction to Advanced Mathematics (C1)

4751

## PRINTED ANSWER BOOK

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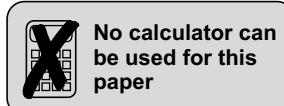
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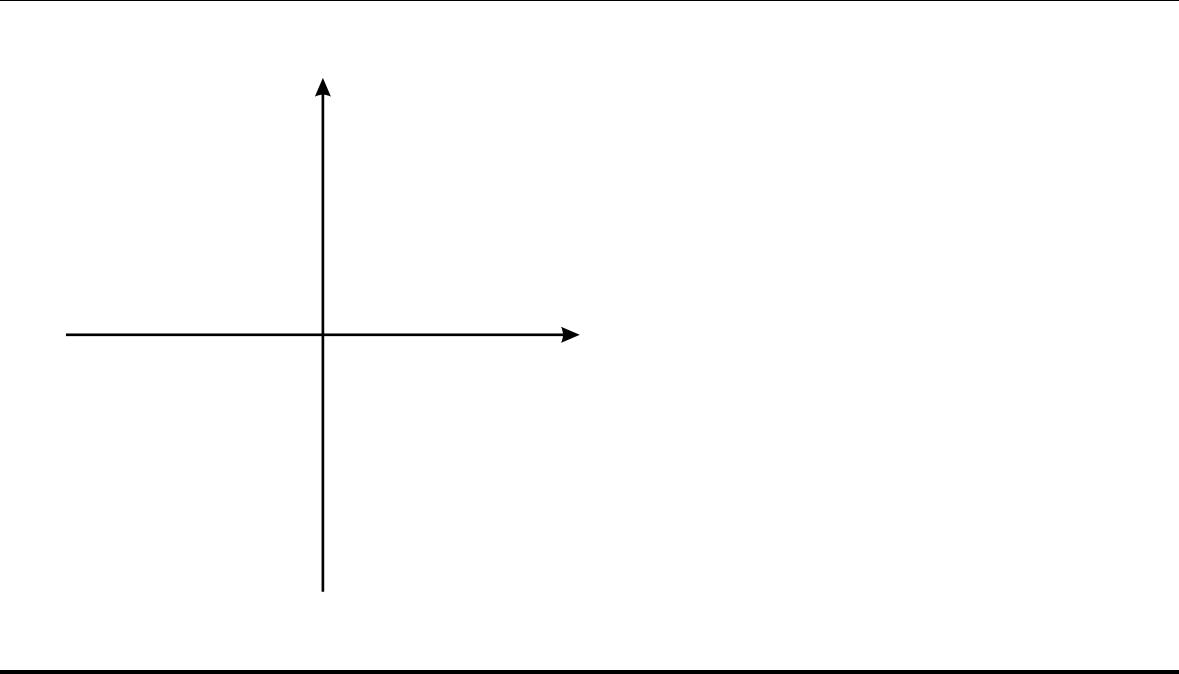
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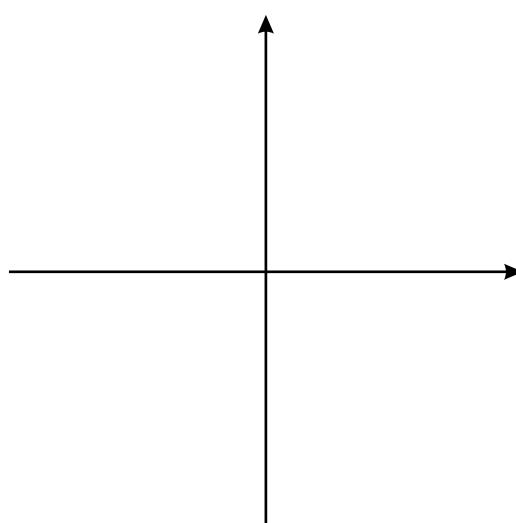
**Section A (36 marks)**

<b>1</b>	
<b>2</b>	

<b>3 (i)</b>	
<b>3 (ii)</b>	
	<b>4 (i)</b>

4 (ii)	
5 (i)	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
5 (ii)	<hr/>

6 (i)



6 (ii)

7

8	
9	

**Section B (36 marks)**

<b>10 (i)</b>	
<hr/>	
<b>10 (ii)</b>	

<b>10 (iii)</b>	
<b>10 (iv)</b>	



<b>11 (iii)</b>	
<b>11 (iv)</b>	

<b>12 (i)</b>	
<b>12 (ii)</b>	
<b>12 (iii)</b>	

12 (iv)



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