

**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**

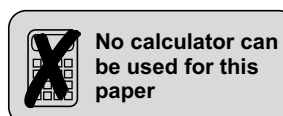
These instructions are the same on the Printed Answer Book and the Question Paper.

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Printed Answer Book.
- **The questions are on the inserted Question Paper.**
- **Write your answer to each question in the space provided in the Printed Answer Book.** If you need more space for an answer use a 4-page answer book; label your answer clearly. Write your Centre Number and Candidate Number on the 4-page answer book and attach it securely to the Printed Answer Book.
- 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

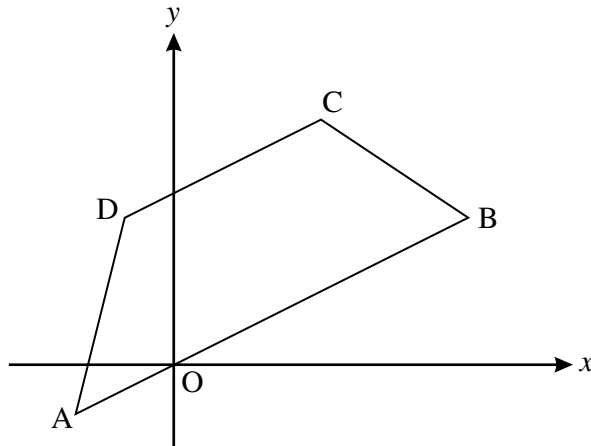


Fig. 10

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.

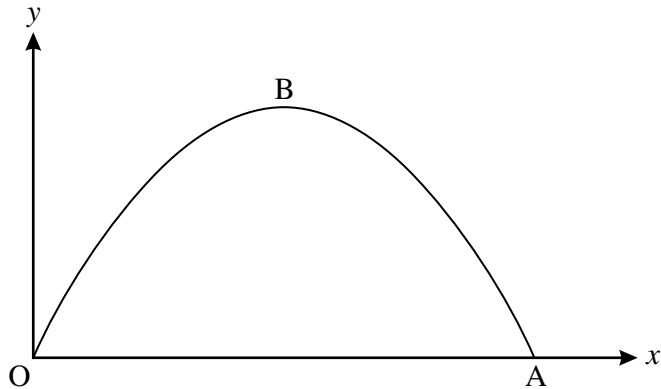


Fig. 12.1

- (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]

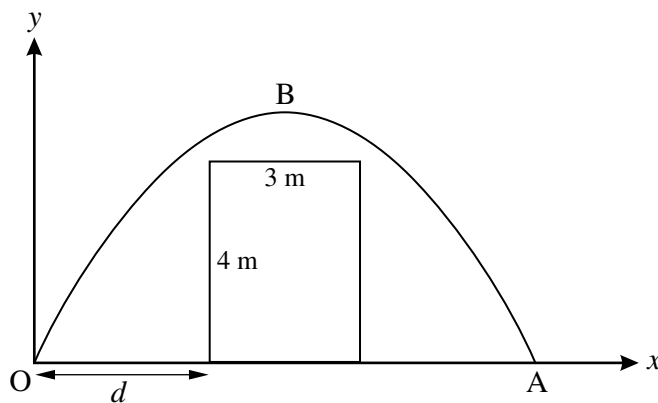


Fig. 12.2

- (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]

**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

**ADVANCED SUBSIDIARY GCE  
MATHEMATICS (MEI)**

Introduction to Advanced Mathematics (C1)

**4751**

**PRINTED ANSWER BOOK**

Candidates answer on this Printed Answer Book

**OCR Supplied Materials:**

- Question Paper 4751 (inserted)
- MEI Examination Formulae and Tables (MF2)

**Other Materials Required:**

None

**Monday 11 January 2010  
Morning**

**Duration:** 1 hour 30 minutes



Candidate Forename		Candidate Surname	
--------------------	--	-------------------	--

Centre Number						Candidate Number				
---------------	--	--	--	--	--	------------------	--	--	--	--

**INSTRUCTIONS TO CANDIDATES**

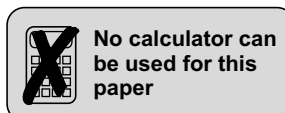
These instructions are the same on the Printed Answer Book and the Question Paper.

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Printed Answer Book.
- **The questions are on the inserted Question Paper.**
- **Write your answer to each question in the space provided in the Printed Answer Book.** If you need more space for an answer use a 4-page answer book; label your answer clearly. Write your Centre Number and Candidate Number on the 4-page answer book and attach it securely to the Printed Answer Book.
- 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.

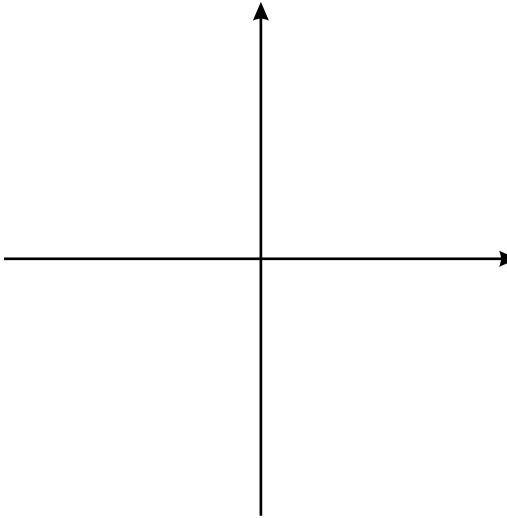
- The number of marks is given in brackets [ ] at the end of each question or part question on the Question Paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for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



**Section A (36 marks)**

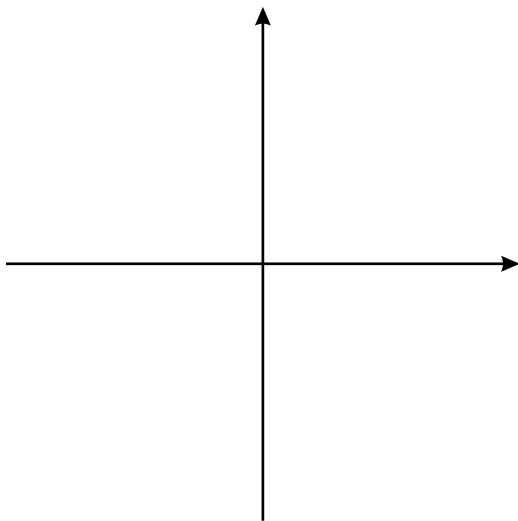
<b>1</b>	
<b>2</b>	

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

<p><b>4 (ii)</b></p>																		
<p><b>5 (i)</b></p>	<table border="1"><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr></table>																	
<p><b>5 (ii)</b></p>	<table border="1"><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr><tr><td> </td></tr></table>																	



6 (i)



6 (ii)


7


<b>8</b>	
<b>9</b>	

**Section B (36 marks)**

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

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

<b>11 (i)</b>	
<b>11 (ii)</b>	

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

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

<b>12 (iv)</b>	



**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.