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0606/23

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 **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 $\triangle ABC$

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

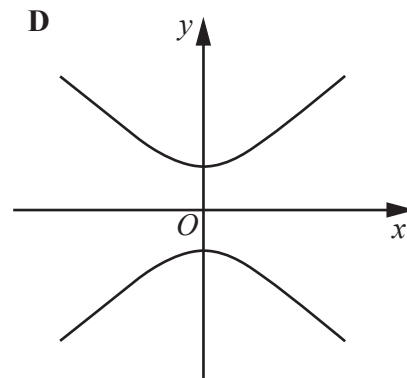
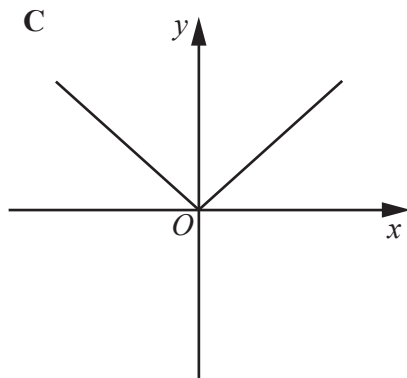
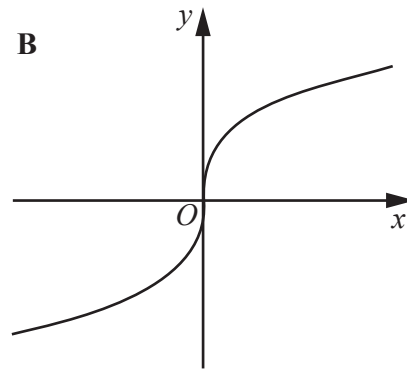
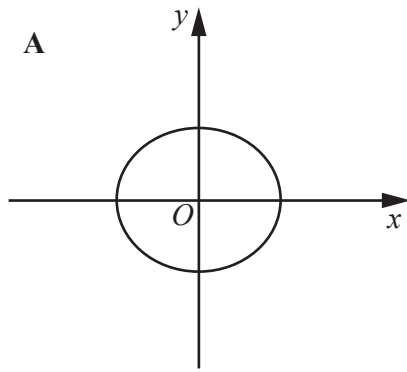
$$a^2 = b^2 + c^2 - 2bc \cos A$$

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

- 1 (a) Solve the equation $7^{2x+5} = 2.5$, giving your answer correct to 2 decimal places. [3]

- (b) Express $\frac{(5\sqrt{q})^3}{(625p^{12}q)^{\frac{1}{4}}}$ in the form $5^a p^b q^c$, where a , b and c are constants. [3]

2

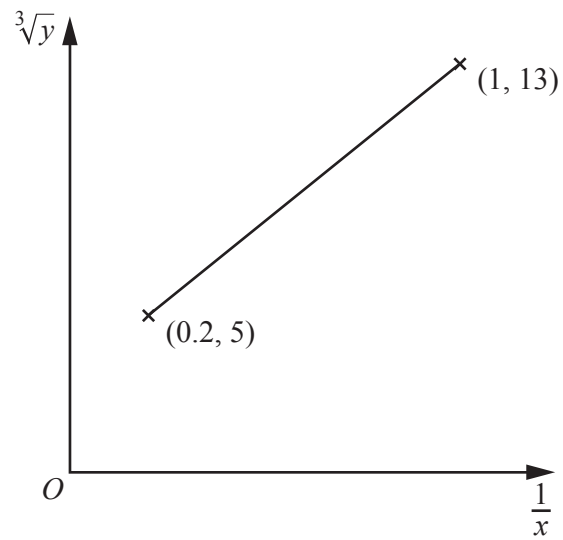


The four graphs above are labelled **A**, **B**, **C** and **D**.

(i) Write down the letter of each graph that represents a function, giving a reason for your choice. [2]

(ii) Write down the letter of each graph that represents a function which has an inverse, giving a reason for your choice. [2]

3



Variables x and y are such that when $\sqrt[3]{y}$ is plotted against $\frac{1}{x}$, a straight line graph passing through the points (0.2, 5) and (1, 13) is obtained. Express y in terms of x . [4]

- 4 (a) Vectors $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ are such that $\mathbf{a} = \begin{pmatrix} 5 \\ -6 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 11 \\ -15 \end{pmatrix}$ and $3\mathbf{a} + \mathbf{c} = \mathbf{b}$.

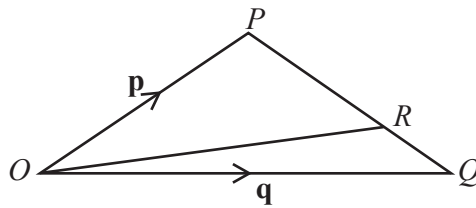
(i) Find $\mathbf{c}$.

[1]

(ii) Find the unit vector in the direction of $\mathbf{b}$.

[2]

(b)



In the diagram, $\vec{OP} = \mathbf{p}$ and $\vec{OQ} = \mathbf{q}$. The point R lies on PQ such that $PR = 3RQ$. Find $\vec{OR}$ in terms of $\mathbf{p}$ and $\mathbf{q}$, simplifying your answer.

[3]

5 (a) How many 5-digit numbers are there that have 5 different digits and are divisible by 5? [3]

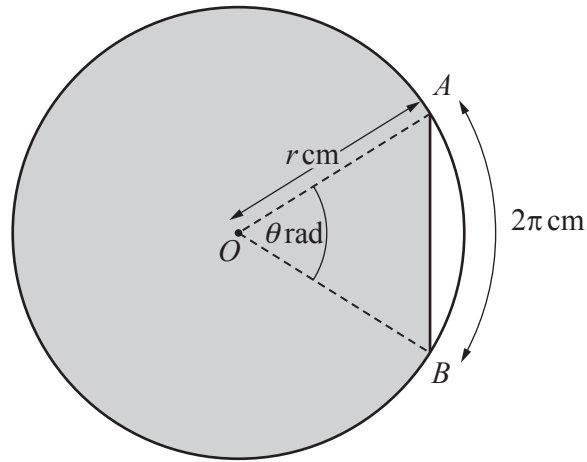
(b) A committee of 8 people is to be selected from 9 men and 5 women. Find the number of different committees that can be selected if the committee must have at least 4 women. [3]

- 6 The first three terms of the binomial expansion of $(2 - ax)^n$ are $64 - 16bx + 100bx^2$. Find the value of each of the integers n , a and b . [7]

7 Differentiate with respect to x ,

(i) $(1 + 4x)^{10} \cos x$, [4]

(ii) $\frac{e^{4x-5}}{\tan x}$. [4]



The diagram shows a circle, centre O of radius r cm, and a chord AB . Angle $AOB = \theta$ radians. The length of the major arc AB is 5 times the length of the minor arc AB . The minor arc AB has length 2π cm.

(i) Find the value of θ and of r . [2]

(ii) Calculate the exact perimeter of the shaded segment. [2]

(iii) Calculate the exact area of the shaded segment. [4]

- 9 The functions f and g are defined, for $x > 1$, by

$$\begin{aligned}f(x) &= 9\sqrt{x-1}, \\g(x) &= x^2 + 2.\end{aligned}$$

- (i) Find an expression for $f^{-1}(x)$, stating its domain. [3]

- (ii) Find the exact value of $fg(7)$. [2]

- (iii) Solve $gf(x) = 5x^2 + 83x - 95$. [4]

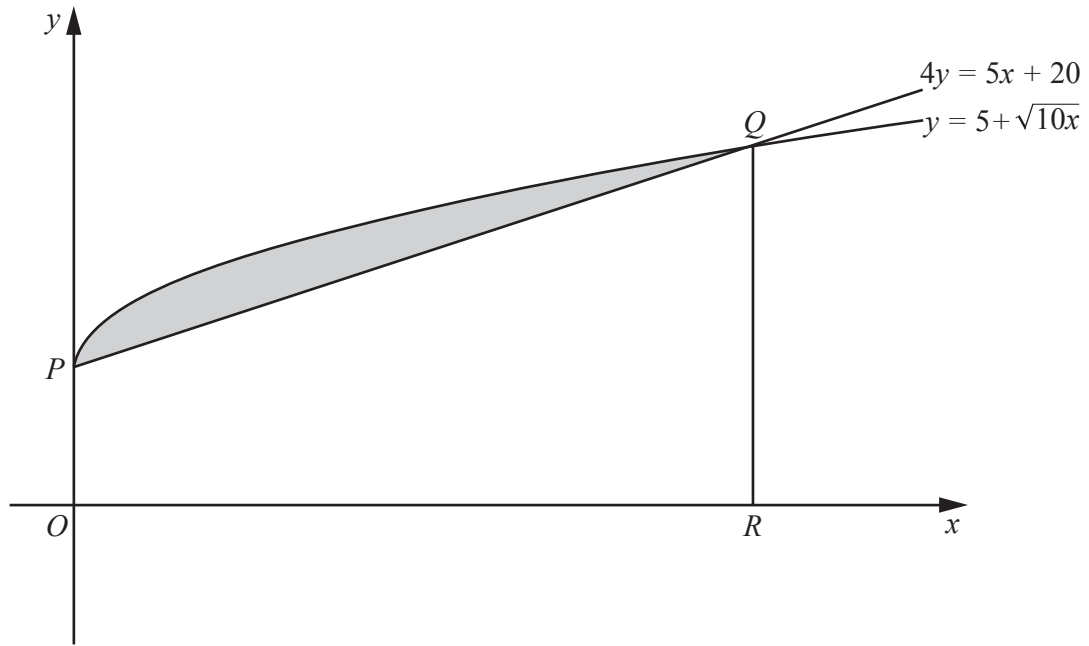
10 Solve the equation

(a) $2|\sin x| = 1$ for $-\pi \leq x \leq \pi$ radians, [3]

(b) $3 \tan(2y + 15^\circ) = 1$ for $0^\circ \leq y \leq 180^\circ$, [4]

(c) $3 \cot^2 z = \operatorname{cosec}^2 z - 7 \operatorname{cosec} z + 1$ for $0^\circ \leq z \leq 360^\circ$. [5]

11



The diagram shows part of the curve $y = 5 + \sqrt{10x}$ and the line $4y = 5x + 20$. The line and curve intersect at the points $P(0, 5)$ and Q . The line QR is parallel to the y -axis.

- (i) Find the coordinates of Q .

[4]

- (ii) Find the area of the shaded region. You must show all your working.

[6]

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