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0606/23

October/November 2018

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 **15** printed pages and **1** blank page.

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 $\triangle ABC$

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

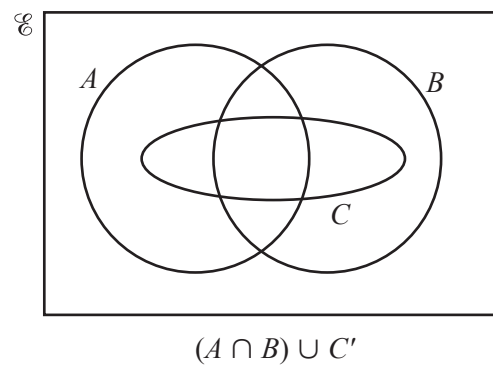
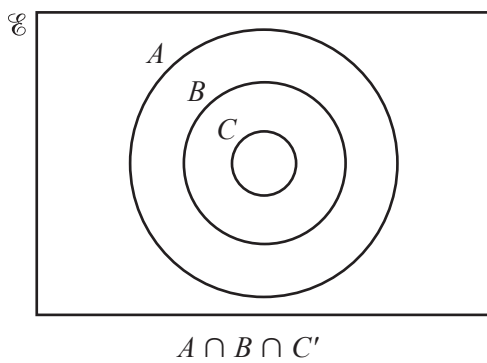
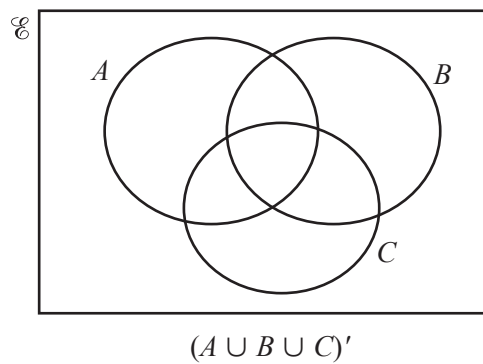
$$a^2 = b^2 + c^2 - 2bc \cos A$$

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

- 1 Solve the equation $|5x - 3| = -3x + 13$.

[3]

- 2 On each of the Venn diagrams below, shade the region indicated.



[3]

3 (i) Write $8 + 7x - x^2$ in the form $a - (x - b)^2$, where a and b are constants. [3]

(ii) Hence state the maximum value of $8 + 7x - x^2$ and the value of x at which it occurs. [2]

(iii) Using your answer to **part (i)**, or otherwise, solve the equation $8 + 7z^2 - z^4 = 0$. [3]

4
$$\frac{d^2y}{dx^2} = 2x + \frac{3}{(x+1)^4}$$

(i) Find $\frac{dy}{dx}$, given that $\frac{dy}{dx} = 1$ when $x = 1$. [3]

(ii) Find y in terms of x , given that $y = 3$ when $x = 1$. [3]

5 Given that $\mathbf{A} = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 1 & 4 \\ -2 & 5 \end{pmatrix}$, find

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

(ii) the matrix $\mathbf{C}$ such that $\mathbf{CA} = \mathbf{B}$, [2]

(iii) the matrix $\mathbf{D}$ such that $\mathbf{A}^{-1}\mathbf{D} + \mathbf{B} = \mathbf{I}$. [3]

6 Solve the simultaneous equations

$$\log_2(x + 2y) = 3,$$

$$\log_2 3x - \log_2 y = 1.$$

[5]

- 7 A squad of 20 boys, which includes 2 sets of twins, is available for selection for a cricket team of 11 players. Calculate the number of different teams that can be selected if

(i) there are no restrictions, [1]

(ii) both sets of twins are selected, [2]

(iii) one set of twins is selected but neither twin from the other set is selected, [2]

(iv) exactly one twin from each set of twins is selected. [2]

- 8 Variables x and y are such that when y^2 is plotted against e^{2x} a straight line is obtained which passes through the points (1.5, 5.5) and (3.7, 12.1). Find

(i) y in terms of e^{2x} , [3]

(ii) the value of y when $x = 3$, [1]

(iii) the value of x when $y = 50$. [3]

9 (a) Solve $2 \sin\left(x + \frac{\pi}{4}\right) = \sqrt{3}$ for $0 < x < \pi$ radians. [3]

(b) Solve $3 \sec y = 4 \operatorname{cosec} y$ for $0^\circ < y < 360^\circ$. [3]

(c) Solve $7 \cot z - \tan z = 2 \operatorname{cosec} z$ for $0^\circ < z < 360^\circ$.

[6]

10 The equation of a curve is $y = x^2\sqrt{3+x}$ for $x \geq -3$.

(i) Find $\frac{dy}{dx}$. [3]

(ii) Find the equation of the tangent to the curve $y = x^2\sqrt{3+x}$ at the point where $x = 1$. [3]

- (iii) Find the coordinates of the turning points of the curve $y = x^2 \sqrt{3+x}$. [4]

11 A line with equation $y = -5x + k + 5$ is a tangent to a curve with equation $y = 7 - kx - x^2$.

(i) Find the two possible values of k . [5]

(ii) Find, for **each** of your values of k ,

- the equation of the tangent
- the equation of the curve
- the coordinates of the point of contact of the tangent and the curve.

[5]

(iii) Find the distance between the two points of contact.

[2]

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