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0606/12

October/November 2015

2 hours

Additional Materials: Electronic calculator

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 **16** 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 Find the range of values of k for which the equation $kx^2 + k = 8x - 2xk$ has 2 real distinct roots. [4]

- 2 A curve, showing the relationship between two variables x and y , passes through the point $P(-1, 3)$.

The curve has a gradient of 2 at P . Given that $\frac{d^2y}{dx^2} = -5$, find the equation of the curve. [4]

- 3 Show that $\sqrt{\sec^2 \theta - 1} + \sqrt{\operatorname{cosec}^2 \theta - 1} = \sec \theta \operatorname{cosec} \theta$. [5]

4 (a) 6 books are to be chosen from 8 different books.

(i) Find the number of different selections of 6 books that could be made. [1]

A clock is to be displayed on a shelf with 3 of the 8 different books on each side of it. Find the number of ways this can be done if

(ii) there are no restrictions on the choice of books, [1]

(iii) 3 of the 8 books are music books which have to be kept together. [2]

(b) A team of 6 tennis players is to be chosen from 10 tennis players consisting of 7 men and 3 women. Find the number of different teams that could be chosen if the team must include at least 1 woman. [3]

5 Variables x and y are such that $y = (x - 3)\ln(2x^2 + 1)$.

(i) Find the value of $\frac{dy}{dx}$ when $x = 2$. [4]

(ii) Hence find the approximate change in y when x changes from 2 to 2.03. [2]

- 6 It is given that $\mathcal{U} = \{x : 1 \leq x \leq 12, \text{ where } x \text{ is an integer}\}$ and that sets A , B , C and D are such that
- $A = \{\text{multiples of } 3\},$
 $B = \{\text{prime numbers}\},$
 $C = \{\text{odd integers}\},$
 $D = \{\text{even integers}\}.$

Write down the following sets in terms of their elements.

(i) $A \cap B$ [1]

(ii) $A \cup C$ [1]

(iii) $A' \cap C$ [1]

(iv) $(D \cup B)'$ [1]

(v) Write down a set E such that $E \subset D$. [1]

- 7 Two variables, x and y , are such that $y = Ax^b$, where A and b are constants. When $\ln y$ is plotted against $\ln x$, a straight line graph is obtained which passes through the points $(1.4, 5.8)$ and $(2.2, 6.0)$.

(i) Find the value of A and of b . [4]

(ii) Calculate the value of y when $x = 5$. [2]

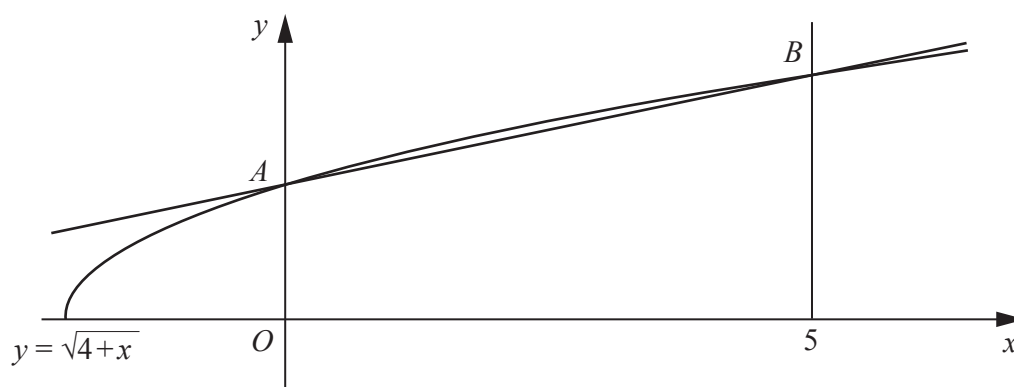
- 8 Find the equation of the tangent to the curve $y = \frac{2x-1}{\sqrt{x^2+5}}$ at the point where $x = 2$. [7]

9 You are not allowed to use a calculator in this question.

(i) Find $\int \sqrt{4+x} \, dx$.

[2]

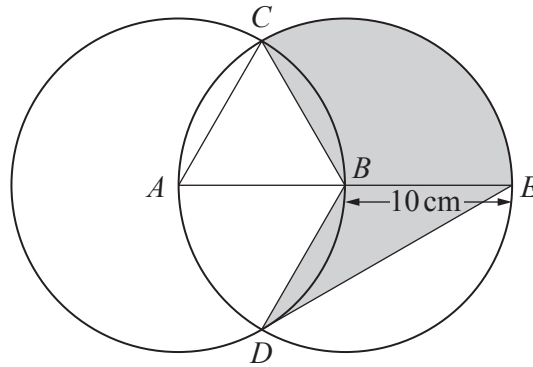
(ii)



The diagram shows the graph of $y = \sqrt{4+x}$, which meets the y -axis at the point A and the line $x = 5$ at the point B . Using your answer to part (i), find the area of the region enclosed by the curve and the straight line AB .

[5]

10



The diagram shows two circles, centres A and B , each of radius 10 cm. The point B lies on the circumference of the circle with centre A . The two circles intersect at the points C and D . The point E lies on the circumference of the circle centre B such that ABE is a diameter.

(i) Explain why triangle ABC is equilateral. [1]

(ii) Write down, in terms of π , angle CBE . [1]

(iii) Find the perimeter of the shaded region. [5]

(iv) Find the area of the shaded region.

[3]

11 (a) A function f is such that $f(x) = x^2 + 6x + 4$ for $x \geq 0$.

(i) Show that $x^2 + 6x + 4$ can be written in the form $(x + a)^2 + b$, where a and b are integers.
[2]

(ii) Write down the range of f . [1]

(iii) Find f^{-1} and state its domain. [3]

(b) Functions g and h are such that, for $x \in \mathbb{R}$,

$$g(x) = e^x \quad \text{and} \quad h(x) = 5x + 2.$$

Solve $h^2g(x) = 37$.

[4]

Question 12 is printed on the next page.

- 12 The line $2x - y + 1 = 0$ meets the curve $x^2 + 3y = 19$ at the points A and B . The perpendicular bisector of the line AB meets the x -axis at the point C . Find the area of the triangle ABC . [9]

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