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4037/13

October/November 2011

2 hours

No Additional Materials are required.

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 80.

For Examiner's Use	
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Total	

This document consists of **16** printed pages.

Mathematical FormulaeFor
Examiner's
Use**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 Given that $\frac{\left(6x^{\frac{3}{2}}y^{\frac{4}{5}}\right)^4}{2x^{\frac{1}{2}}y^{-1}} = ax^py^q$, find the values of the constants a , p and q .

[3] *For
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Use*

-
- 2 Express $\sqrt{\frac{1 - \cos^2 \theta}{4 \sec^2 \theta - 4}}$ in the form $k \cos \theta$, where k is a constant to be found.

[4]

3 (i) Given that $\mathbf{A} = \begin{pmatrix} 4 & 3 \\ -8 & -2 \end{pmatrix}$, find $\mathbf{A}^{-1}$.

[2]

For
Examiner's
Use

(ii) Hence find the matrix $\mathbf{M}$ such that $\begin{pmatrix} 4 & 3 \\ -8 & -2 \end{pmatrix} \mathbf{M} = \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$.

[3]

- 4 (a) Sets A and B are such that $n(A) = 11$, $n(B) = 13$ and $n(A \cup B) = 18$.
Find $n(A \cap B)$.

[2]

For
Examiner's
Use

- (b) Sets $\mathcal{C}$, X and Y are such that

$$\mathcal{C} = \{\theta: 0 \leq \theta \leq 2\pi\}, X = \{\theta: \sin \theta = -0.5\}, Y = \left\{\theta: \sec^2 \theta = \frac{4}{3}\right\}.$$

- (i) Find, in terms of π , the elements of the set X .

[1]

- (ii) Find, in terms of π , the elements of the set Y .

[2]

- (iii) Use set notation to describe the relationship between the sets X and Y .

[1]

5 It is given that $\lg p^3 q = 10a$ and $\lg \left(\frac{p}{q^2} \right) = a$.

For
Examiner's
Use

(i) Find, in terms of a , expressions for $\lg p$ and $\lg q$.

[5]

(ii) Find the value of $\log_p q$.

[1]

6 A curve has equation $y = 6 \cos \frac{x}{2} + 4 \sin \frac{x}{2}$, for $0 < x < 2\pi$ radians.

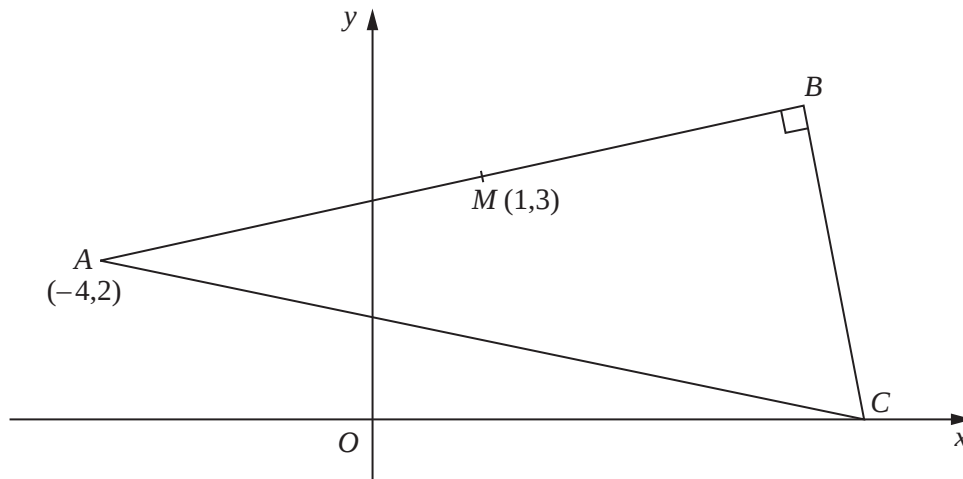
For
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Use

(i) Find the x -coordinate of the stationary point on the curve.

[5]

(ii) Determine the nature of this stationary point.

[2]



The figure shows a right-angled triangle ABC , where the point A has coordinates $(-4, 2)$, the angle B is 90° and the point C lies on the x -axis. The point $M(1, 3)$ is the midpoint of AB . Find the area of the triangle ABC .

[7]

8 Vectors $\mathbf{a}$ and $\mathbf{b}$ are such that $\mathbf{a} = \begin{pmatrix} 3 + m \\ 5 - 2n \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 4 - 2n \\ 10 + 3m \end{pmatrix}$.

(i) Given that $3\mathbf{a} + \mathbf{b} = \begin{pmatrix} 1 + n \\ -5 \end{pmatrix}$, find the value of m and of n . [4]

(ii) Show that the magnitude of $\mathbf{b}$ is $k\sqrt{5}$, where k is an integer to be found. [2]

(iii) Find the unit vector in the direction of $\mathbf{b}$. [1]

9 The function f is defined, for $0^\circ \leq x \leq 360^\circ$, by $f(x) = 2 \sin 3x - 1$.

For
Examiner's
Use

(i) State the amplitude and period of f . [2]

(ii) State the maximum value of f and the corresponding values of x . [3]

(iii) Sketch the graph of f . [2]

10 (a) Differentiate $\tan(3x + 2)$ with respect to x .

[2]

For
Examiner's
Use

(b) Differentiate $(\sqrt{x} + 1)^{\frac{2}{3}}$ with respect to x .

[3]

(c) Differentiate $\frac{\ln(x^3 - 1)}{2x + 3}$ with respect to x .

[3]

- 11 A particle moves in a straight line so that, t s after leaving a fixed point O , its velocity v ms^{-1} is given by $v = 3e^{2t} + 4t$.

For
Examiner's
Use

(i) Find the initial velocity of the particle. [1]

(ii) Find the initial acceleration of the particle. [3]

- (iii) Find the distance travelled by the particle in the third second.

[4]

*For
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Use*

12 Answer only **one** of the following two alternatives.

For
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Use

EITHER

A function f is such that $f(x) = \ln(5x - 10)$, for $x > 2$.

- (i) State the range of f . [1]
- (ii) Find $f^{-1}(x)$. [3]
- (iii) State the range of f^{-1} . [1]
- (iv) Solve $f(x) = 0$. [2]

A function g is such that $g(x) = 2x - \ln 2$, for $x \in \mathbb{R}$.

- (v) Solve $gf(x) = f(x^2)$. [5]

OR

A function f is such that $f(x) = 4e^{-x} + 2$, for $x \in \mathbb{R}$.

- (i) State the range of f . [1]
- (ii) Solve $f(x) = 26$. [2]
- (iii) Find $f^{-1}(x)$. [3]
- (iv) State the domain of f^{-1} . [1]

A function g is such that $g(x) = 2e^x - 4$, for $x \in \mathbb{R}$.

- (v) Using the substitution $t = e^x$ or otherwise, solve $g(x) = f(x)$. [5]

Start your answer to Question 12 here.

Indicate which question you are answering.

EITHER	
OR	

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This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for letter height. The entire page is otherwise blank, with no margins, text, or other markings.

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

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