

# 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

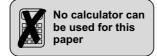


### **INSTRUCTIONS TO CANDIDATES**

- 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

$$4x^2 + y^2 = 10,$$
  $2x - y = 4.$  [6]

5 (i) Expand and simplify 
$$(2x+1)(x-3)(x+4)$$
. [3]

(ii) Find the coefficient of  $x^4$  in the expansion of

$$x(x^2 + 2x + 3)(x^2 + 7x - 2)$$
. [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) 
$$3x^2 > 48$$
.

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- 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.
  - (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).

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