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0606/21

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 **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 $\triangle ABC$

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

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

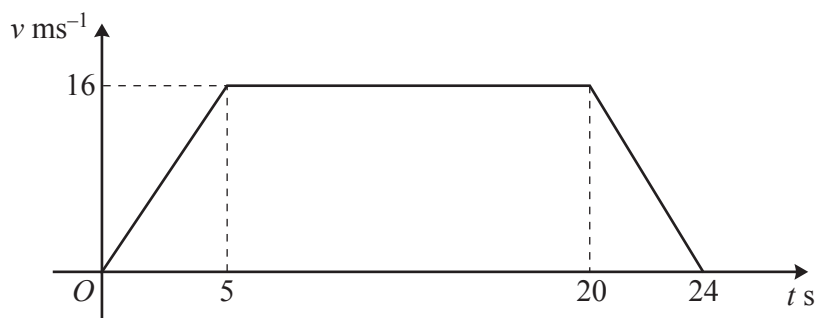
$$\Delta = \frac{1}{2} bc \sin A$$

1 Prove that $\left(\frac{1 + \sin \theta}{\cos \theta}\right)^2 + \left(\frac{1 - \sin \theta}{\cos \theta}\right)^2 = 2 + 4 \tan^2 \theta$.

[4]

*For
Examiner's
Use*

2

For
Examiner's
Use

The velocity-time graph represents the motion of a particle moving in a straight line.

(i) Find the acceleration during the first 5 seconds. [1]

(ii) Find the length of time for which the particle is travelling with constant velocity. [1]

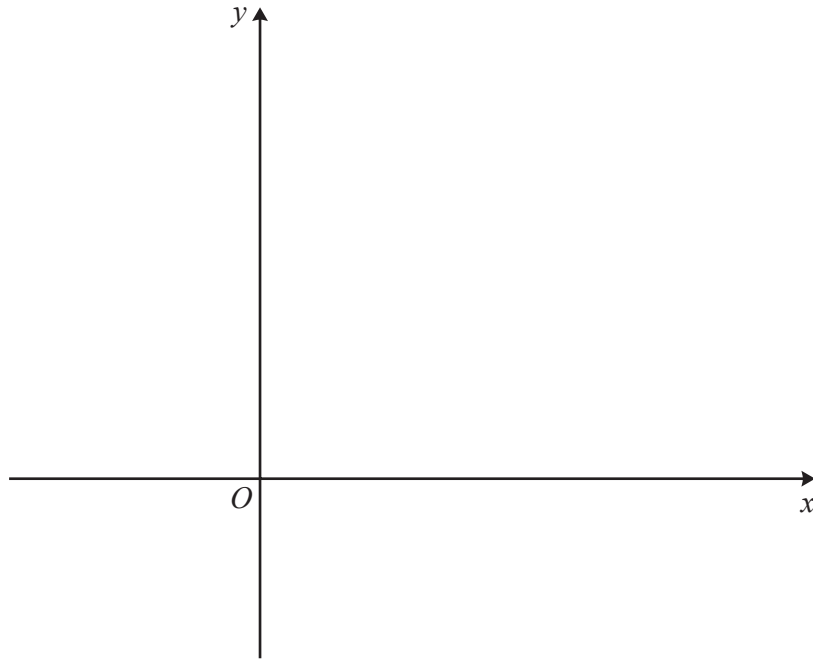
(iii) Find the total distance travelled by the particle. [3]

- 3 Variables x and y are related by the equation $y = 10 - 4 \sin^2 x$, where $0 \leq x \leq \frac{\pi}{2}$. Given that x is increasing at a rate of 0.2 radians per second, find the corresponding rate of change of y when $y = 8$. [6]

For
Examiner's
Use

- 4 (i) Sketch the graph of $y = |4x - 2|$ on the axes below, showing the coordinates of the points where the graph meets the axes. [3]

For
Examiner's
Use



- (ii) Solve the equation $|4x - 2| = x$. [3]

5

For
Examiner's
Use

A piece of wire of length 96 cm is formed into the rectangular shape $PQRSTU$ shown in the diagram. It is given that $PQ = TU = SR = x$ cm. It may be assumed that PQ and TU coincide and that TS and QR have the same length.

(i) Show that the area, A cm², enclosed by the wire is given by $A = \frac{96x - 3x^2}{2}$. [2]

(ii) Given that x can vary, find the stationary value of A and determine the nature of this stationary value. [4]

- 6 Find the equation of the normal to the curve $y = \frac{x^2 + 8}{x - 2}$ at the point on the curve where $x = 4$.
[6]

*For
Examiner's
Use*

- 7 (i) Find the first four terms in the expansion of $(2 + x)^6$ in ascending powers of x .

[3]

*For
Examiner's
Use*

- (ii) Hence find the coefficient of x^3 in the expansion of $(1 + 3x)(1 - x)(2 + x)^6$.

[4]

- 8 The line $y = 2x - 8$ cuts the curve $2x^2 + y^2 - 5xy + 32 = 0$ at the points A and B . Find the length of the line AB . [7]

For
Examiner's
Use

- 9 It is given that $x \in \mathbb{R}$ and that
- $$\mathcal{C} = \{x : -5 < x < 12\},$$
- $$S = \{x : 5x + 24 > x^2\},$$
- $$T = \{x : 2x + 7 > 15\}.$$

For
Examiner's
Use

Find the values of x such that

(i) $x \in S,$ [3]

(ii) $x \in S \cup T,$ [2]

(iii) $x \in (S \cap T)'.$ [3]

- 10 A plane, whose speed in still air is 240 kmh^{-1} , flies directly from A to B , where B is 500 km from A on a bearing of 032° . There is a constant wind of 50 kmh^{-1} blowing from the west.

For
Examiner's
Use

- (i) Find the bearing on which the plane is steered.

[4]

- (ii) Find, to the nearest minute, the time taken for the flight.

[4]

*For
Examiner's
Use*

11 A one-one function f is defined by $f(x) = (x - 1)^2 - 5$ for $x \geq k$.

(i) State the least value that k can take.

[1]

For
Examiner's
Use

For this least value of k

(ii) write down the range of f ,

[1]

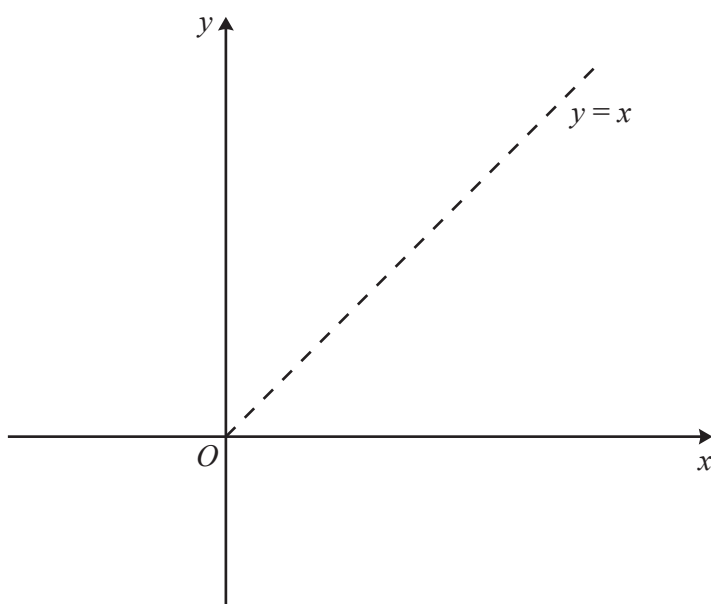
(iii) find $f^{-1}(x)$,

[2]

- (iv) sketch and label, on the axes below, the graph of $y = f(x)$ and of $y = f^{-1}(x)$,

[2]

For
Examiner's
Use



- (v) find the value of x for which $f(x) = f^{-1}(x)$.

[2]

Question 12 is printed on the next page.

- 12 The function $f(x) = x^3 + x^2 + ax + b$ is divisible by $x - 3$ and leaves a remainder of 20 when divided by $x + 1$.

(i) Show that $b = 6$ and find the value of a .

[4]

- (ii) Using your value of a and taking b as 6, find the non-integer roots of the equation $f(x) = 0$ in the form $p \pm \sqrt{q}$, where p and q are integers.

[5]