OCR

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

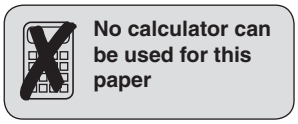
These instructions are the same on the Printed Answer Book and the Question Paper.
- The Question Paper will be found inside the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **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

- Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.



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 $y = \mathrm{f}(x)$ passes through the point P with coordinates (2, 5).

(i) State the coordinates of the point corresponding to P on the curve $y = \mathrm{f}(x) + 2$. **[1]**

(ii) State the coordinates of the point corresponding to P on the curve $y = \mathrm{f}(2x)$. **[1]**

(iii) Describe the transformation that transforms the curve $y = \mathrm{f}(x)$ to the curve $y = \mathrm{f}(x+4)$. **[2]**

5 Solve the following inequalities.

(i) $5 < 6x + 3 < 14$ **[3]**

(ii) $x(3x - 13) \geqslant 10$ **[5]**

6 Given that $y = 6x^3 + \frac{4}{\sqrt{x}} + 5x$, find

(i) $\frac{\mathrm{d}y}{\mathrm{d}x}$, **[4]**

(ii) $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$. **[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