

Friday 18 January 2013 – Afternoon

AS GCE MATHEMATICS (MEI)

4752/01 Concepts for Advanced Mathematics (C2)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer Book 4752/01
- MEI Examination Formulae and Tables (MF2)

Other materials required:

- Scientific or graphical calculator

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 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.
- Read each question carefully. Make sure 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 scientific or graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

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 advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **8** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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This paper has been pre modified for carrier language

Section A (36 marks)

1 Find $\int 30x^{\frac{3}{2}} dx$. [3]

2 For each of the following sequences, state with a reason whether it is convergent, periodic or neither. Each sequence continues in the pattern established by the given terms.

(i) $3, \frac{3}{2}, \frac{3}{4}, \frac{3}{8}, \dots$ [1]

(ii) $3, 7, 11, 15, \dots$ [1]

(iii) $3, 5, -3, -5, 3, 5, -3, -5, \dots$ [1]

3 (i) The point $P(4, -2)$ lies on the curve $y = f(x)$. Find the coordinates of the image of P when the curve is transformed to $y = f(5x)$. [2]

(ii) Describe fully a single transformation which maps the curve $y = \sin x^\circ$ onto the curve $y = \sin(x - 90)^\circ$. [2]

4

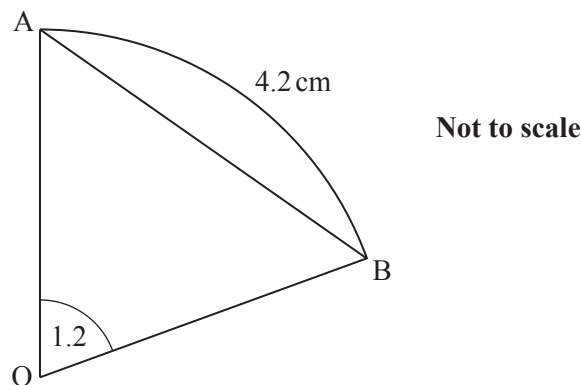


Fig. 4

Fig. 4 shows sector OAB with sector angle 1.2 radians and arc length 4.2 cm. It also shows chord AB .

(i) Find the radius of this sector. [2]

(ii) Calculate the perpendicular distance of the chord AB from O . [2]

5 A and B are points on the curve $y = 4\sqrt{x}$. Point A has coordinates $(9, 12)$ and point B has x -coordinate 9.5 . Find the gradient of the chord AB .

The gradient of AB is an approximation to the gradient of the curve at A . State the x -coordinate of a point C on the curve such that the gradient of AC is a closer approximation. [3]

- 6 Differentiate $2x^3 + 9x^2 - 24x$. Hence find the set of values of x for which the function $f(x) = 2x^3 + 9x^2 - 24x$ is increasing. [4]
- 7 Fig. 7 shows a sketch of a village green ABC which is bounded by three straight roads. $AB = 92$ m, $BC = 75$ m and $AC = 105$ m.

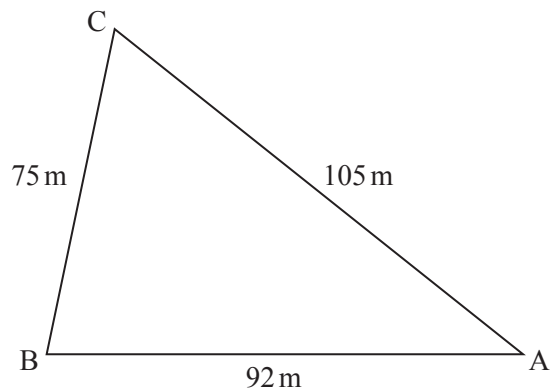


Fig. 7

Calculate the area of the village green. [5]

- 8 (i) Sketch the graph of $y = 3^x$. [2]
- (ii) Solve the equation $3^{5x-1} = 500000$. [3]
- 9 (i) Show that the equation $\frac{\tan \theta}{\cos \theta} = 1$ may be rewritten as $\sin \theta = 1 - \sin^2 \theta$. [2]
- (ii) Hence solve the equation $\frac{\tan \theta}{\cos \theta} = 1$ for $0^\circ \leq \theta \leq 360^\circ$. [3]

Section B (36 marks)

- 10 Fig. 10 shows a sketch of the curve $y = x^2 - 4x + 3$. The point A on the curve has x -coordinate 4. At point B the curve crosses the x -axis.

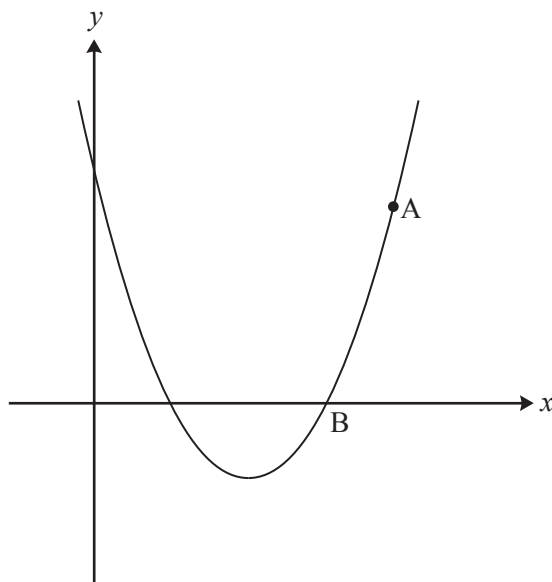


Fig. 10

- (i) Use calculus to find the equation of the normal to the curve at A and show that this normal intersects the x -axis at C (16, 0). [6]
- (ii) Find the area of the region ABC bounded by the curve, the normal at A and the x -axis. [5]
- 11 (i) An arithmetic progression has first term A and common difference D . The sum of its first two terms is 25 and the sum of its first four terms is 250.
- (A) Find the values of A and D . [4]
- (B) Find the sum of the 21st to 50th terms inclusive of this sequence. [3]
- (ii) A geometric progression has first term a and common ratio r , with $r \neq \pm 1$. The sum of its first two terms is 25 and the sum of its first four terms is 250.
- Use the formula for the sum of a geometric progression to show that $\frac{r^4 - 1}{r^2 - 1} = 10$ and hence or otherwise find algebraically the possible values of r and the corresponding values of a . [5]

12 The table shows population data for a country.

Year	1969	1979	1989	1999	2009
Population in millions (p)	58.81	80.35	105.27	134.79	169.71

The data may be represented by an exponential model of growth. Using t as the number of years after 1960, a suitable model is $p = a \times 10^{kt}$.

- (i) Derive an equation for $\log_{10} p$ in terms of a , k and t . [2]
- (ii) Complete the table and draw the graph of $\log_{10} p$ against t , drawing a line of best fit by eye. [3]
- (iii) Use your line of best fit to express $\log_{10} p$ in terms of t and hence find p in terms of t . [4]
- (iv) According to the model, what was the population in 1960? [1]
- (v) According to the model, when will the population reach 200 million? [3]

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