# Monday 14 January 2013 – Morning

## AS GCE MATHEMATICS

**4721** Core Mathematics 1

### QUESTION PAPER

**Duration:** 1 hour 30 minutes

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## INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.
* The Question Paper will be found in the centre of 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.

No calculator can be used for this paper

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**Turn over**
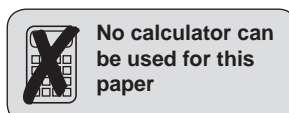
1    **(i)** Solve the equation $x^2 - 6x - 2 = 0$, giving your answers in simplified surd form.     **[3]**

    **(ii)** Find the gradient of the curve $y = x^2 - 6x - 2$ at the point where $x = -5$.     **[2]**

2    Solve the equations

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

    **(ii)** $t^{-3} = 64$,     **[2]**

    **(iii)** $\left(8p^6\right)^{\frac{1}{3}} = 8$.     **[3]**

3    **(i)** Sketch the curve $y = (1 + x)(2 - x)(3 + x)$, giving the coordinates of all points of intersection with the axes.     **[3]**

    **(ii)** Describe the transformation that transforms the curve $y = (1 + x)(2 - x)(3 + x)$ to the curve $y = (1 - x)(2 + x)(3 - x)$.     **[2]**

4    **(i)** Solve the simultaneous equations

$$y = 2x^2 - 3x - 5, \qquad 10x + 2y + 11 = 0.$$     **[5]**

    **(ii)** What can you deduce from the answer to part **(i)** about the curve $y = 2x^2 - 3x - 5$ and the line $10x + 2y + 11 = 0$?     **[1]**

5    **(i)** Simplify $(x + 4)(5x - 3) - 3(x - 2)^2$.     **[3]**

    **(ii)** The coefficient of $x^2$ in the expansion of

$$(x + 3)(x + k)(2x - 5)$$

    is $-3$. Find the value of the constant $k$.     **[3]**

**6**  **(i)** The line joining the points $(-2, 7)$ and $(-4, p)$ has gradient 4. Find the value of $p$.  **[3]**

**(ii)** The line segment joining the points $(-2, 7)$ and $(6, q)$ has mid-point $(m, 5)$. Find $m$ and $q$.  **[3]**

**(iii)** The line segment joining the points $(-2, 7)$ and $(d, 3)$ has length $2\sqrt{13}$. Find the two possible values of $d$.  **[4]**

**7**  Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ in each of the following cases:

**(i)** $y = \dfrac{(3x)^2 \times x^4}{x}$,  **[3]**

**(ii)** $y = \sqrt[3]{x}$,  **[3]**

**(iii)** $y = \dfrac{1}{2x^3}$.  **[2]**

**8**  The quadratic equation $kx^2 + (3k - 1)x - 4 = 0$ has no real roots. Find the set of possible values of $k$.  **[7]**

**9**  A circle with centre $C$ has equation $x^2 + y^2 - 2x + 10y - 19 = 0$.

**(i)** Find the coordinates of $C$ and the radius of the circle.  **[3]**

**(ii)** Verify that the point $(7, -2)$ lies on the circumference of the circle.  **[1]**

**(iii)** Find the equation of the tangent to the circle at the point $(7, -2)$, giving your answer in the form $ax + by + c = 0$, where $a$, $b$ and $c$ are integers.  **[5]**

**10**  Find the coordinates of the points on the curve $y = \dfrac{1}{3}x^3 + \dfrac{9}{x}$ at which the tangent is parallel to the line $y = 8x + 3$.  **[10]**

**THERE ARE NO QUESTIONS PRINTED ON THIS PAGE**