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0606/13

May/June 2013

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 **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 ΔABC

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

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

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

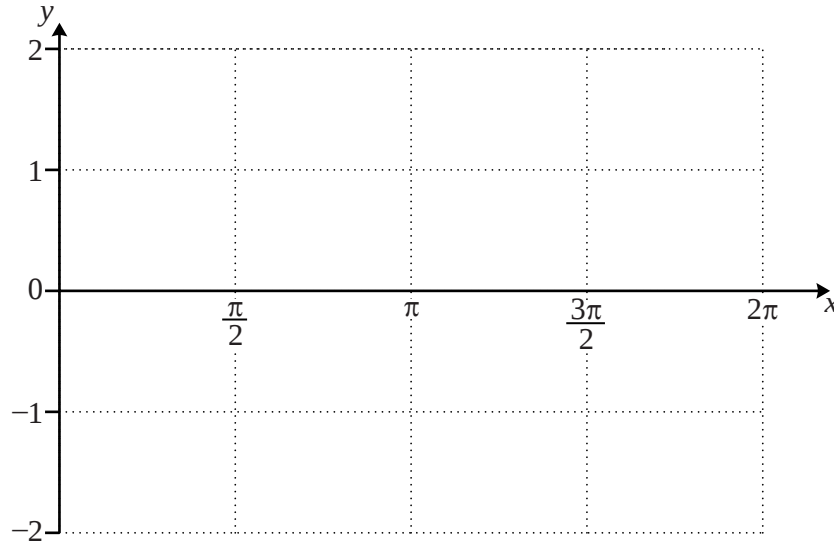
1 On the axes below sketch, for $0 \leq x \leq 2\pi$, the graph of

(i) $y = \cos x - 1$,

[2]

(ii) $y = \sin 2x$.

[2]

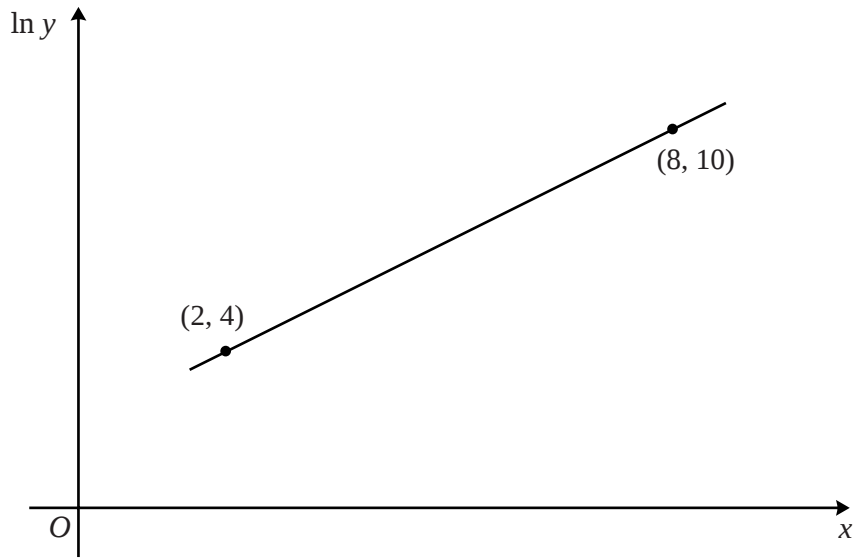


(iii) State the number of solutions of the equation $\cos x - \sin 2x = 1$, for $0 \leq x \leq 2\pi$.

[1]

- 2 Variables x and y are such that $y = Ab^x$, where A and b are constants. The diagram shows the graph of $\ln y$ against x , passing through the points $(2, 4)$ and $(8, 10)$.

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Find the value of A and of b .

[5]

- 3 A committee of 6 members is to be selected from 5 men and 9 women. Find the number of different committees that could be selected if

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(i) there are no restrictions, [1]

(ii) there are exactly 3 men and 3 women on the committee, [2]

(iii) there is at least 1 man on the committee. [3]

- 4 (i) Given that $\log_4 x = \frac{1}{2}$, find the value of x .

[1]

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- (ii) Solve $2\log_4 y - \log_4(5y - 12) = \frac{1}{2}$.

[4]

5 (i) Find $\int \left(1 - \frac{6}{x^2}\right) dx$.

[2]

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(ii) Hence find the value of the positive constant k for which $\int_k^{3k} \left(1 - \frac{6}{x^2}\right) dx = 2$.

[4]

- 6 (i) Given that $\mathbf{A} = \begin{pmatrix} 2 & -1 \\ 3 & 5 \end{pmatrix}$, find $\mathbf{A}^{-1}$.

[2]

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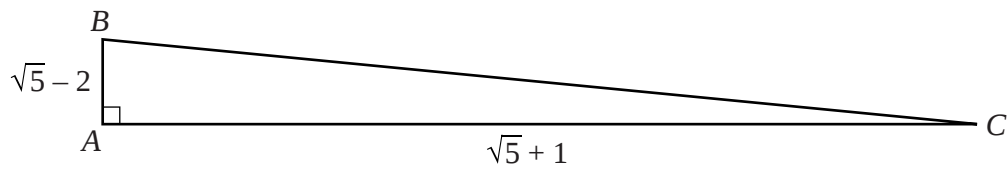
- (ii) Using your answer from part (i), or otherwise, find the values of a , b , c and d such that

$$\mathbf{A} \begin{pmatrix} a & b \\ c & -1 \end{pmatrix} = \begin{pmatrix} 7 & 5 \\ 17 & d \end{pmatrix}.$$

[5]

7 Calculators must not be used in this question.

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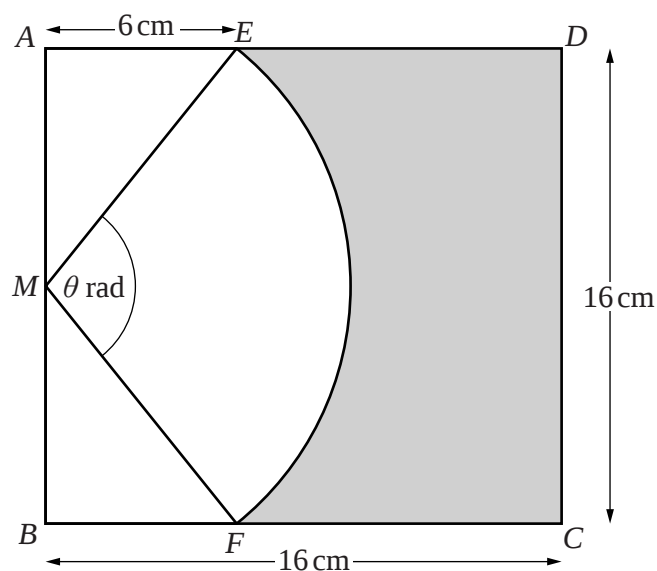


The diagram shows a triangle ABC in which angle $A = 90^\circ$. Sides AB and AC are $\sqrt{5} - 2$ and $\sqrt{5} + 1$ respectively. Find

(i) $\tan B$ in the form $a + b\sqrt{5}$, where a and b are integers, [3]

(ii) $\sec^2 B$ in the form $c + d\sqrt{5}$, where c and d are integers. [4]

8

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The diagram shows a square $ABCD$ of side 16 cm. M is the mid-point of AB . The points E and F are on AD and BC respectively such that $AE = BF = 6$ cm. EF is an arc of the circle centre M , such that angle EMF is θ radians.

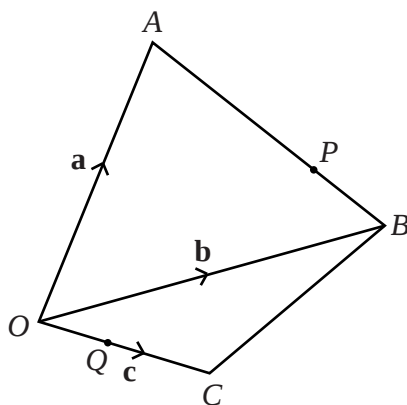
(i) Show that $\theta = 1.855$ radians, correct to 3 decimal places. [2]

(ii) Calculate the perimeter of the shaded region. [4]

(iii) Calculate the area of the shaded region.

[3]

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The figure shows points A , B and C with position vectors $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ respectively, relative to an origin O . The point P lies on AB such that $AP:AB = 3:4$. The point Q lies on OC such that $OQ:QC = 2:3$.

- (i) Express $\overrightarrow{AP}$ in terms of $\mathbf{a}$ and $\mathbf{b}$ and hence show that $\overrightarrow{OP} = \frac{1}{4}(\mathbf{a} + 3\mathbf{b})$. [3]

- (ii) Find $\overrightarrow{PQ}$ in terms of $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$. [3]

- (iii) Given that $5\overrightarrow{PQ} = 6\overrightarrow{BC}$, find **c** in terms of **a** and **b**.

[2]

*For
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Use*

10 The point A , whose x -coordinate is 2, lies on the curve with equation $y = x^3 - 4x^2 + x + 1$.

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(i) Find the equation of the tangent to the curve at A .

[4]

This tangent meets the curve again at the point B .

(ii) Find the coordinates of B .

[4]

- (iii) Find the equation of the perpendicular bisector of the line AB .

[4]

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Question 11 is printed on the next page.

11 (a) Solve $2 \sin\left(x + \frac{\pi}{3}\right) = -1$ for $0 \leq x \leq 2\pi$ radians.

[4]

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(b) Solve $\tan y - 2 = \cot y$ for $0^\circ \leq y \leq 180^\circ$.

[6]

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