

**ADVANCED SUBSIDIARY GCE  
MATHEMATICS**

**4721/01**

Core Mathematics 1

**WEDNESDAY 9 JANUARY 2008**

Afternoon

Time: 1 hour 30 minutes

**Additional materials:** Answer Booklet (8 pages)  
List of Formulae (MF1)

**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- 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.
- **You are reminded of the need for clear presentation in your answers.**



**WARNING**

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

This document consists of 4 printed pages.

- 1 Express  $\frac{4}{3 - \sqrt{7}}$  in the form  $a + b\sqrt{7}$ , where  $a$  and  $b$  are integers. [3]
- 2 (i) Write down the equation of the circle with centre  $(0, 0)$  and radius 7. [1]  
 (ii) A circle with centre  $(3, 5)$  has equation  $x^2 + y^2 - 6x - 10y - 30 = 0$ . Find the radius of the circle. [2]
- 3 Given that  $3x^2 + bx + 10 = a(x + 3)^2 + c$  for all values of  $x$ , find the values of the constants  $a$ ,  $b$  and  $c$ . [4]
- 4 Solve the equations  
 (i)  $10^p = 0.1$ , [1]  
 (ii)  $(25k^2)^{\frac{1}{2}} = 15$ , [3]  
 (iii)  $t^{-\frac{1}{3}} = \frac{1}{2}$ . [2]
- 5 (i) Sketch the curve  $y = x^3 + 2$ . [2]  
 (ii) Sketch the curve  $y = 2\sqrt{x}$ . [2]  
 (iii) Describe a transformation that transforms the curve  $y = 2\sqrt{x}$  to the curve  $y = 3\sqrt{x}$ . [3]
- 6 (i) Solve the equation  $x^2 + 8x + 10 = 0$ , giving your answers in simplified surd form. [3]  
 (ii) Sketch the curve  $y = x^2 + 8x + 10$ , giving the coordinates of the point where the curve crosses the  $y$ -axis. [3]  
 (iii) Solve the inequality  $x^2 + 8x + 10 \geq 0$ . [2]
- 7 (i) Find the gradient of the line  $l$  which has equation  $x + 2y = 4$ . [1]  
 (ii) Find the equation of the line parallel to  $l$  which passes through the point  $(6, 5)$ , giving your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. [3]  
 (iii) Solve the simultaneous equations  

$$y = x^2 + x + 1 \quad \text{and} \quad x + 2y = 4. \quad [4]$$
- 8 (i) Find the coordinates of the stationary points on the curve  $y = x^3 + x^2 - x + 3$ . [6]  
 (ii) Determine whether each stationary point is a maximum point or a minimum point. [3]  
 (iii) For what values of  $x$  does  $x^3 + x^2 - x + 3$  decrease as  $x$  increases? [2]

9 The points  $A$  and  $B$  have coordinates  $(-5, -2)$  and  $(3, 1)$  respectively.

(i) Find the equation of the line  $AB$ , giving your answer in the form  $ax + by + c = 0$ . [3]

(ii) Find the coordinates of the mid-point of  $AB$ . [2]

The point  $C$  has coordinates  $(-3, 4)$ .

(iii) Calculate the length of  $AC$ , giving your answer in simplified surd form. [3]

(iv) Determine whether the line  $AC$  is perpendicular to the line  $BC$ , showing all your working. [4]

10 Given that  $f(x) = 8x^3 + \frac{1}{x^3}$ ,

(i) find  $f''(x)$ , [5]

(ii) solve the equation  $f(x) = -9$ . [5]

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