

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

**Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education**

MATHEMATICS

4721

Core Mathematics 1

Specimen Paper

Additional materials:
Answer booklet
Graph paper
List of Formulae (MF 1)

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.
- Give non-exact numerical answers correct to 3 significant figures, unless a different degree of accuracy is specified in the question or is clearly appropriate.
- **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.
- The total number of marks for this paper is 72.
- Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.
- **You are reminded of the need for clear presentation in your answers.**

This question paper consists of 4 printed pages.

1 Write down the exact values of

(i) 4^{-2} , [1]

(ii) $(2\sqrt{2})^2$, [1]

(iii) $(1^3 + 2^3 + 3^3)^{\frac{1}{2}}$. [2]

2 (i) Express $x^2 - 8x + 3$ in the form $(x + a)^2 + b$. [3]

(ii) Hence write down the coordinates of the minimum point on the graph of $y = x^2 - 8x + 3$. [2]

3 The quadratic equation $x^2 + kx + k = 0$ has no real roots for x .

(i) Write down the discriminant of $x^2 + kx + k$ in terms of k . [2]

(ii) Hence find the set of values that k can take. [4]

4 Find $\frac{dy}{dx}$ in each of the following cases:

(i) $y = 4x^3 - 1$, [2]

(ii) $y = x^2(x^2 + 2)$, [3]

(iii) $y = \sqrt{x}$ [2]

5 (i) Solve the simultaneous equations

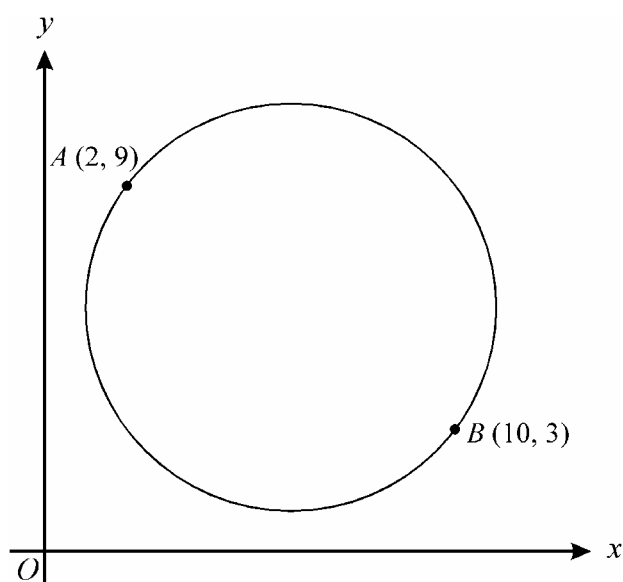
$$y = x^2 - 3x + 2, \quad y = 3x - 7. \quad [5]$$

(ii) What can you deduce from the solution to part (i) about the graphs of $y = x^2 - 3x + 2$ and $y = 3x - 7$? [2]

(iii) Hence, or otherwise, find the equation of the normal to the curve $y = x^2 - 3x + 2$ at the point $(3, 2)$, giving your answer in the form $ax + by + c = 0$ where a , b and c are integers. [4]

- 6 (i) Sketch the graph of $y = \frac{1}{x}$, where $x \neq 0$, showing the parts of the graph corresponding to both positive and negative values of x . [2]
- (ii) Describe fully the geometrical transformation that transforms the curve $y = \frac{1}{x}$ to the curve $y = \frac{1}{x+2}$.
Hence sketch the curve $y = \frac{1}{x+2}$. [5]
- (iii) Differentiate $\frac{1}{x}$ with respect to x . [2]
- (iv) Use parts (ii) and (iii) to find the gradient of the curve $y = \frac{1}{x+2}$ at the point where it crosses the y -axis. [3]

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The diagram shows a circle which passes through the points $A(2, 9)$ and $B(10, 3)$. AB is a diameter of the circle.

- (i) Calculate the radius of the circle and the coordinates of the centre. [4]
- (ii) Show that the equation of the circle may be written in the form $x^2 + y^2 - 12x - 12y + 47 = 0$. [3]
- (iii) The tangent to the circle at the point B cuts the x -axis at C . Find the coordinates of C . [6]

8 (i) Find the coordinates of the stationary points on the curve $y = 2x^3 - 3x^2 - 12x - 7$. [6]

(ii) Determine whether each stationary point is a maximum point or a minimum point. [3]

(iii) By expanding the right-hand side, show that

$$2x^3 - 3x^2 - 12x - 7 = (x+1)^2(2x-7). \quad [2]$$

(iv) Sketch the curve $y = 2x^3 - 3x^2 - 12x - 7$, marking the coordinates of the stationary points and the points where the curve meets the axes. [3]