



--

--	--	--	--	--

--	--	--	--

0606/12

February/March 2017

2 hours

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

You are reminded of the need for clear presentation in your answers.

The total number of marks for this paper is 80.

This document consists of **14** printed pages and **2** blank pages.

Mathematical Formulae**1. ALGEBRA***Quadratic Equation*

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \dots + \binom{n}{r} a^{n-r} b^r + \dots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY*Identities*

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for $\triangle ABC$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

- 1 (a) It is given that $\mathcal{E} = \{x : 0 < x < 35, x \in \mathbb{R}\}$ and sets A and B are such that

$$A = \{\text{multiples of } 5\} \text{ and } B = \{\text{multiples of } 7\}.$$

- (i) Find $n(A \cap B)$. [1]

- (ii) Find $n(A \cup B)$. [1]

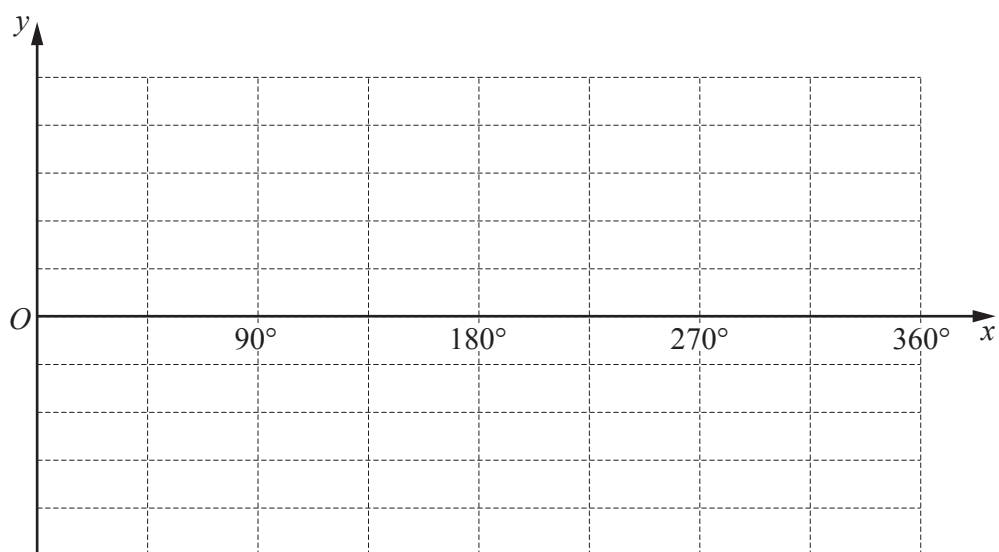
- (b) It is given that sets X , Y and Z are such that

$$X \cap Y = Y, \quad X \cap Z = Z \quad \text{and} \quad Y \cap Z = \emptyset.$$

On the Venn diagram below, illustrate sets X , Y and Z . [3]



- 2 (i) On the axes below sketch, for $0^\circ \leq x \leq 360^\circ$, the graph of $y = 1 + 3 \cos 2x$. [3]



- (ii) Write down the coordinates of the point where this graph first has a minimum value. [1]

- 3 The first three terms in the expansion of $\left(a + \frac{x}{4}\right)^5$ are $32 + bx + cx^2$. Find the value of each of the constants a , b and c . [5]

4 (a) It is given that $\mathbf{A} = \begin{pmatrix} 1 & -3 \\ 2 & 4 \end{pmatrix}$.

(i) Find $\mathbf{A}^{-1}$. [2]

(ii) Using your answer to part (i), find the matrix $\mathbf{M}$ such that $\mathbf{AM} = \begin{pmatrix} -1 & -5 \\ 4 & 2 \end{pmatrix}$. [3]

(b) $\mathbf{X}$ is $\begin{pmatrix} a & -1 \\ 2 & -3 \end{pmatrix}$ and $\mathbf{Y}$ is $\begin{pmatrix} 2 & 1 \\ 4 & 3a \end{pmatrix}$, where a is a constant.

Given that $\det \mathbf{X} = 4 \det \mathbf{Y}$, find the value of a . [2]

5 (i) Show that $\operatorname{cosec} \theta - \sin \theta = \cot \theta \cos \theta$.

[3]

(ii) Hence solve the equation $\operatorname{cosec} \theta - \sin \theta = \frac{1}{3} \cos \theta$, for $0 \leq \theta \leq 2\pi$ radians.

[4]

- 6 (a)** The letters of the word THURSDAY are arranged in a straight line. Find the number of different arrangements of these letters if
- (i)** there are no restrictions, [1]
 - (ii)** the arrangement must start with the letter T and end with the letter Y, [1]
 - (iii)** the second letter in the arrangement must be Y. [1]
- (b)** 7 children have to be divided into two groups, one of 4 children and the other of 3 children. Given that there are 3 girls and 4 boys, find the number of different ways this can be done if
- (i)** there are no restrictions, [1]
 - (ii)** all the boys are in one group, [1]
 - (iii)** one boy and one girl are twins and must be in the same group. [3]

- 7 (a) A vector $\mathbf{v}$ has a magnitude of 102 units and has the same direction as $\begin{pmatrix} 8 \\ -15 \end{pmatrix}$. Find $\mathbf{v}$ in the form $\begin{pmatrix} a \\ b \end{pmatrix}$, where a and b are integers. [2]

- (b) Vectors $\mathbf{c} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ and $\mathbf{d} = \begin{pmatrix} p - q \\ 5p + q \end{pmatrix}$ are such that $\mathbf{c} + 2\mathbf{d} = \begin{pmatrix} p^2 \\ 27 \end{pmatrix}$. Find the possible values of the constants p and q . [6]

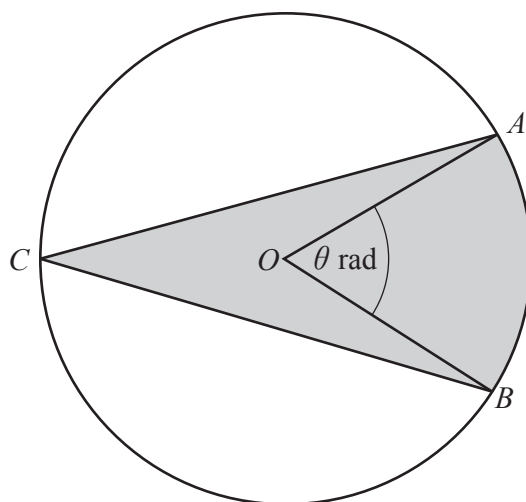
8 A curve is such that $\frac{d^2y}{dx^2} = 4 \sin 2x$. The curve has a gradient of 5 at the point where $x = \frac{\pi}{2}$.

(i) Find an expression for the gradient of the curve at the point (x, y) . [4]

The curve passes through the point $P\left(\frac{\pi}{12}, -\frac{1}{2}\right)$.

(ii) Find the equation of the curve. [4]

(iii) Find the equation of the normal to the curve at the point P , giving your answer in the form $y = mx + c$, where m and c are constants correct to 3 decimal places. [3]



The diagram shows a circle, centre O , radius 10 cm. Points A , B and C lie on the circumference of the circle such that $AC = BC$. The area of the minor sector AOB is $20\pi \text{ cm}^2$ and angle AOB is θ radians.

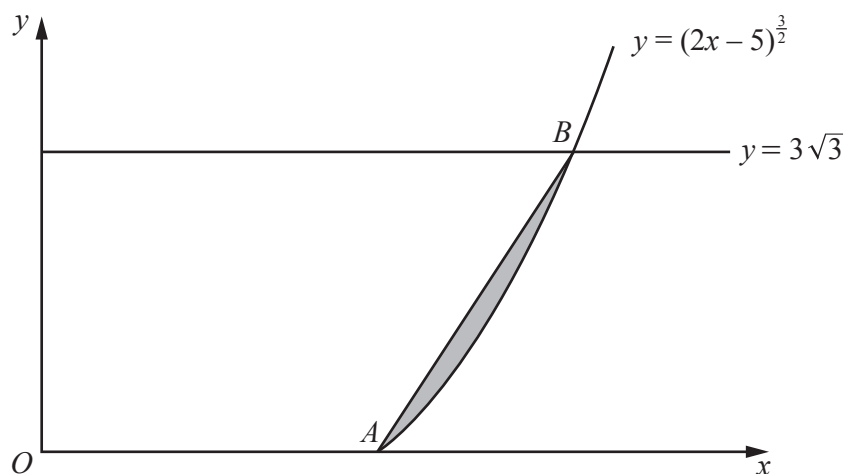
- (i) Find the value of θ in terms of π . [2]

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

(iii) Find the area of the shaded region.

[3]

10



The diagram shows part of the curve $y = (2x - 5)^{\frac{3}{2}}$ and the line $y = 3\sqrt{3}$. The curve meets the x -axis at the point A and the line $y = 3\sqrt{3}$ at the point B . Find the area of the shaded region enclosed

by the line AB and the curve, giving your answer in the form $\frac{p\sqrt{3}}{20}$, where p is an integer. You must show all your working. [8]

Question 11 is printed on the next page.

- 11** It is given that $y = Ae^{bx}$, where A and b are constants. When $\ln y$ is plotted against x a straight line graph is obtained which passes through the points $(1.0, 0.7)$ and $(2.5, 3.7)$.

(i) Find the value of A and of b . [6]

(ii) Find the value of y when $x = 2$. [2]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.