

**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

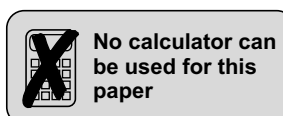
These instructions are the same on the Printed Answer Book and the Question Paper.

- 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

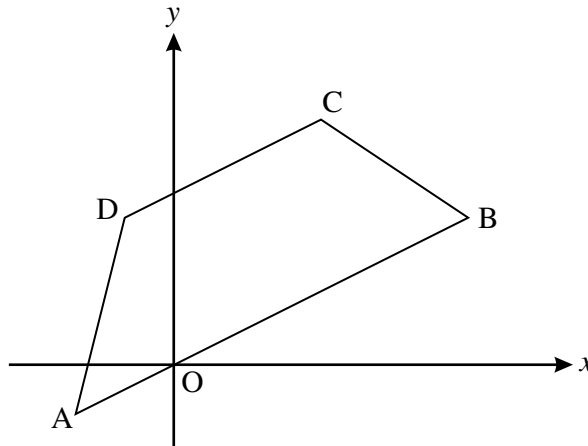


Fig. 10

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.

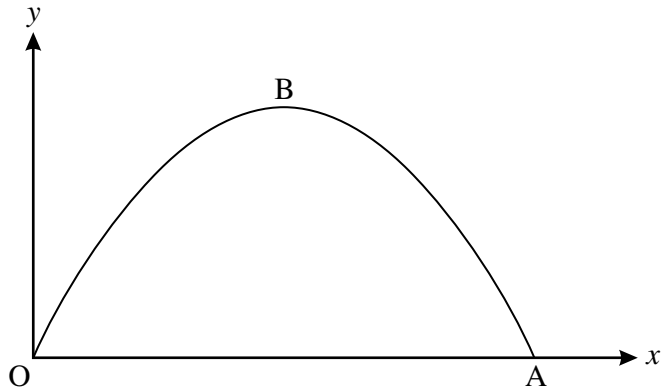


Fig. 12.1

- (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]

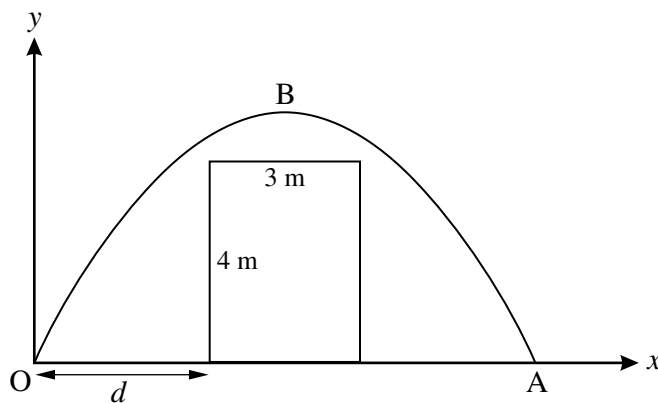


Fig. 12.2

- (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]

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