

Friday 17 May 2013 – Morning

AS GCE MATHEMATICS

4722/01 Core Mathematics 2

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer Book 4722/01
- List of Formulae (MF1)

Other materials required:

- Scientific or graphical calculator

Duration: 1 hour 30 minutes

MODIFIED LANGUAGE



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 permitted to use a scientific or 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

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- 1 Use the trapezium rule, with 3 strips each of width 2, to estimate the value of

$$\int_5^{11} \frac{8}{x} dx. \quad [4]$$

- 2 Solve each of the following equations, for $0^\circ \leq x \leq 360^\circ$.

(i) $\sin \frac{1}{2}x = 0.8$ [3]

(ii) $\sin x = 3 \cos x$ [3]

- 3 (i) Find and simplify the first three terms in the expansion of $(2 + 5x)^6$ in ascending powers of x . [4]

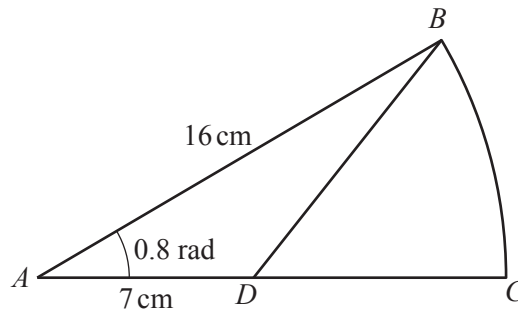
(ii) In the expansion of $(3 + cx)^2(2 + 5x)^6$, the coefficient of x is 4416. Find the value of c . [3]

4 (a) Find $\int (5x^3 - 6x + 1) dx$. [3]

(b) (i) Find $\int 24x^{-3} dx$. [2]

(ii) Given that $\int_a^\infty 24x^{-3} dx = 3$, find the value of the positive constant a . [3]

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The diagram shows a sector BAC of a circle with centre A and radius 16 cm. The angle BAC is 0.8 radians. The length AD is 7 cm.

(i) Find the area of the region BDC . [4]

(ii) Find the perimeter of the region BDC . [4]

- 6 Sarah is carrying out a series of experiments which involve using increasing amounts of a chemical. In the first experiment she uses 6 g of the chemical and in the second experiment she uses 7.8 g of the chemical.

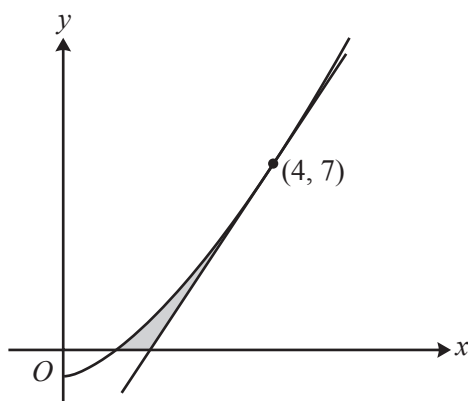
- (i) The amounts of the chemical used form an arithmetic progression. Find the total amount of chemical used in the first 30 experiments. [3]
- (ii) Instead it is given that the amounts of the chemical used form a geometric progression. Sarah has a total of 1800 g of the chemical available. Show that N , the greatest number of experiments possible, satisfies the inequality

$$1.3^N \leq 91,$$

and use logarithms to calculate the value of N .

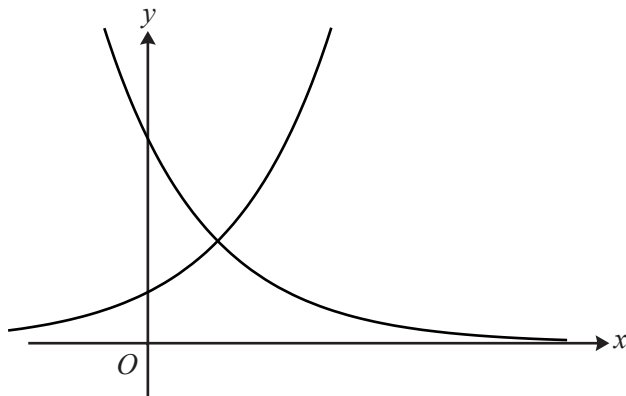
[6]

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The diagram shows the curve $y = x^{\frac{3}{2}} - 1$, which crosses the x -axis at $(1, 0)$, and the tangent to the curve at the point $(4, 7)$.

- (i) Show that $\int_1^4 (x^{\frac{3}{2}} - 1) dx = 9\frac{2}{5}$. [4]
- (ii) Hence find the exact area of the shaded region enclosed by the curve, the tangent and the x -axis. [5]



The diagram shows the curves $y = a^x$ and $y = 4b^x$.

- (i) (a) State the coordinates of the point of intersection of $y = a^x$ with the y -axis. [1]
- (b) State the coordinates of the point of intersection of $y = 4b^x$ with the y -axis. [1]
- (c) State a possible value for a and a possible value for b . [2]
- (ii) It is now given that $ab = 2$. Show that the x -coordinate of the point of intersection of $y = a^x$ and $y = 4b^x$ can be written as

$$x = \frac{2}{2\log_2 a - 1}.$$

[5]

9 The cubic polynomial $f(x)$ is defined by $f(x) = 4x^3 - 7x - 3$.

- (i) Find the remainder when $f(x)$ is divided by $(x - 2)$. [2]
- (ii) Show that $(2x + 1)$ is a factor of $f(x)$ and hence factorise $f(x)$ completely. [6]
- (iii) Solve the equation

$$4\cos^3\theta - 7\cos\theta - 3 = 0$$

for $0 \leq \theta \leq 2\pi$. Give each solution for θ in an exact form. [4]

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