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## 0606/21

October/November 2013

**2 hours**

Additional Materials: Electronic calculator

Write your Centre number, candidate number and name on all the work you hand in.  
Write in dark blue or black pen.  
You may use a pencil for any diagrams or graphs.  
Do not use staples, paper clips, highlighters, glue or correction fluid.  
**DO NOT WRITE IN ANY BARCODES.**

Answer **all** the questions.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

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

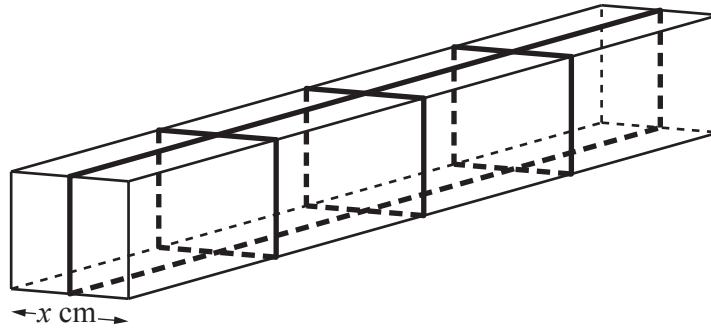
- (ii) Find the coefficient of  $x^3$  in the expansion of  $\left(1 + \frac{x}{2}\right)(1 - 2x)^6$ .

[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  $y$ .

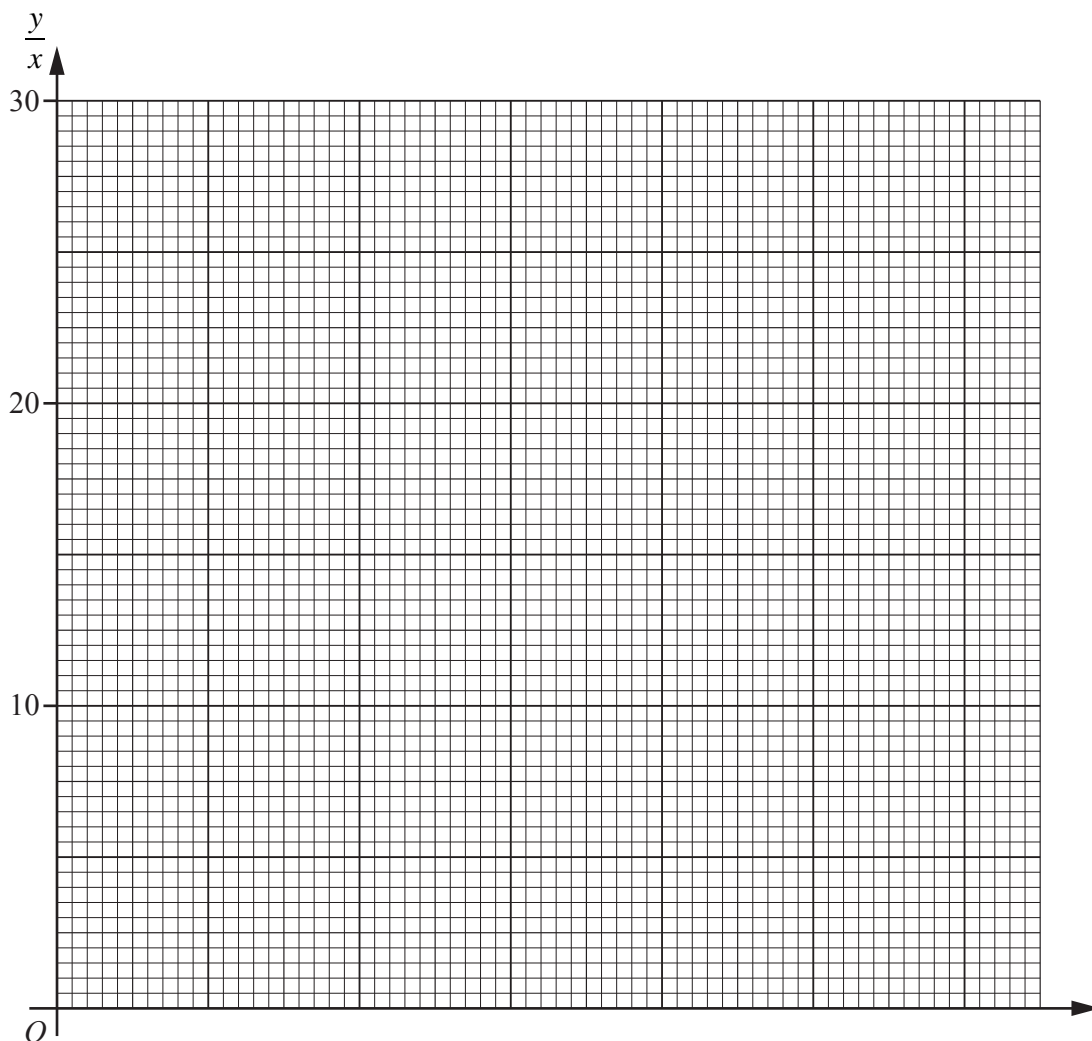
$x$	2	4	6	8
$y$	9.6	38.4	105	232

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]



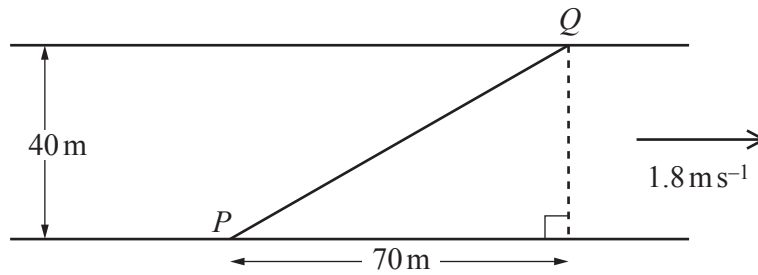
(iii) Use your graph to estimate the value of  $a$  and of  $b$ .

[3]

*For  
Examiner's  
Use*

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

[2]

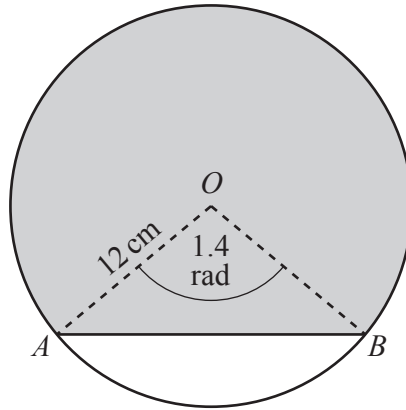


The diagram shows a river with parallel banks. The river is 40 m wide and is flowing with a speed of  $1.8 \text{ ms}^{-1}$ . A canoe travels in a straight line from a point  $P$  on one bank to a point  $Q$  on the opposite bank 70 m downstream from  $P$ . Given that the canoe takes 12 s to travel from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

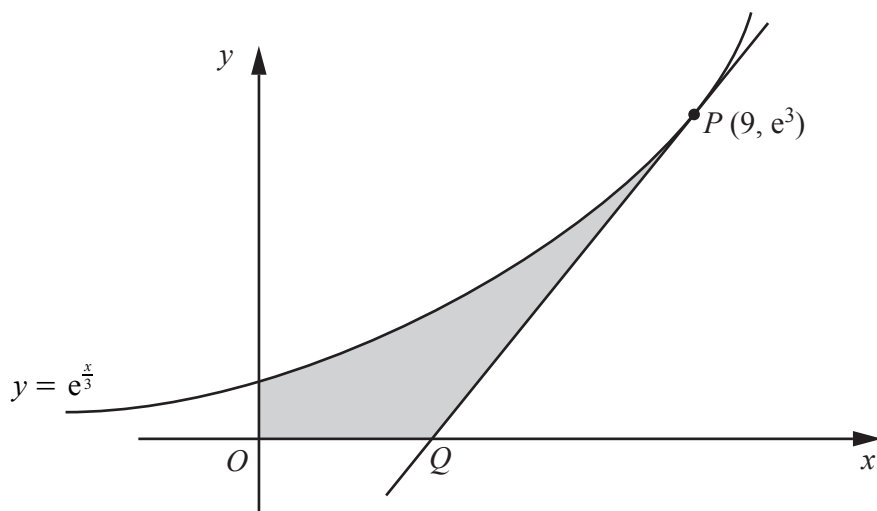
- (i) Find the perimeter of the shaded region.

[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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