OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS

4721

Core Mathematics 1

QUESTION PAPER

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

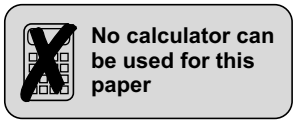
4721

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.

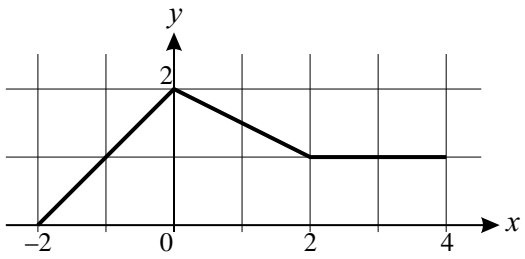
INFORMATION FOR CANDIDATES
This information is the same on the Printed Answer Book and the Question Paper.

- 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 $-2 \leqslant x \leqslant 4$ is shown above.

(i) Sketch the graph of $y = 2f(x)$ for $-2 \leqslant x \leqslant 4$ 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

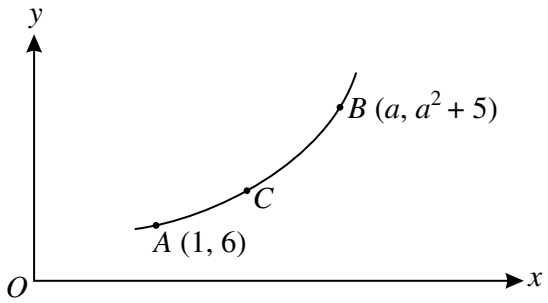
(i) $3^m = 81$, **[1]**

(ii) $\left(36p^4\right)^{\frac{1}{2}} = 24$, **[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

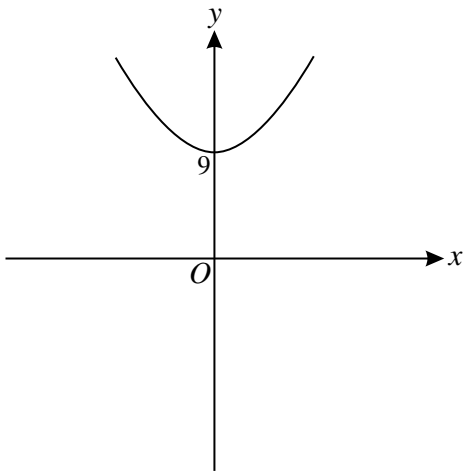


Fig. 1

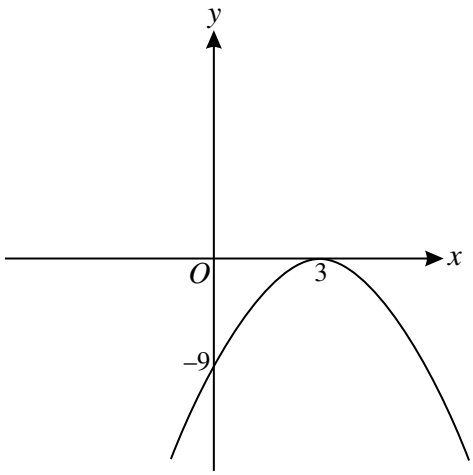


Fig. 2

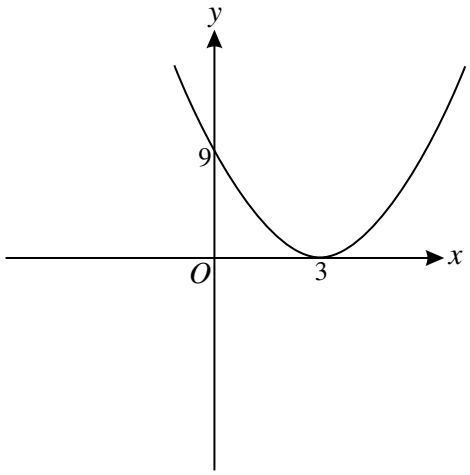


Fig. 3

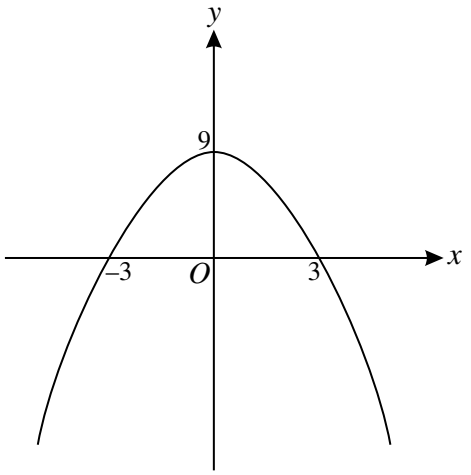


Fig. 4

(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]**

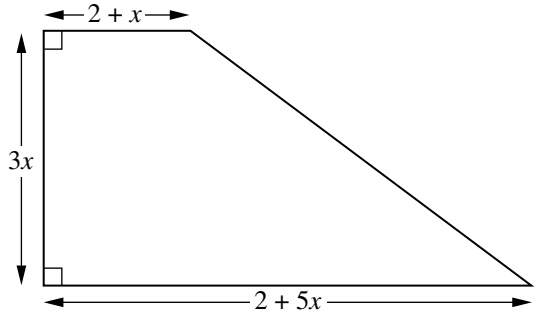
9 Given that $\mathrm{f}(x) = \dfrac{1}{x} - \sqrt{x} + 3$,

(i) find $\mathrm{f}'(x)$, **[3]**

(ii) find $\mathrm{f}''(4)$. **[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^2, 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^2.

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