

**ADVANCED SUBSIDIARY GCE**  
**MATHEMATICS**  
Core Mathematics 1

**4721**

Candidates answer on the Answer Booklet

**OCR Supplied Materials:**

- 8 page Answer Booklet
- List of Formulae (MF1)

**Other Materials Required:**

None

**Wednesday 20 May 2009**  
**Afternoon**

**Duration: 1 hour 30 minutes**

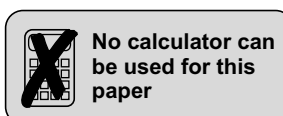


**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- This document consists of **4** pages. Any blank pages are indicated.



- 1 Given that  $y = x^5 + \frac{1}{x^2}$ , find
- (i)  $\frac{dy}{dx}$ , [3]
  - (ii)  $\frac{d^2y}{dx^2}$ . [2]
- 2 Express  $\frac{8 + \sqrt{7}}{2 + \sqrt{7}}$  in the form  $a + b\sqrt{7}$ , where  $a$  and  $b$  are integers. [4]
- 3 Express each of the following in the form  $3^n$ :
- (i)  $\frac{1}{9}$ , [1]
  - (ii)  $\sqrt[3]{3}$ , [1]
  - (iii)  $3^{10} \times 9^{15}$ . [2]
- 4 Solve the simultaneous equations
- $$4x^2 + y^2 = 10, \quad 2x - y = 4. \quad [6]$$
- 5 (i) Expand and simplify  $(2x + 1)(x - 3)(x + 4)$ . [3]
- (ii) Find the coefficient of  $x^4$  in the expansion of
- $$x(x^2 + 2x + 3)(x^2 + 7x - 2). \quad [2]$$
- 6 (i) Sketch the curve  $y = -\sqrt{x}$ . [2]
- (ii) Describe fully a transformation that transforms the curve  $y = -\sqrt{x}$  to the curve  $y = 5 - \sqrt{x}$ . [2]
- (iii) The curve  $y = -\sqrt{x}$  is stretched by a scale factor of 2 parallel to the  $x$ -axis. State the equation of the curve after it has been stretched. [2]
- 7 (i) Express  $x^2 - 5x + \frac{1}{4}$  in the form  $(x - a)^2 - b$ . [3]
- (ii) Find the centre and radius of the circle with equation  $x^2 + y^2 - 5x + \frac{1}{4} = 0$ . [3]
- 8 Solve the inequalities
- (i)  $-35 < 6x + 7 < 1$ , [3]
  - (ii)  $3x^2 > 48$ . [3]

- 9  $A$  is the point  $(4, -3)$  and  $B$  is the point  $(-1, 9)$ .
- (i) Calculate the length of  $AB$ . [2]
  - (ii) Find the coordinates of the mid-point of  $AB$ . [2]
  - (iii) Find the equation of the line through  $(1, 3)$  which is parallel to  $AB$ , giving your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. [4]
- 10
- (i) Solve the equation  $9x^2 + 18x - 7 = 0$ . [3]
  - (ii) Find the coordinates of the stationary point on the curve  $y = 9x^2 + 18x - 7$ . [4]
  - (iii) Sketch the curve  $y = 9x^2 + 18x - 7$ , giving the coordinates of all intercepts with the axes. [3]
  - (iv) For what values of  $x$  does  $9x^2 + 18x - 7$  increase as  $x$  increases? [1]
- 11 The point  $P$  on the curve  $y = k\sqrt{x}$  has  $x$ -coordinate 4. The normal to the curve at  $P$  is parallel to the line  $2x + 3y = 0$ .
- (i) Find the value of  $k$ . [6]
  - (ii) This normal meets the  $x$ -axis at the point  $Q$ . Calculate the area of the triangle  $OPQ$ , where  $O$  is the point  $(0, 0)$ . [5]

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