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4037/22

October/November 2013

2 hours

No Additional Materials are required.

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.



[Turn over

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 Find the set of values of x for which $x^2 < 6 - 5x$.

[3]

*For
Examiner's
Use*

2 Do not use a calculator in this question.

Express $\frac{(4\sqrt{5} - 2)^2}{\sqrt{5} - 1}$ in the form $p\sqrt{5} + q$, where p and q are integers.

[4]

*For
Examiner's
Use*

- 3 (i) Given that $y = \left(\frac{1}{4}x - 5\right)^8$, find $\frac{dy}{dx}$.

[2]

*For
Examiner's
Use*

- (ii) Hence find the approximate change in y as x increases from 12 to $12 + p$, where p is small.
[2]

4 Given that $\log_p X = 5$ and $\log_p Y = 2$, find

(i) $\log_p X^2$,

[1]

For
Examiner's
Use

(ii) $\log_p \frac{1}{X}$,

[1]

(iii) $\log_{XY} p$.

[2]

5 Solve the simultaneous equations

$$\frac{4^x}{256^y} = 1024,$$
$$3^{2x} \times 9^y = 243.$$

[5]

*For
Examiner's
Use*

- 6 (a) (i) Find the coefficient of x^3 in the expansion of $(1 - 2x)^6$.

[2]

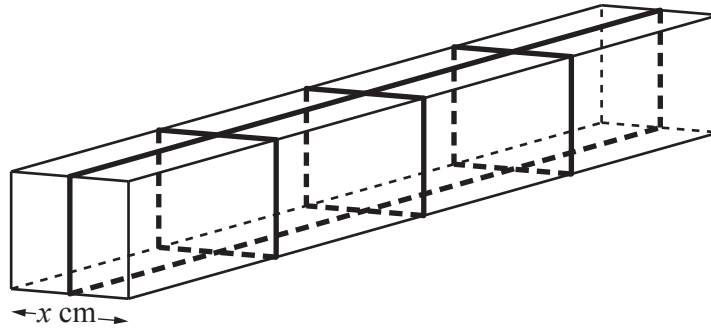
*For
Examiner's
Use*

- (ii) Find the coefficient of x^3 in the expansion of $\left(1 + \frac{x}{2}\right)(1 - 2x)^6$.

[3]

- (b) Expand $\left(2\sqrt{x} + \frac{1}{\sqrt{x}}\right)^4$ in a series of powers of x with integer coefficients.

[3]



The diagram shows a box in the shape of a cuboid with a square cross-section of side x cm. The volume of the box is 3500 cm^3 . Four pieces of tape are fastened round the box as shown. The pieces of tape are parallel to the edges of the box.

- (i) Given that the total length of the four pieces of tape is L cm, show that $L = 14x + \frac{7000}{x^2}$. [3]

- (ii) Given that x can vary, find the stationary value of L and determine the nature of this stationary value. [5]

- 8 The table shows experimental values of two variables x and y .

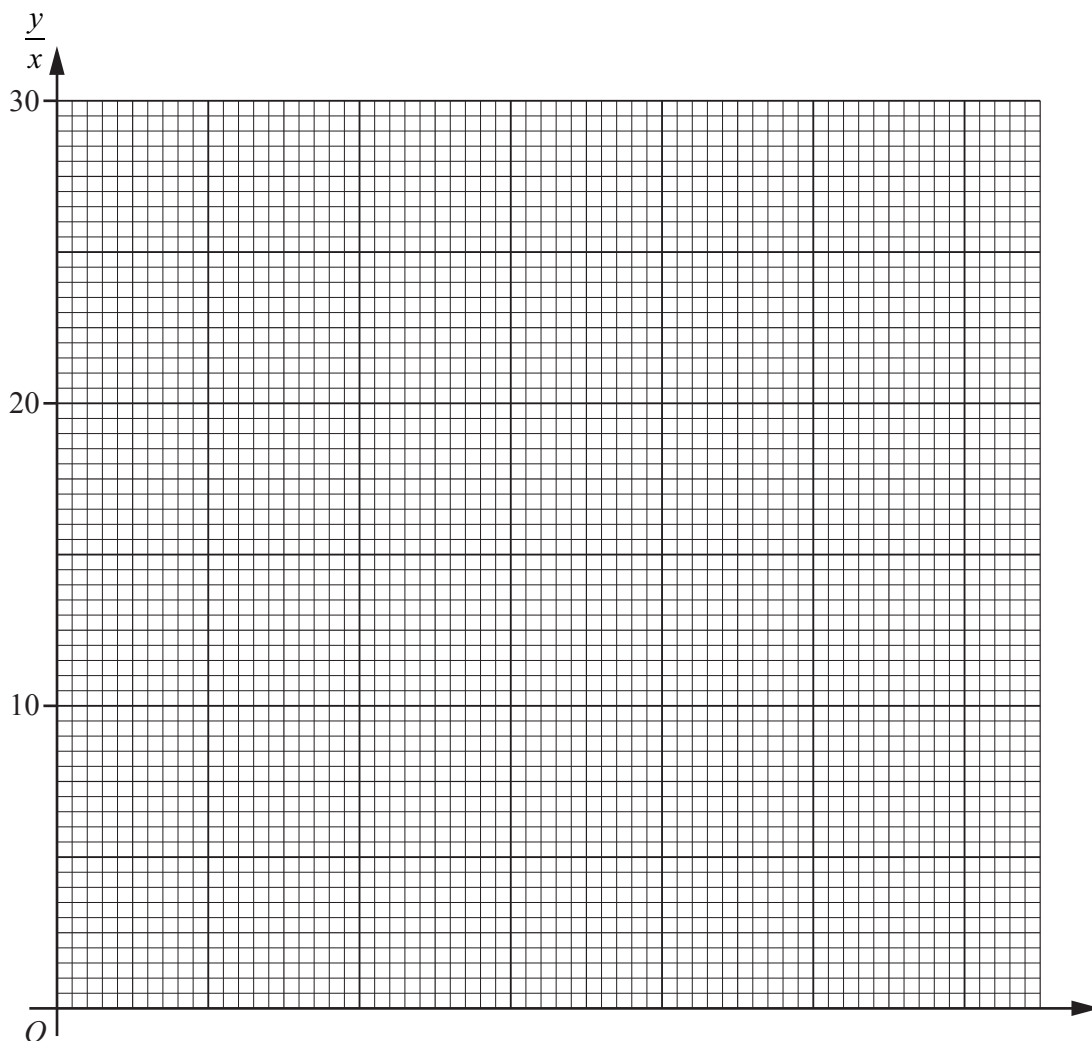
x	2	4	6	8
y	9.6	38.4	105	232

For
Examiner's
Use

It is known that x and y are related by the equation $y = ax^3 + bx$, where a and b are constants.

- (i) A straight line graph is to be drawn for this information with $\frac{y}{x}$ on the vertical axis. State the variable which must be plotted on the horizontal axis. [1]

- (ii) Draw this straight line graph on the grid below. [2]



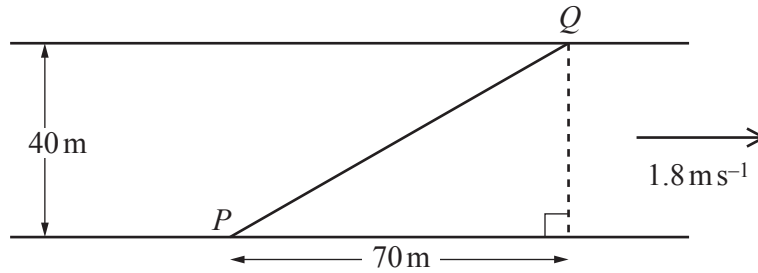
(iii) Use your graph to estimate the value of a and of b .

[3]

*For
Examiner's
Use*

(iv) Estimate the value of x for which $2y = 25x$.

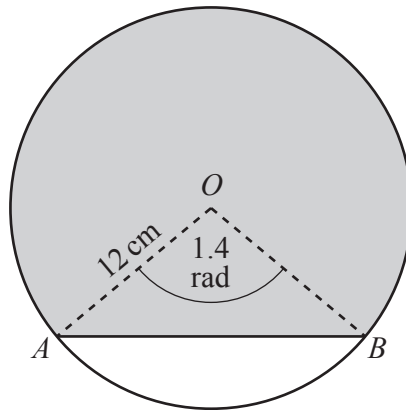
[2]



The diagram shows a river with parallel banks. The river is 40 m wide and is flowing with a speed of 1.8 ms^{-1} . A canoe travels in a straight line from a point P on one bank to a point Q on the opposite bank 70 m downstream from P . Given that the canoe takes 12 s to travel from P to Q , calculate the speed of the canoe in still water and the angle to the bank that the canoe was steered.

[8]

10

*For
Examiner's
Use*

The diagram shows a circle with centre O and a chord AB . The radius of the circle is 12 cm and angle AOB is 1.4 radians.

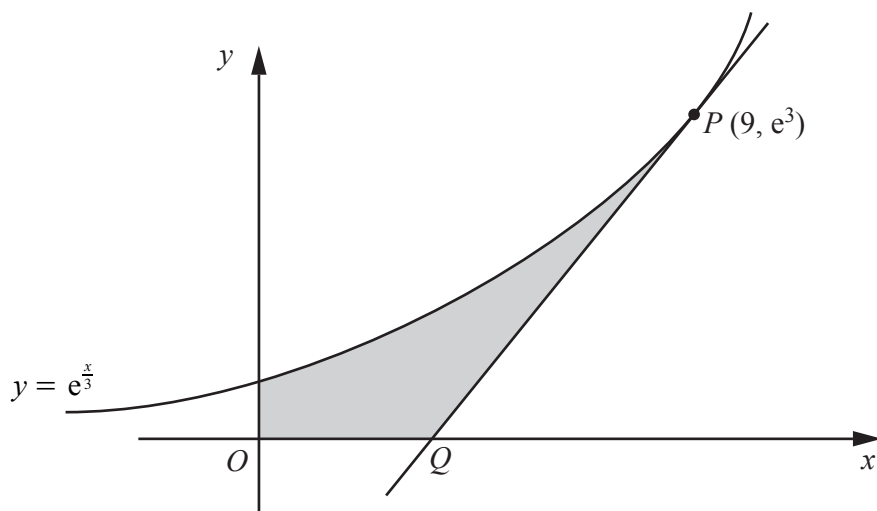
- (i) Find the perimeter of the shaded region.

[5]

- (ii) Find the area of the shaded region.

[4]

*For
Examiner's
Use*



The diagram shows part of the curve $y = e^{\frac{x}{3}}$. The tangent to the curve at $P(9, e^3)$ meets the x -axis at Q .

- (i) Find the coordinates of Q .

[4]

- (ii) Find the area of the shaded region bounded by the curve, the coordinate axes and the tangent to the curve at P . [6]

*For
Examiner's
Use*

12 (a) Solve the equation $2 \operatorname{cosec} x + \frac{7}{\cos x} = 0$ for $0^\circ \leq x \leq 360^\circ$.

[4]

*For
Examiner's
Use*

(b) Solve the equation $7 \sin(2y - 1) = 5$ for $0 \leq y \leq 5$ radians.

[5]

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