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0606/21

May/June 2011

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.

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This document consists of **14** printed pages and **2** blank 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 Without using a calculator, express $\frac{(5 + 2\sqrt{3})^2}{2 + \sqrt{3}}$ in the form $p + q\sqrt{3}$, where p and q are integers. [4]

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- 2 (i) Find the coefficient of x^3 in the expansion of $\left(1 - \frac{x}{2}\right)^{12}$. [2]

- (ii) Find the coefficient of x^3 in the expansion of $(1 + 4x)\left(1 - \frac{x}{2}\right)^{12}$. [3]

- 3 Relative to an origin O , the position vectors of the points A and B are $\mathbf{i} - 4\mathbf{j}$ and $7\mathbf{i} + 20\mathbf{j}$ respectively. The point C lies on AB and is such that $\vec{AC} = \frac{2}{3} \vec{AB}$. Find the position vector of C and the magnitude of this vector. [5]

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- 4 Find the set of values of k for which the line $y = 2x - 5$ cuts the curve $y = x^2 + kx + 11$ in two distinct points. [6]

*For
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Use*

- 5 The expression $x^3 + 8x^2 + px - 25$ leaves a remainder of R when divided by $x - 1$ and a remainder of $-R$ when divided by $x + 2$.

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Use

(i) Find the value of p . [4]

(ii) Hence find the remainder when the expression is divided by $x + 3$. [2]

6 (a) A shelf contains 8 different travel books, of which 5 are about Europe and 3 are about Africa.

(i) Find the number of different ways the books can be arranged if there are no restrictions. [2]

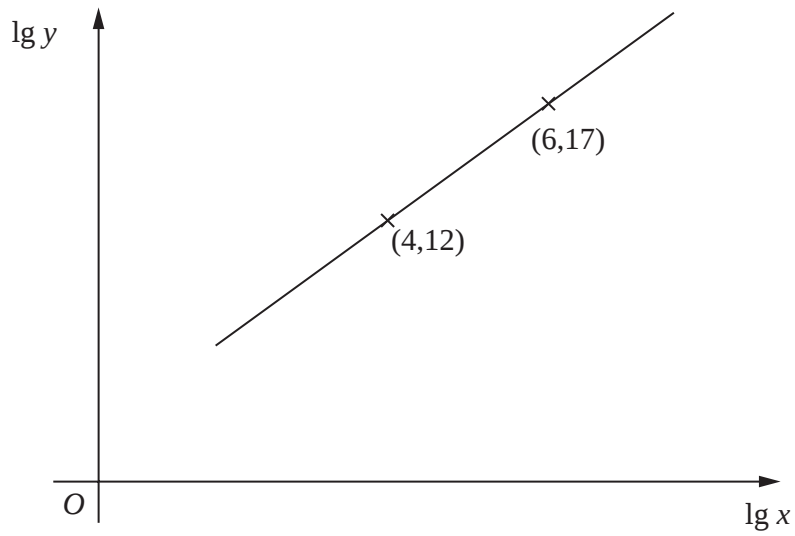
(ii) Find the number of different ways the books can be arranged if the 5 books about Europe are kept together. [2]

(b) 3 DVDs and 2 videotapes are to be selected from a collection of 7 DVDs and 5 videotapes.

Calculate the number of different selections that could be made. [3]

- 7 The variables x and y are related so that when $\lg y$ is plotted against $\lg x$ a straight line graph passing through the points $(4, 12)$ and $(6, 17)$ is obtained.

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- (i) Express y in terms of x , giving your answer in the form $y = ax^b$. [6]

- (ii) Find the value of x when $y = 300$. [2]

- 8 The temperature, T° Celsius, of an object, t minutes after it is removed from a heat source, is given by

$$T = 55e^{-0.1t} + 15.$$

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Use

- (i) Find the temperature of the object at the instant it is removed from the heat source. [1]
- (ii) Find the temperature of the object when $t = 8$. [1]
- (iii) Find the value of t when $T = 25$. [3]
- (iv) Find the rate of change of T when $t = 16$. [3]

- 9 A coastguard station receives a distress call from a ship which is travelling at 15 km h^{-1} on a bearing of 150° . A lifeboat leaves the coastguard station at 15 00 hours; at this time the ship is at a distance of 30 km on a bearing of 270° . The lifeboat travels in a straight line at constant speed and reaches the ship at 15 40 hours.

(i) Find the speed of the lifeboat. [5]

(ii) Find the bearing on which the lifeboat travelled. [3]

10 (i) Solve the equation $3\sin x + 4\cos x = 0$ for $0^\circ < x < 360^\circ$.

[3]

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(ii) Solve the equation $6\cos y + 6\sec y = 13$ for $0^\circ < y < 360^\circ$.

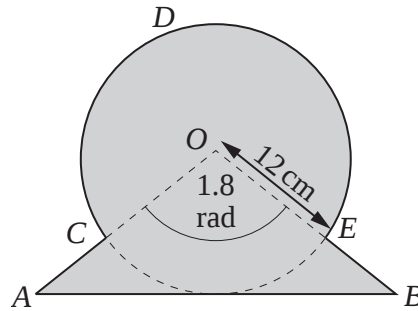
[5]

(iii) Solve the equation $\sin(2z - 3) = 0.7$ for $0 < z < \pi$ radians.

[3]

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

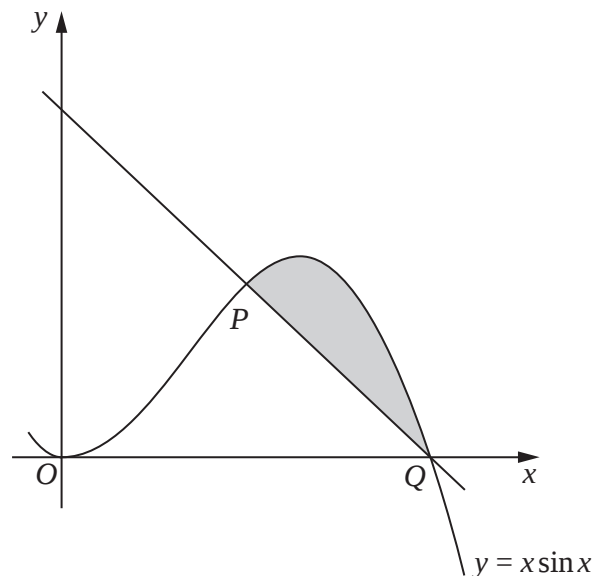
EITHER



The diagram shows an isosceles triangle AOB and a sector $OCDEO$ of a circle with centre O . The line AB is a tangent to the circle. Angle $AOB = 1.8$ radians and the radius of the circle is 12 cm.

- (i) Show that the distance $AC = 7.3$ cm to 1 decimal place. [2]
- (ii) Find the perimeter of the shaded region. [6]
- (iii) Find the area of the shaded region. [4]

OR



The diagram shows part of the curve $y = x \sin x$ and the normal to the curve at the point $P\left(\frac{\pi}{2}, \frac{\pi}{2}\right)$. The curve passes through the point $Q(\pi, 0)$.

- (i) Show that the normal to the curve at P passes through the point Q . [4]
- (ii) Given that $\frac{d}{dx}(x \cos x) = \cos x - x \sin x$, find $\int x \sin x dx$. [3]
- (iii) Find the area of the shaded region. [5]

Indicate which question you are answering.

EITHER	
OR	

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