

**ADVANCED SUBSIDIARY GCE**

**MATHEMATICS (MEI)**

Introduction to Advanced Mathematics (C1)

**4751**

Candidates answer on the Answer Booklet

**OCR Supplied Materials:**

- 8 page Answer Booklet
- Insert for Question 13 (inserted)
- MEI Examination Formulae and Tables (MF2)

**Other Materials Required:**

None

**Friday 9 January 2009**  
**Morning**

**Duration:** 1 hour 30 minutes

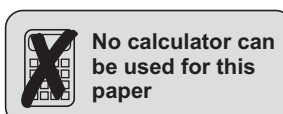


**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- 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.
- There is an **insert** for use in Question **13**.
- 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**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- 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**.
- This document consists of **4** pages. Any blank pages are indicated.



## Section A (36 marks)

- 1 State the value of each of the following.
- (i)  $2^{-3}$  [1]
- (ii)  $9^0$  [1]
- 2 Find the equation of the line passing through  $(-1, -9)$  and  $(3, 11)$ . Give your answer in the form  $y = mx + c$ . [3]
- 3 Solve the inequality  $7 - x < 5x - 2$ . [3]
- 4 You are given that  $f(x) = x^4 + ax - 6$  and that  $x - 2$  is a factor of  $f(x)$ .  
Find the value of  $a$ . [3]
- 5 (i) Find the coefficient of  $x^3$  in the expansion of  $(x^2 - 3)(x^3 + 7x + 1)$ . [2]  
(ii) Find the coefficient of  $x^2$  in the binomial expansion of  $(1 + 2x)^7$ . [3]
- 6 Solve the equation  $\frac{3x + 1}{2x} = 4$ . [3]
- 7 (i) Express  $125\sqrt{5}$  in the form  $5^k$ . [2]  
(ii) Simplify  $(4a^3b^5)^2$ . [2]
- 8 Find the range of values of  $k$  for which the equation  $2x^2 + kx + 18 = 0$  does not have real roots. [4]
- 9 Rearrange  $y + 5 = x(y + 2)$  to make  $y$  the subject of the formula. [4]
- 10 (i) Express  $\sqrt{75} + \sqrt{48}$  in the form  $a\sqrt{3}$ . [2]  
(ii) Express  $\frac{14}{3 - \sqrt{2}}$  in the form  $b + c\sqrt{d}$ . [3]

## Section B (36 marks)

11

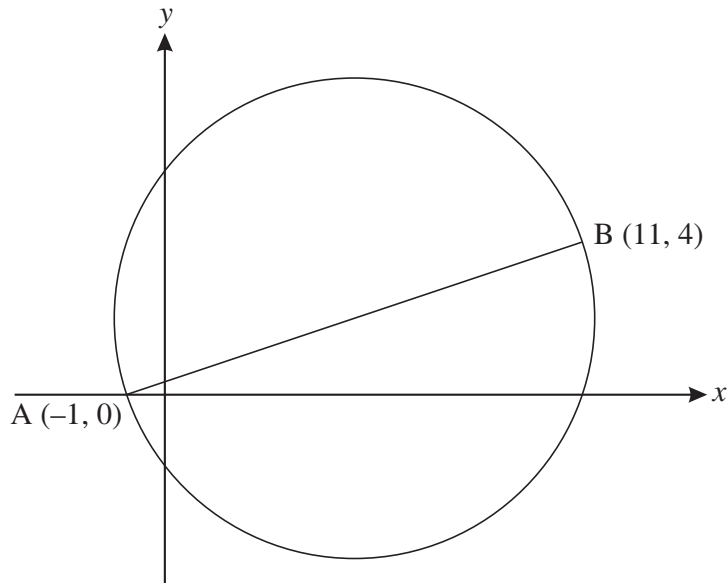


Fig. 11

Fig. 11 shows the points A and B, which have coordinates  $(-1, 0)$  and  $(11, 4)$  respectively.

- (i) Show that the equation of the circle with AB as diameter may be written as

$$(x - 5)^2 + (y - 2)^2 = 40. \quad [4]$$

- (ii) Find the coordinates of the points of intersection of this circle with the  $y$ -axis. Give your answer in the form  $a \pm \sqrt{b}$ . [4]
- (iii) Find the equation of the tangent to the circle at B. Hence find the coordinates of the points of intersection of this tangent with the axes. [6]

- 12 (i) Find algebraically the coordinates of the points of intersection of the curve  $y = 3x^2 + 6x + 10$  and the line  $y = 2 - 4x$ . [5]
- (ii) Write  $3x^2 + 6x + 10$  in the form  $a(x + b)^2 + c$ . [4]
- (iii) Hence or otherwise, show that the graph of  $y = 3x^2 + 6x + 10$  is always above the  $x$ -axis. [2]

[Question 13 is printed overleaf.]

**13 Answer part (i) of this question on the insert provided.**

The insert shows the graph of  $y = \frac{1}{x}$ .

- (i) **On the insert**, on the same axes, plot the graph of  $y = x^2 - 5x + 5$  for  $0 \leq x \leq 5$ . [4]
- (ii) Show algebraically that the  $x$ -coordinates of the points of intersection of the curves  $y = \frac{1}{x}$  and  $y = x^2 - 5x + 5$  satisfy the equation  $x^3 - 5x^2 + 5x - 1 = 0$ . [2]
- (iii) Given that  $x = 1$  at one of the points of intersection of the curves, factorise  $x^3 - 5x^2 + 5x - 1$  into a linear and a quadratic factor.

Show that only one of the three roots of  $x^3 - 5x^2 + 5x - 1 = 0$  is rational. [5]