

ADVANCED SUBSIDIARY GCE

MATHEMATICS

Core Mathematics 2

4722

QUESTION PAPER

Candidates answer on the Printed Answer Book

OCR Supplied Materials:

- Printed Answer Book 4722
- List of Formulae (MF1)

Other Materials Required:

- Scientific or graphical calculator

Thursday 27 May 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.** Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).
- 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 permitted to use a graphical 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.

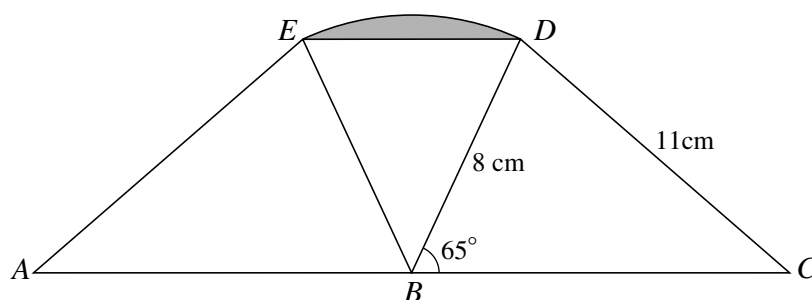
- The number of marks is given in brackets [] at the end of each question or part question on the Question Paper.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question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

- 1 The cubic polynomial $f(x)$ is defined by $f(x) = x^3 + ax^2 - ax - 14$, where a is a constant.
- (i) Given that $(x - 2)$ is a factor of $f(x)$, find the value of a . [3]
- (ii) Using this value of a , find the remainder when $f(x)$ is divided by $(x + 1)$. [2]
- 2 (i) Use the trapezium rule, with 3 strips each of width 3, to estimate the area of the region bounded by the curve $y = \sqrt[3]{7+x}$, the x -axis, and the lines $x = 1$ and $x = 10$. Give your answer correct to 3 significant figures. [4]
- (ii) Explain how the trapezium rule could be used to obtain a more accurate estimate of the area. [1]
- 3 (i) Find and simplify the first four terms in the binomial expansion of $(1 + \frac{1}{2}x)^{10}$ in ascending powers of x . [4]
- (ii) Hence find the coefficient of x^3 in the expansion of $(3 + 4x + 2x^2)(1 + \frac{1}{2}x)^{10}$. [3]
- 4 A sequence u_1, u_2, u_3, \dots is defined by $u_n = 5n + 1$.
- (i) State the values of u_1, u_2 and u_3 . [1]
- (ii) Evaluate $\sum_{n=1}^{40} u_n$. [3]
- Another sequence w_1, w_2, w_3, \dots is defined by $w_1 = 2$ and $w_{n+1} = 5w_n + 1$.
- (iii) Find the value of p such that $u_p = w_3$. [3]

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The diagram shows two congruent triangles, BCD and BAE , where ABC is a straight line. In triangle BCD , $BD = 8$ cm, $CD = 11$ cm and angle $CBD = 65^\circ$. The points E and D are joined by an arc of a circle with centre B and radius 8 cm.

- (i) Find angle BCD . [2]
- (ii) (a) Show that angle EBD is 0.873 radians, correct to 3 significant figures. [2]
- (b) Hence find the area of the shaded segment bounded by the chord ED and the arc ED , giving your answer correct to 3 significant figures. [4]

- 6 (a) Use integration to find the exact area of the region enclosed by the curve $y = x^2 + 4x$, the x -axis and the lines $x = 3$ and $x = 5$. [4]
- (b) Find $\int (2 - 6\sqrt{y}) \, dy$. [3]
- (c) Evaluate $\int_1^{\infty} \frac{8}{x^3} \, dx$. [4]
- 7 (i) Show that $\frac{\sin^2 x - \cos^2 x}{1 - \sin^2 x} \equiv \tan^2 x - 1$. [2]
- (ii) Hence solve the equation
- $$\frac{\sin^2 x - \cos^2 x}{1 - \sin^2 x} = 5 - \tan x,$$
- for $0^\circ \leq x \leq 360^\circ$. [6]
- 8 (a) Use logarithms to solve the equation $5^{3w-1} = 4^{250}$, giving the value of w correct to 3 significant figures. [5]
- (b) Given that $\log_x(5y + 1) - \log_x 3 = 4$, express y in terms of x . [4]
- 9 A geometric progression has first term a and common ratio r , and the terms are all different. The first, second and fourth terms of the geometric progression form the first three terms of an arithmetic progression.
- (i) Show that $r^3 - 2r + 1 = 0$. [3]
- (ii) Given that the geometric progression converges, find the exact value of r . [5]
- (iii) Given also that the sum to infinity of this geometric progression is $3 + \sqrt{5}$, find the value of the integer a . [4]

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