

**ADVANCED SUBSIDIARY GCE**

**MATHEMATICS**

Core Mathematics 1

**QUESTION PAPER**

**4721**

Candidates answer on the Printed Answer Book

**OCR Supplied Materials:**

- Printed Answer Book 4721
- List of Formulae (MF1)

**Other Materials Required:**

None

**Monday 11 January 2010**  
**Morning**

**Duration:** 1 hour 30 minutes



**INSTRUCTIONS TO CANDIDATES**

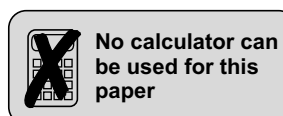
These instructions are the same on the Printed Answer Book and the Question Paper.

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Printed Answer Book.
- **The questions are on the inserted Question Paper.**
- **Write your answer to each question in the space provided in the Printed Answer Book.** If you need more space for an answer use a 4-page answer book; label your answer clearly. Write your Centre Number and Candidate Number on the 4-page answer book and attach it securely to the Printed Answer Book.
- 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.
- You are **not** permitted to use a calculator in this paper.
- 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.

**INFORMATION FOR CANDIDATES**

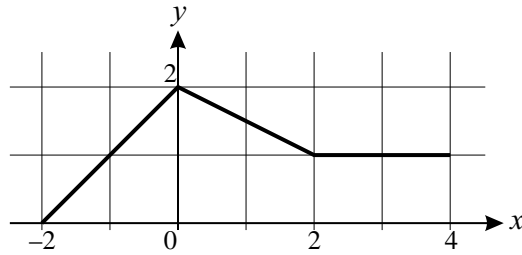
This information is the same on the Printed Answer Book and the Question Paper.

- The number of marks is given in brackets [ ] at the end of each question or part question on the Question Paper.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.



1 Express  $x^2 - 12x + 1$  in the form  $(x - p)^2 + q$ . [3]

2



The graph of  $y = f(x)$  for  $-2 \leq x \leq 4$  is shown above.

(i) Sketch the graph of  $y = 2f(x)$  for  $-2 \leq x \leq 4$  on the axes provided. [2]

(ii) Describe the transformation which transforms the graph of  $y = f(x)$  to the graph of  $y = f(x - 1)$ . [2]

3 Find the equation of the normal to the curve  $y = x^3 - 4x^2 + 7$  at the point  $(2, -1)$ , giving your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. [7]

4 Solve the equations

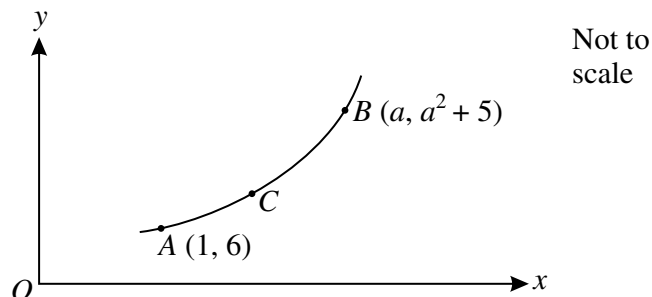
(i)  $3^m = 81$ , [1]

(ii)  $(36p^4)^{\frac{1}{2}} = 24$ , [3]

(iii)  $5^n \times 5^{n+4} = 25$ . [3]

5 Solve the equation  $x - 8\sqrt{x} + 13 = 0$ , giving your answers in the form  $p \pm q\sqrt{r}$ , where  $p$ ,  $q$  and  $r$  are integers. [7]

6



The diagram shows part of the curve  $y = x^2 + 5$ . The point  $A$  has coordinates  $(1, 6)$ . The point  $B$  has coordinates  $(a, a^2 + 5)$ , where  $a$  is a constant greater than 1. The point  $C$  is on the curve between  $A$  and  $B$ .

(i) Find by differentiation the value of the gradient of the curve at the point  $A$ . [2]

(ii) The line segment joining the points  $A$  and  $B$  has gradient 2.3. Find the value of  $a$ . [4]

(iii) State a possible value for the gradient of the line segment joining the points  $A$  and  $C$ . [1]

7

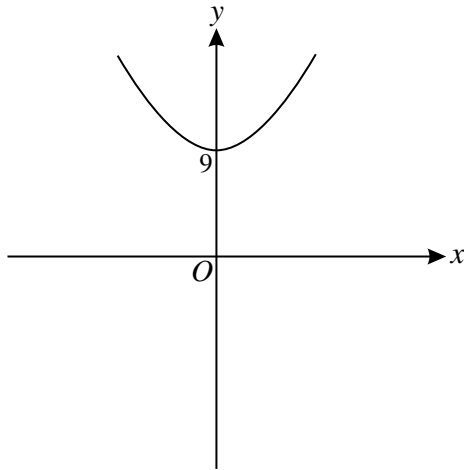


Fig. 1

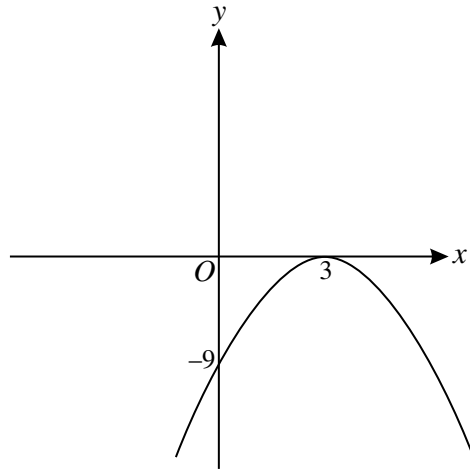


Fig. 2

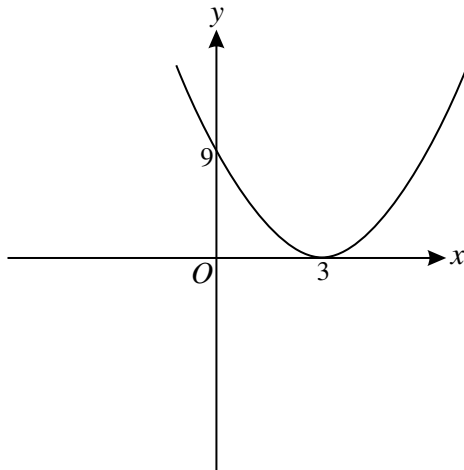


Fig. 3

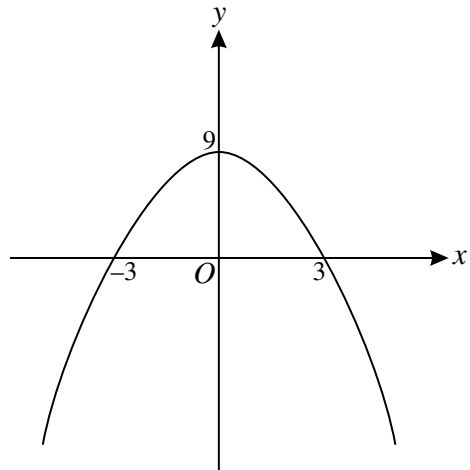


Fig. 4

(i) Each diagram shows a quadratic curve. State which diagram corresponds to the curve

(a)  $y = (3 - x)^2$ , [1]

(b)  $y = x^2 + 9$ , [1]

(c)  $y = (3 - x)(x + 3)$ . [1]

(ii) Give the equation of the curve which does not correspond to any of the equations in part (i). [2]

8 A circle has equation  $x^2 + y^2 + 6x - 4y - 4 = 0$ .

(i) Find the centre and radius of the circle. [3]

(ii) Find the coordinates of the points where the circle meets the line with equation  $y = 3x + 4$ . [6]

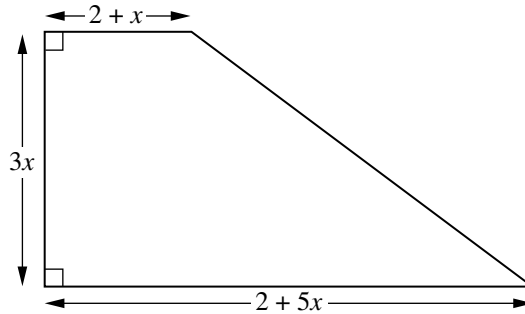
9 Given that  $f(x) = \frac{1}{x} - \sqrt{x} + 3$ ,

(i) find  $f'(x)$ , [3]

(ii) find  $f''(4)$ . [5]

10 The quadratic equation  $kx^2 - 30x + 25k = 0$  has equal roots. Find the possible values of  $k$ . [4]

11 A lawn is to be made in the shape shown below. The units are metres.



(i) The perimeter of the lawn is  $P$  m. Find  $P$  in terms of  $x$ . [2]

(ii) Show that the area,  $A$  m<sup>2</sup>, of the lawn is given by  $A = 9x^2 + 6x$ . [2]

The perimeter of the lawn must be at least 39 m and the area of the lawn must be less than 99 m<sup>2</sup>.

(iii) By writing down and solving appropriate inequalities, determine the set of possible values of  $x$ . [7]

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