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0606/22

May/June 2013

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 **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*

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

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

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

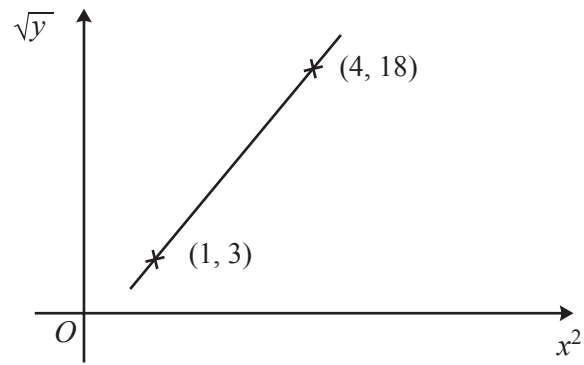
Formulae for $\triangle ABC$

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

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

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

1



For
Examiner's
Use

Variables x and y are such that when $\sqrt{y}$ is plotted against x^2 a straight line graph passing through the points (1, 3) and (4, 18) is obtained. Express y in terms of x . [4]

- 2 (a) Solve the equation $3^{p+1} = 0.7$, giving your answer to 2 decimal places.

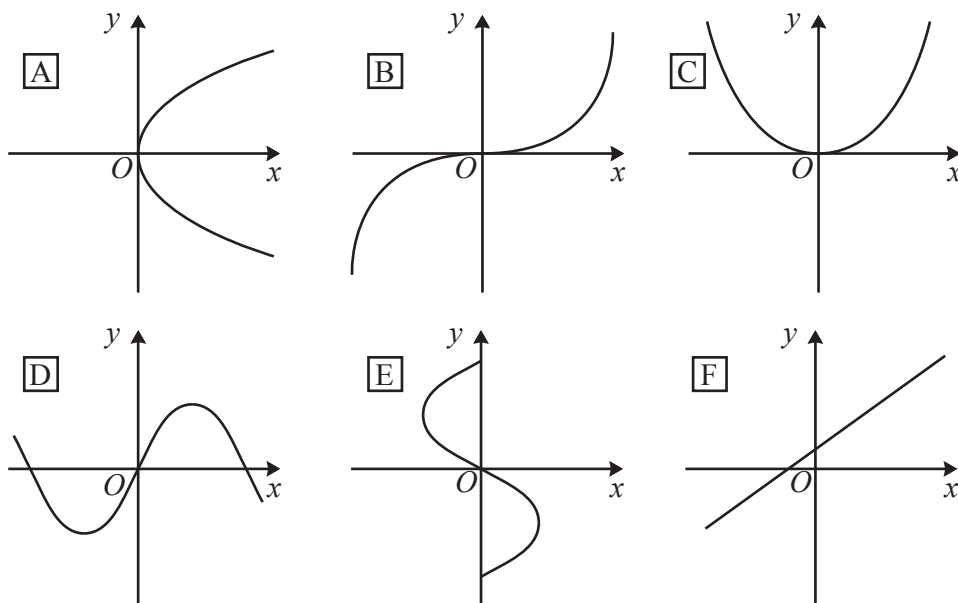
[3]

For
Examiner's
Use

- (b) Express $\frac{y \times (4x^3)^2}{\sqrt{8y^3}}$ in the form $2^a \times x^b \times y^c$, where a , b and c are constants.

[3]

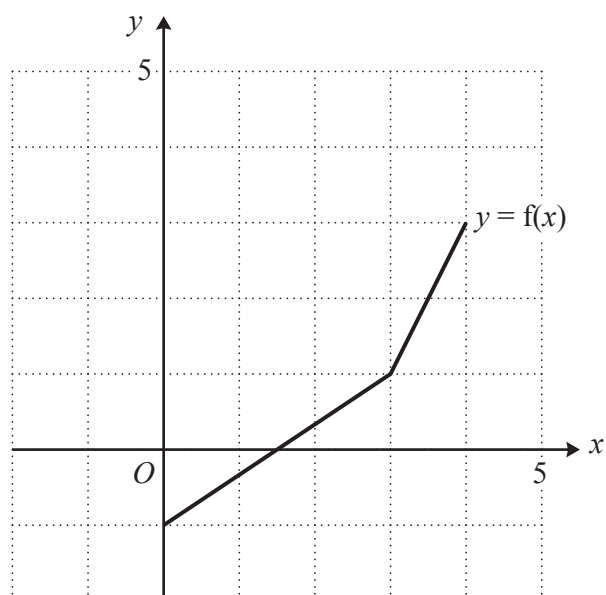
3 (a)



(i) Write down the letter of each graph which does **not** represent a function. [2]

(ii) Write down the letter of each graph which represents a function that does **not** have an inverse. [2]

(b)



The diagram shows the graph of a function $y = f(x)$. On the same axes sketch the graph of $y = f^{-1}(x)$. [2]

- 4 The position vectors of the points A and B , relative to an origin O , are $4\mathbf{i} - 21\mathbf{j}$ and $22\mathbf{i} - 30\mathbf{j}$ respectively. The point C lies on AB such that $\overrightarrow{AB} = 3\overrightarrow{AC}$.

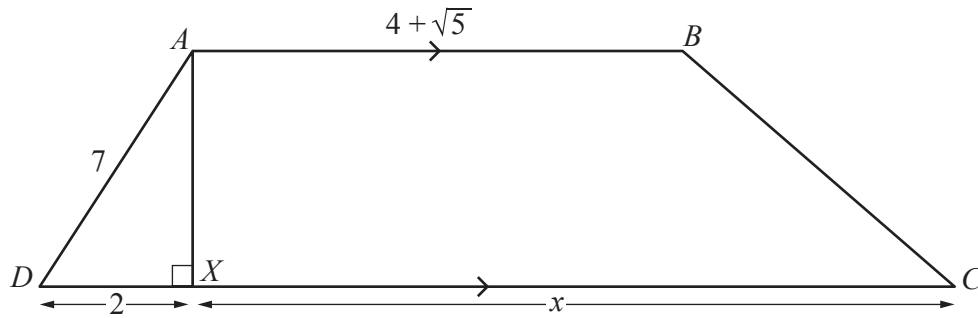
For
Examiner's
Use

- (i) Find the position vector of C relative to O . [4]

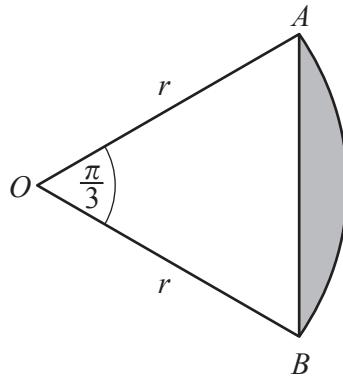
- (ii) Find the unit vector in the direction $\overrightarrow{OC}$. [2]

5 Calculators must not be used in this question.

For
Examiner's
Use



The diagram shows a trapezium $ABCD$ in which $AD = 7\text{ cm}$ and $AB = (4 + \sqrt{5})\text{ cm}$. AX is perpendicular to DC with $DX = 2\text{ cm}$ and $XC = x\text{ cm}$. Given that the area of trapezium $ABCD$ is $15(\sqrt{5} + 2)\text{ cm}^2$, obtain an expression for x in the form $a + b\sqrt{5}$, where a and b are integers. [6]



The shaded region in the diagram is a segment of a circle with centre O and radius r cm.

Angle $AOB = \frac{\pi}{3}$ radians.

- (i) Show that the perimeter of the segment is $r \left(\frac{3 + \pi}{3} \right)$ cm. [2]

- (ii) Given that the perimeter of the segment is 26 cm, find the value of r and the area of the segment. [5]

7 Differentiate, with respect to x ,

(i) $(3 - 5x)^{12}$,

[2]

For
Examiner's
Use

(ii) $x^2 \sin x$,

[2]

(iii) $\frac{\tan x}{1 + e^{2x}}$.

[4]

8 Solutions to this question by accurate drawing will not be accepted.*For
Examiner's
Use*

The points $A(-6, 2)$, $B(2, 6)$ and C are the vertices of a triangle.

(i) Find the equation of the line AB in the form $y = mx + c$. [2]

(ii) Given that angle $ABC = 90^\circ$, find the equation of BC . [2]

- (iii) Given that the length of AC is 10 units, find the coordinates of each of the two possible positions of point C . [4]

*For
Examiner's
Use*

- 9 (a) The graph of $y = k(3^x) + c$ passes through the points (0, 14) and (−2, 6). Find the value of k and of c . [3]

For
Examiner's
Use

- (b) The variables x and y are connected by the equation $y = e^x + 25 - 24e^{-x}$.

- (i) Find the value of y when $x = 4$. [1]

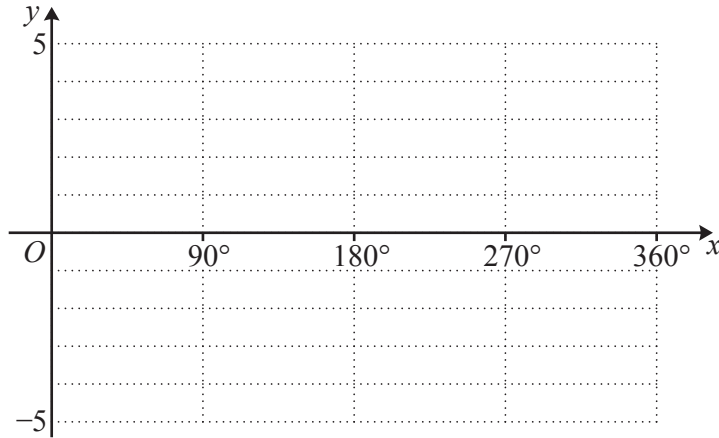
- (ii) Find the value of e^x when $y = 20$ and hence find the corresponding value of x . [4]

10 (a) The function f is defined, for $0^\circ \leq x \leq 360^\circ$, by $f(x) = 1 + 3 \cos 2x$.

(i) Sketch the graph of $y = f(x)$ on the axes below.

[4]

For
Examiner's
Use



(ii) State the amplitude of f .

[1]

(iii) State the period of f .

[1]

(b) Given that $\cos x = p$, where $270^\circ < x < 360^\circ$, find $\operatorname{cosec} x$ in terms of p .

[3]

11 A curve has equation $y = 3x + \frac{1}{(x-4)^3}$.

For
Examiner's
Use

(i) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.

[4]

(ii) Show that the coordinates of the stationary points of the curve are (5, 16) and (3, 8). [2]

(iii) Determine the nature of each of these stationary points. [2]

(iv) Find $\int \left(3x + \frac{1}{(x-4)^3} \right) dx$.

[2]

For
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- (v) Hence find the area of the region enclosed by the curve, the line $x = 5$, the x -axis and the line $x = 6$.

[2]

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