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## 0606/22

October/November 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 **18** 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 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*

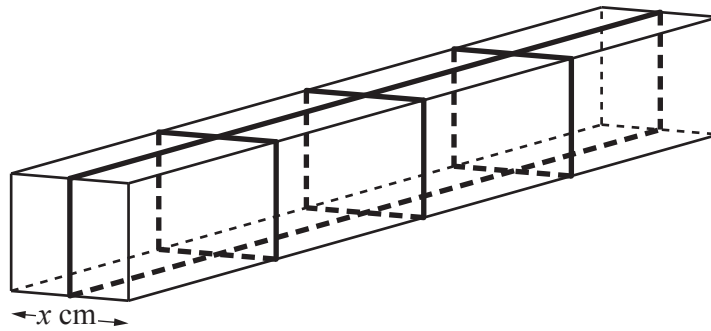
- (ii) Find the coefficient of  $x^3$  in the expansion of  $\left(1 + \frac{x}{2}\right)(1 - 2x)^6$ .

[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  $3500 \text{ cm}^3$ . 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  $y$ .

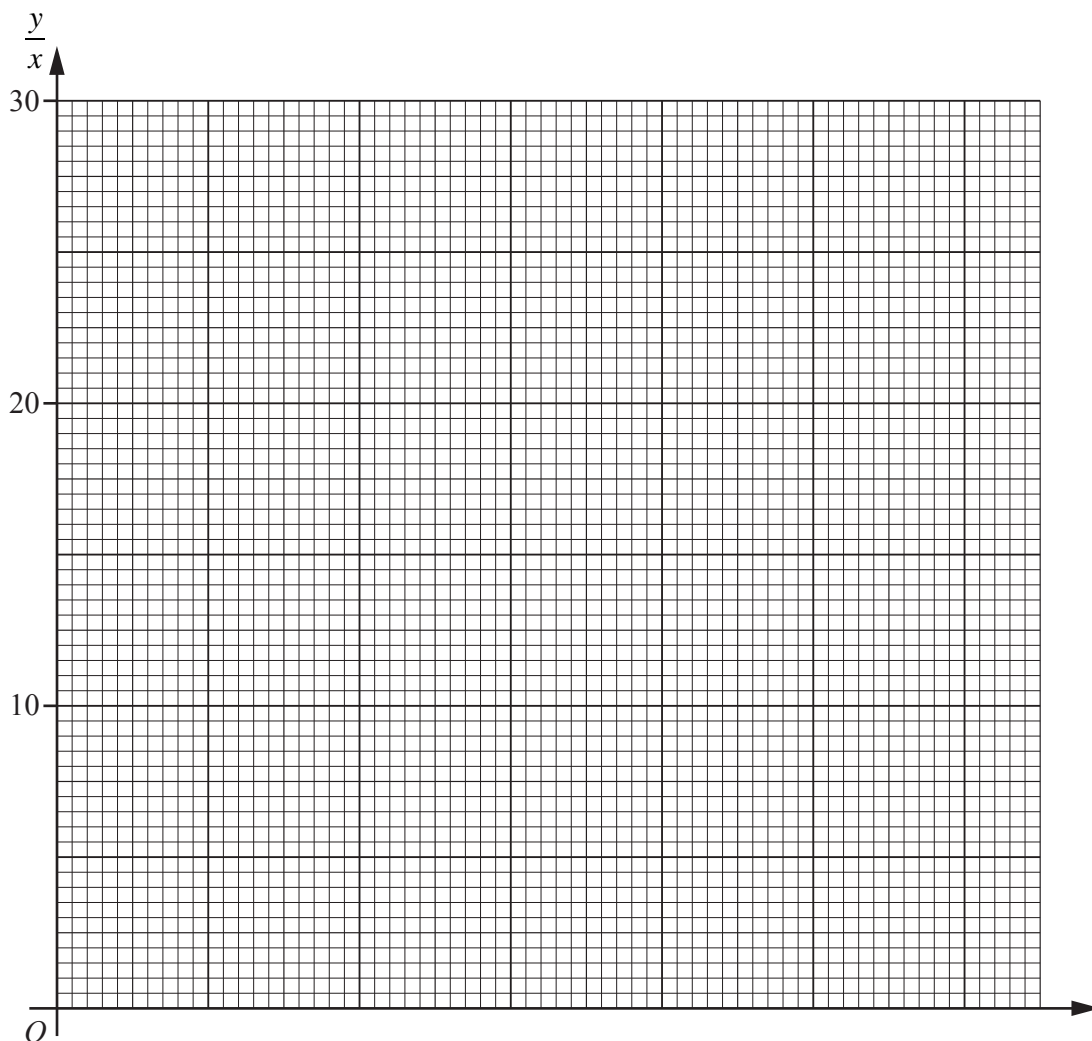
$x$	2	4	6	8
$y$	9.6	38.4	105	232

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]



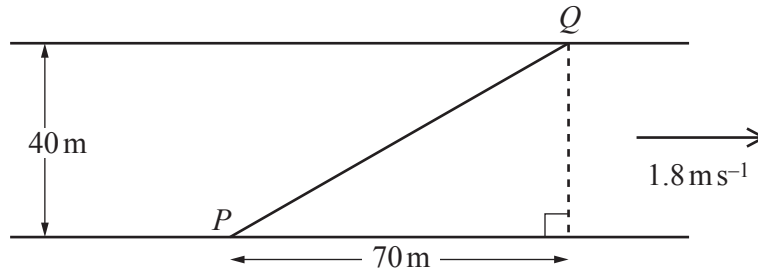
(iii) Use your graph to estimate the value of  $a$  and of  $b$ .

[3]

*For  
Examiner's  
Use*

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

[2]

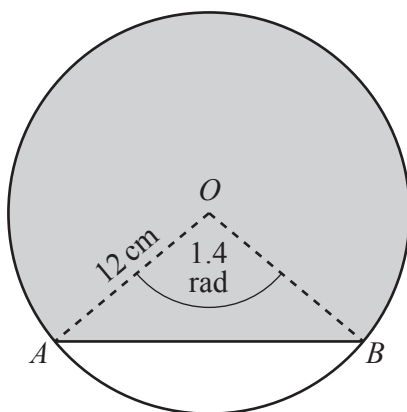


The diagram shows a river with parallel banks. The river is 40 m wide and is flowing with a speed of  $1.8 \text{ ms}^{-1}$ . A canoe travels in a straight line from a point  $P$  on one bank to a point  $Q$  on the opposite bank 70 m downstream from  $P$ . Given that the canoe takes 12 s to travel from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

[8]

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10

*For  
Examiner's  
Use*

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

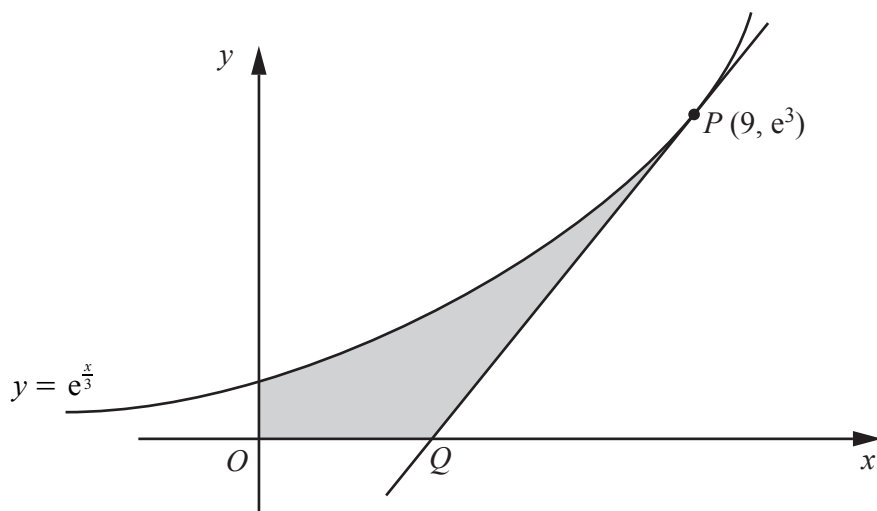
- (i) Find the perimeter of the shaded region.

[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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