

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education Advanced General Certificate of Education

MATHEMATICS 4721

Core Mathematics 1

Monday 23 MAY 2005 Morning 1 hour 30 minutes

Additional materials: Answer booklet Graph paper List of Formulae (MF1)

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.



WARNING

You are not allowed to use a calculator in this paper.

1	Solve the inequality $x^2 - 6x - 40 \ge 0$.	[4]

- 2 (i) Express $3x^2 + 12x + 7$ in the form $3(x+a)^2 + b$. [4]
 - (ii) Hence write down the equation of the line of symmetry of the curve $y = 3x^2 + 12x + 7$. [1]
- 3 (i) Sketch the curve $y = x^3$. [1]
 - (ii) Describe a transformation that transforms the curve $y = x^3$ to the curve $y = -x^3$. [2]
 - (iii) The curve $y = x^3$ is translated by p units, parallel to the x-axis. State the equation of the curve after it has been transformed. [2]
- 4 Solve the equation $x^6 + 26x^3 27 = 0$. [5]
- 5 (a) Simplify $2x^{\frac{2}{3}} \times 3x^{-1}$. [2]
 - **(b)** Express $2^{40} \times 4^{30}$ in the form 2^n . [2]
 - (c) Express $\frac{26}{4-\sqrt{3}}$ in the form $a+b\sqrt{3}$. [3]
- 6 Given that $f(x) = (x+1)^2(3x-4)$,
 - (i) express f(x) in the form $ax^3 + bx^2 + cx + d$, [3]
 - (ii) find f'(x), [2]
 - (iii) find f''(x). [2]

7 (i) Calculate the discriminant of each of the following:

(a)
$$x^2 + 6x + 9$$
,

(b)
$$x^2 - 10x + 12$$
,

(c)
$$x^2 - 2x + 5$$
.

[3]

(ii)

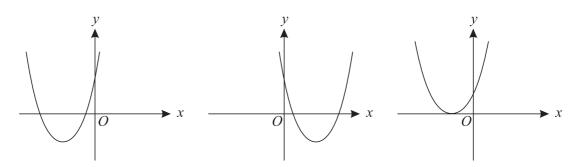


Fig. 1

Fig. 2

Fig. 3

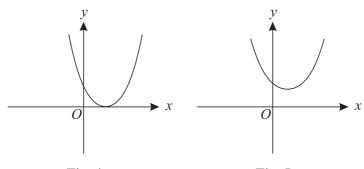


Fig. 4

Fig. 5

State with reasons which of the diagrams corresponds to the curve

(a)
$$y = x^2 + 6x + 9$$
,

(b)
$$y = x^2 - 10x + 12$$
,

(c)
$$y = x^2 - 2x + 5$$
.

[4]

8 (i) Describe completely the curve $x^2 + y^2 = 25$.

[2]

(ii) Find the coordinates of the points of intersection of the curve $x^2 + y^2 = 25$ and the line 2x + y - 5 = 0. [6]

[Questions 9 and 10 are printed overleaf.]

4721/S05 [Turn over

- 9 (i) Find the gradient of the line l_1 which has equation 4x 3y + 5 = 0. [1]
 - (ii) Find an equation of the line l_2 , which passes through the point (1, 2) and which is perpendicular to the line l_1 , giving your answer in the form ax + by + c = 0. [4]

The line l_1 crosses the x-axis at P and the line l_2 crosses the y-axis at Q.

- (iii) Find the coordinates of the mid-point of PQ. [3]
- (iv) Calculate the length of PQ, giving your answer in the form $\frac{\sqrt{a}}{b}$, where a and b are integers. [3]
- **10** (i) Given that $y = \frac{1}{3}x^3 9x$, find $\frac{dy}{dx}$. [2]
 - (ii) Find the coordinates of the stationary points on the curve $y = \frac{1}{3}x^3 9x$. [3]
 - (iii) Determine whether each stationary point is a maximum point or a minimum point. [3]
 - (iv) Given that 24x + 3y + 2 = 0 is the equation of the tangent to the curve at the point (p, q), find p and q.