

**Monday 19 May 2014 – Morning**

**AS GCE MATHEMATICS**

**4721/01** Core Mathematics 1

**QUESTION PAPER**

Candidates answer on the Printed Answer Book.

**OCR supplied materials:**

- Printed Answer Book 4721/01
- List of Formulae (MF1)

**Other materials required:**

None

**Duration:** 1 hour 30 minutes



## INSTRUCTIONS TO CANDIDATES

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

- The Question Paper will be found inside the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the Printed Answer Book.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- 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.

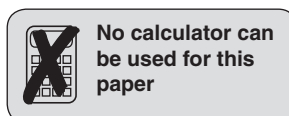
## INFORMATION FOR CANDIDATES

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.

## INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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- 1 Express  $5x^2 + 10x + 2$  in the form  $p(x+q)^2 + r$ , where  $p$ ,  $q$  and  $r$  are integers. [4]
- 2 Express each of the following in the form  $k\sqrt{3}$ , where  $k$  is an integer.
- (i)  $\frac{6}{\sqrt{3}}$  [1]
- (ii)  $10\sqrt{3} - 6\sqrt{27}$  [2]
- (iii)  $3^{\frac{5}{2}}$  [2]
- 3 Find the real roots of the equation  $4x^4 + 3x^2 - 1 = 0$ . [5]
- 4 The curve  $y = f(x)$  passes through the point  $P$  with coordinates  $(2, 5)$ .
- (i) State the coordinates of the point corresponding to  $P$  on the curve  $y = f(x) + 2$ . [1]
- (ii) State the coordinates of the point corresponding to  $P$  on the curve  $y = f(2x)$ . [1]
- (iii) Describe the transformation that transforms the curve  $y = f(x)$  to the curve  $y = f(x+4)$ . [2]
- 5 Solve the following inequalities.
- (i)  $5 < 6x + 3 < 14$  [3]
- (ii)  $x(3x - 13) \geq 10$  [5]
- 6 Given that  $y = 6x^3 + \frac{4}{\sqrt{x}} + 5x$ , find
- (i)  $\frac{dy}{dx}$ , [4]
- (ii)  $\frac{d^2y}{dx^2}$ . [2]
- 7  $A$  is the point  $(5, 7)$  and  $B$  is the point  $(-1, -5)$ .
- (i) Find the coordinates of the mid-point of the line segment  $AB$ . [2]
- (ii) Find an equation of the line through  $A$  that is perpendicular to the line segment  $AB$ , giving your answer in the form  $ax + by + c = 0$  where  $a$ ,  $b$  and  $c$  are integers. [5]

- 8 A curve has equation  $y = 3x^3 - 7x + \frac{2}{x}$ .
- (i) Verify that the curve has a stationary point when  $x = 1$ . [5]
  - (ii) Determine the nature of this stationary point. [2]
  - (iii) The tangent to the curve at this stationary point meets the  $y$ -axis at the point  $Q$ . Find the coordinates of  $Q$ . [2]
- 9 A circle with centre  $C$  has equation  $(x-2)^2 + (y+5)^2 = 25$ .
- (i) Show that no part of the circle lies above the  $x$ -axis. [3]
  - (ii) The point  $P$  has coordinates  $(6, k)$  and lies inside the circle. Find the set of possible values of  $k$ . [5]
  - (iii) Prove that the line  $2y = x$  does not meet the circle. [4]
- 10 A curve has equation  $y = (x+2)^2(2x-3)$ .
- (i) Sketch the curve, giving the coordinates of all points of intersection with the axes. [3]
  - (ii) Find an equation of the tangent to the curve at the point where  $x = -1$ . Give your answer in the form  $ax + by + c = 0$ . [9]

**END OF QUESTION PAPER**

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