OCR
RECOGNISING ACHIEVEMENT

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

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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.
- 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

- 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.

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) $3, \ \frac{3}{2}, \ \frac{3}{4}, \ \frac{3}{8}, \ \ldots$ **[1]**

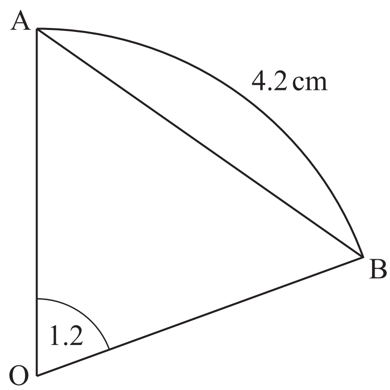
(ii) $3, \ 7, \ 11, \ 15, \ \ldots$ **[1]**

(iii) $3, \ 5, \ -3, \ -5, \ 3, \ 5, \ -3, \ -5, \ \ldots$ **[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 $y = \sin x°$ onto the curve $y = \sin(x - 90)°$. **[2]**

4



Not to scale

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.

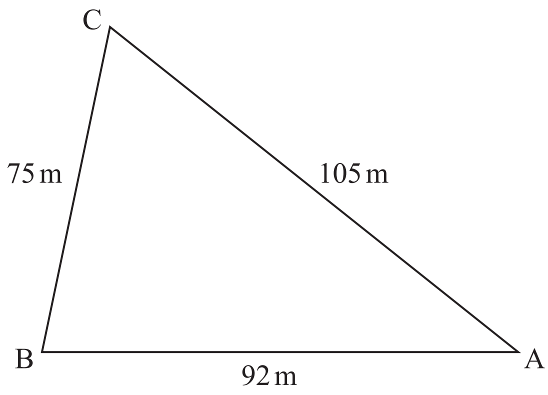


Fig. 7

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 $\dfrac{\tan\theta}{\cos\theta} = 1$ may be rewritten as $\sin\theta = 1 - \sin^2\theta$. **[2]**

(ii) Hence solve the equation $\dfrac{\tan\theta}{\cos\theta} = 1$ for $0° \leqslant \theta \leqslant 360°$. **[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.

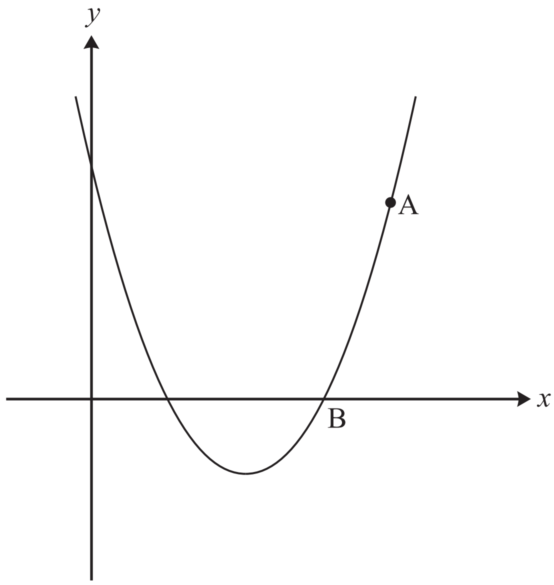


Fig. 10

(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 $\dfrac{r^4 - 1}{r^2 - 1} = 10$ 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]**