

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

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

MATHEMATICS

2631

Pure Mathematics 1

Monday **10 JANUARY 2005** Afternoon 1 hour 20 minutes

Additional materials:
Answer booklet
Graph paper
List of Formulae (MF8)

TIME 1 hour 20 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 permitted to use only a scientific 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 60.
- 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 3 printed pages and 1 blank page.

- 1 (i) Express 11^{-2} as a fraction. [1]
- (ii) Express $\sqrt{50} + \frac{6}{\sqrt{3}}$ in the form $a\sqrt{2} + b\sqrt{3}$, where a and b are integers. [3]
- 2 Given that $2x^2 - 12x + p = q(x - r)^2 + 10$ for all values of x , find the constants p , q and r . [4]
- 3 The curve $y = 5\sqrt{x}$ is transformed by a stretch, scale factor $\frac{1}{2}$, parallel to the x -axis, followed by a translation of -3 units parallel to the y -axis. Find the equation of the curve after it has been transformed. [4]
- 4 (a) Find the values of x , in the interval $0 \leq x \leq 180$, for which $\tan 2x^\circ = 1$. [3]
- (b) Show that $\tan \theta^\circ + \frac{1}{\tan \theta^\circ} \equiv \frac{1}{\sin \theta^\circ \cos \theta^\circ}$. [3]
- 5 Solve the simultaneous equations
- $$x^2 - 3y + 11 = 0, \quad 2x - y + 1 = 0. \quad [5]$$
- 6 (i) Calculate the discriminant of $x^2 + 3x + 7$ and hence state the number of real roots of the equation $x^2 + 3x + 7 = 0$. [2]
- (ii) The quadratic equation $2x^2 + (p + 1)x + 8 = 0$ has equal roots. Find the possible values of p . [4]
- 7 The points D , E and F have coordinates $(-2, 0)$, $(0, -1)$ and $(2, 3)$ respectively.
- (i) Calculate the gradient of DE . [1]
- (ii) By calculating the gradient of EF , show that DEF is a right-angled triangle. [2]
- (iii) Find the equation of the line through F , parallel to DE , giving your answer in the form $ax + by + c = 0$. [3]
- 8 (i) Find the gradient of the curve $y = 2x^2$ at the point where $x = 3$. [2]
- (ii) At a point A on the curve $y = 2x^2$, the gradient of the normal is $\frac{1}{8}$. Find the coordinates of A . [3]
- Points $P_1(1, y_1)$, $P_2(1.01, y_2)$ and $P_3(1.1, y_3)$ lie on the curve $y = kx^2$. The gradient of the chord P_1P_3 is 6.3 and the gradient of the chord P_1P_2 is 6.03.
- (iii) What do these results suggest about the gradient of the tangent to the curve $y = kx^2$ at P_1 ? [1]
- (iv) Deduce the value of k . [3]

- 9 (i) Sketch the curve $y = x(x^2 - 1)$, stating the coordinates of the points where it crosses the x -axis. [3]
- (ii) Find the area of the region bounded by the curve and the negative x -axis. [5]
- 10 The length of a rectangular children's playground is 10 m more than its width. The width of the playground is x metres.
- (i) The perimeter of the playground is greater than 64 m. Write down a linear inequality in x . [1]
- (ii) The area of the playground is less than 299 m^2 . Show that $(x - 13)(x + 23) < 0$. [2]
- (iii) By solving the inequalities in parts (i) and (ii), determine the set of possible values of x . [5]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (OCR) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

OCR is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.