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0606/12

May/June 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 **12** printed 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*

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

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

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

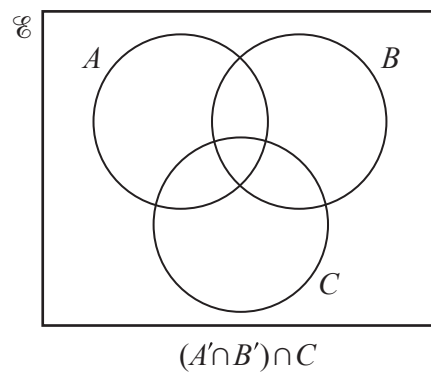
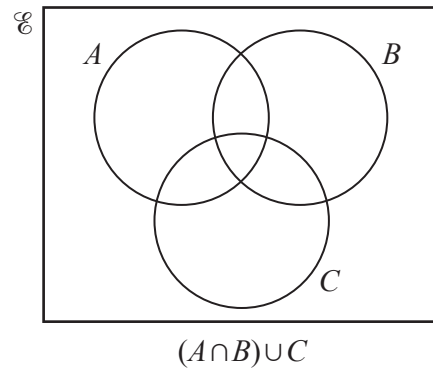
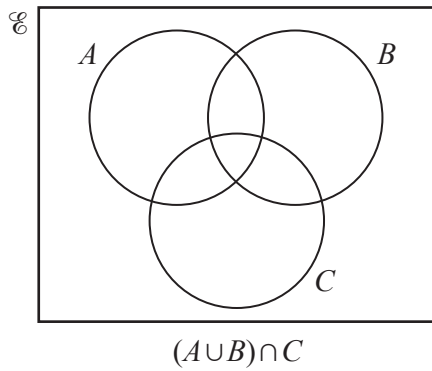
Formulae for $\triangle ABC$

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

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

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

- 1 On each of the Venn diagrams below, shade the region which represents the given set.



[3]

- 2 It is given that $y = \frac{(5x^2 + 4)^{\frac{1}{2}}}{x + 1}$. Showing all your working, find the exact value of $\frac{dy}{dx}$ when $x = 3$.

[5]

3 Vectors $\mathbf{i}$ and $\mathbf{j}$ are unit vectors parallel to the x -axis and y -axis respectively.

(a) The vector $\mathbf{v}$ has a magnitude of $3\sqrt{5}$ units and has the same direction as $\mathbf{i} - 2\mathbf{j}$. Find $\mathbf{v}$ giving your answer in the form $a\mathbf{i} + b\mathbf{j}$, where a and b are integers. [2]

(b) The velocity vector $\mathbf{w}$ makes an angle of 30° with the positive x -axis and is such that $|\mathbf{w}| = 2$. Find $\mathbf{w}$ giving your answer in the form $\sqrt{c}\mathbf{i} + d\mathbf{j}$, where c and d are integers. [2]

4 The first 3 terms in the expansion of $\left(3 - \frac{x}{6}\right)^n$ are $81 + ax + bx^2$. Find the value of each of the constants n , a and b . [5]

- 5** A particle P moves in a straight line, such that its displacement, x m, from a fixed point O , t s after passing O , is given by $x = 4 \cos(3t) - 4$.

(i) Find the velocity of P at time t . [1]

(ii) Hence write down the maximum speed of P . [1]

(iii) Find the smallest value of t for which the acceleration of P is zero. [3]

(iv) For the value of t found in part **(iii)**, find the distance of P from O . [1]

- 6 (i) Show that $\frac{\operatorname{cosec} \theta}{\cot \theta + \tan \theta} = \cos \theta$. [4]

It is given that $\int_0^a \frac{\operatorname{cosec} 2\theta}{\cot 2\theta + \tan 2\theta} d\theta = \frac{\sqrt{3}}{4}$, where $0 < a < \frac{\pi}{4}$.

- (ii) Using your answer to part (i) find the value of a , giving your answer in terms of π . [4]

- 7 It is given that $y = A(10^{bx})$, where A and b are constants. The straight line graph obtained when $\lg y$ is plotted against x passes through the points $(0.5, 2.2)$ and $(1.0, 3.7)$.

(i) Find the value of A and of b . [5]

Using your values of A and b , find

(ii) the value of y when $x = 0.6$, [2]

(iii) the value of x when $y = 600$. [2]

- 8 (a)** A 5-digit number is to be formed from the seven digits 1, 2, 3, 5, 6, 8 and 9. Each digit can only be used once in any 5-digit number. Find the number of different 5-digit numbers that can be formed if
- (i)** there are no restrictions, [1]
 - (ii)** the number is divisible by 5, [1]
 - (iii)** the number is greater than 60 000, [1]
 - (iv)** the number is greater than 60 000 and even. [3]
- (b)** Ranjit has 25 friends of whom 15 are boys and 10 are girls. Ranjit wishes to hold a birthday party but can only invite 7 friends. Find the number of different ways these 7 friends can be selected if
- (i)** there are no restrictions, [1]
 - (ii)** only 2 of the 7 friends are boys, [1]
 - (iii)** the 25 friends include a boy and his sister who cannot be separated. [3]

9 (a) Given that $\mathbf{A} = \begin{pmatrix} 3 & 1 \\ -1 & 2 \\ 4 & 5 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 1 & -2 \\ 3 & 0 \end{pmatrix}$ and $\mathbf{C} = \mathbf{AB}$,

(i) state the order of $\mathbf{A}$, [1]

(ii) find $\mathbf{C}$. [3]

(b) The matrix $\mathbf{X} = \begin{pmatrix} 5 & -12 \\ 4 & -7 \end{pmatrix}$.

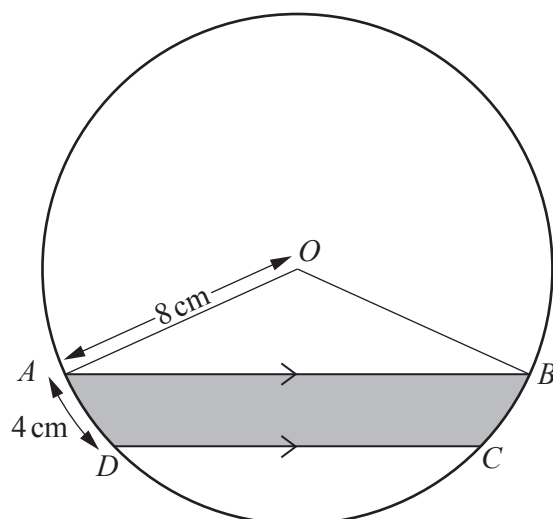
(i) Find $\mathbf{X}^{-1}$. [2]

(ii) Using $\mathbf{X}^{-1}$, find the coordinates of the point of intersection of the lines

$$12y = 5x - 26,$$

$$7y = 4x - 52.$$

[4]



The diagram shows a circle, centre O , radius 8 cm. The points A , B , C and D lie on the circumference of the circle such that AB is parallel to DC . The length of the arc AD is 4 cm and the length of the chord AB is 15 cm.

(i) Find, in radians, angle AOD . [1]

(ii) Hence show that angle $DOC = 1.43$ radians, correct to 2 decimal places. [3]

(iii) Find the perimeter of the shaded region.

[3]

(iv) Find the area of the shaded region.

[4]

Question 11 is printed on the next page.

11 The curve $y = f(x)$ passes through the point $\left(\frac{1}{2}, \frac{7}{2}\right)$ and is such that $f'(x) = e^{2x-1}$.

(i) Find the equation of the curve.

[4]

(ii) Find the value of x for which $f''(x) = 4$, giving your answer in the form $a + b \ln \sqrt{2}$, where a and b are constants.

[4]

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