OCR
RECOGNISING ACHIEVEMENT

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.

 Registered Charity Number: 1066969 **[Turn over**

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

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

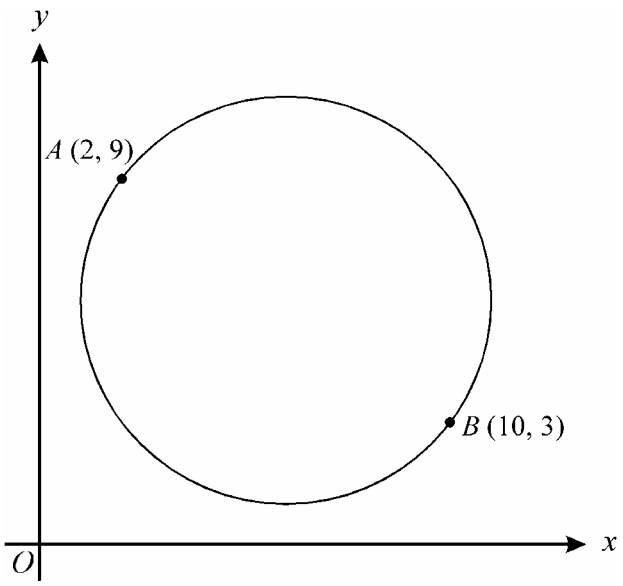
(ii) Describe fully the geometrical transformation that transforms the curve $y = \frac{1}{x}$ to the curve $y = \frac{1}{x+2}$.

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]

7



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

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