OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

MEI STRUCTURED MATHEMATICS 4751

Introduction to Advanced Mathematics (C1)

Monday **23 MAY 2005** Morning 1 hour 30 minutes

Additional materials:
Answer booklet
Graph paper
MEI Examination Formulae and Tables (MF2)

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- You are **not** permitted to use a calculator in this paper.

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.
- Final answers should be given to a degree of accuracy appropriate to the context.
- The total number of marks for this paper is 72.

WARNING

You are not allowed to use a calculator in this paper

This question paper consists of 4 printed pages.

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Section A (36 marks)

1 Find the remainder when $x^3 + 2x^2 - 5$ is divided by $x - 3$. [2]

2 Make x the subject of

$$3x - 5y = y - mx.$$ [3]

3 The smallest of three consecutive integers is n.

Write down the other two integers.

Prove that the sum of any three consecutive integers is divisible by 3. [3]

4 A line has equation $3x + 5y = 12$. Find its gradient and the coordinates of the points where it crosses the axes. [4]

5 Find the binomial expansion of $(2 - x)^3$. [4]

6 Simplify the following.

(i) a^0 [1]

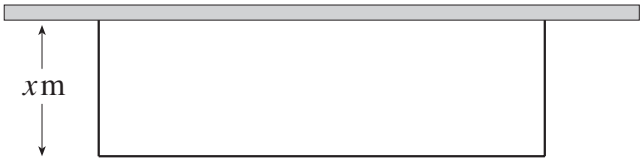
(ii) $a^6 \div a^{-2}$ [1]

(iii) $(9a^6b^2)^{-\frac{1}{2}}$ [3]

7 **(i)** Simplify $\sqrt{24} + \sqrt{6}$. [2]

(ii) Express $\dfrac{36}{5 - \sqrt{7}}$ in the form $a + b\sqrt{7}$, where a and b are integers. [3]

8 Fig. 8 is a plan view of a rectangular enclosure. A wall forms one side of the enclosure. The other three sides are formed by fencing of total length 30 m. The width of the rectangle is x m and the area enclosed is 112 m^2.



Not to scale

Fig. 8

Show that $x^2 - 15x + 56 = 0$.

By factorising, solve this equation and find the possible dimensions of the rectangle. [5]

9 Find the x-coordinates of the points of intersection of the line $y = 3x + 2$ and the curve $y = 3x^2 - 7x + 1$. Leave your answers in surd form. [5]

Section B (36 marks)

10 **(i)** Write $x^2 - 8x + 25$ in the form $(x - a)^2 + b$. [3]

(ii) State the coordinates of the minimum point on the graph of $y = x^2 - 8x + 25$ and sketch this graph. [4]

(iii) Solve the inequality $x^2 - 8x + 25 > 18$. [3]

(iv) The graph of $y = x^2 - 8x + 25$ is translated by $\begin{pmatrix} 0 \\ -20 \end{pmatrix}$. State an equation for the resulting graph. [1]

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11 The points A(0, 2), B(7, 9) and C(6, 10) lie on the circumference of a circle, as shown in Fig.11.

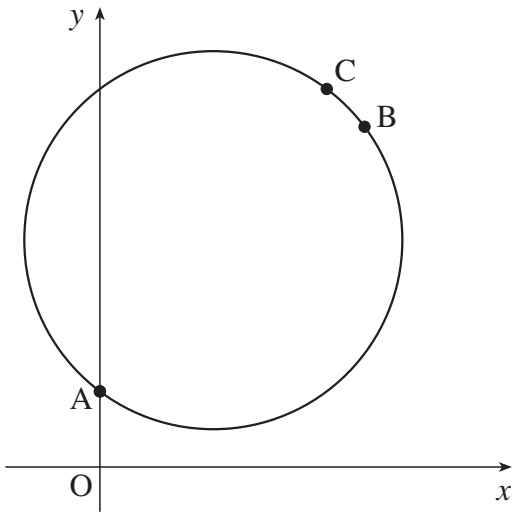

Fig. 11

(i) Find the length of AC.

Prove that triangle ABC is right-angled at B. [4]

(ii) Hence show that the centre of the circle is (3, 6) and its radius is 5.

Find the equation of the circle. [4]

(iii) Find an equation for the tangent to the circle at C.

Find the coordinates of the points where this tangent crosses the axes. [5]

12 In the cubic polynomial f(x), the coefficient of x^3 is 1. The roots of f(x) = 0 are –1, 2 and 5.

(i) Write f(x) in factorised form.

Show that f(x) may be written as

$$f(x) = x^3 - 6x^2 + 3x + 10.$$ [3]

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

(iii) Show that $x = 4$ is one root of the equation $f(x) + 10 = 0$.

Hence find a quadratic equation which is satisfied by the other two roots of the equation $f(x) + 10 = 0$. [6]

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