UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

3031944723

ADDITIONAL MATHEMATICS **0606/22**

Paper 2 **October/November 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

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.

DC (SJW/SW) 81064

UNIVERSITY *of* CAMBRIDGE International Examinations

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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

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

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

2 **Do not use a calculator in this question.**

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

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

(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]

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

(iii) $\log_{XY} p$. [2]

5 Solve the simultaneous equations

$$\frac{4^x}{256^y} = 1024,$$

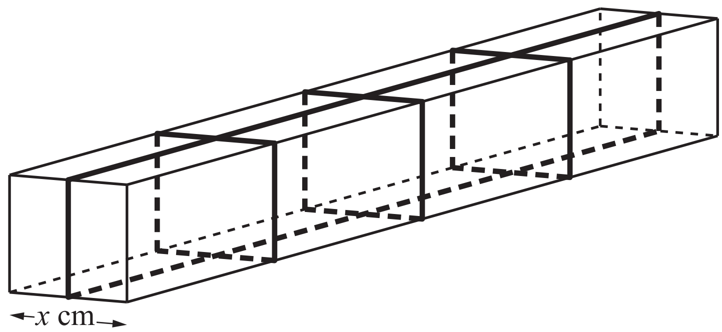
$$3^{2x} \times 9^y = 243.$$ [5]

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

(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]

7



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]

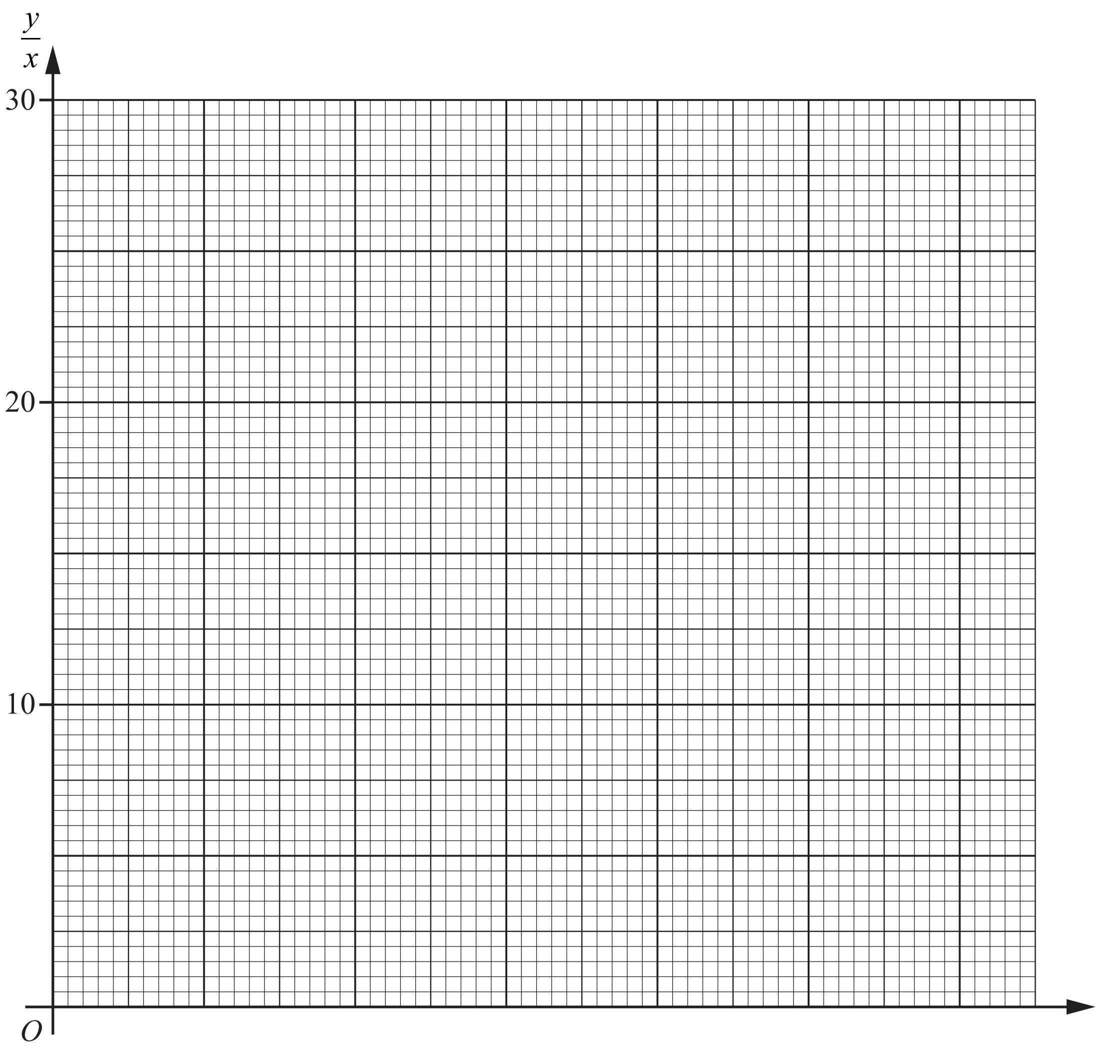
8 The table shows experimental values of two variables x and y.

x	2	4	6	8
y	9.6	38.4	105	232

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]

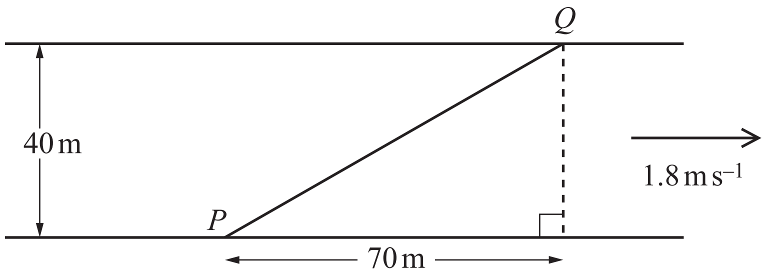
(ii) Draw this straight line graph on the grid below. [2]



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

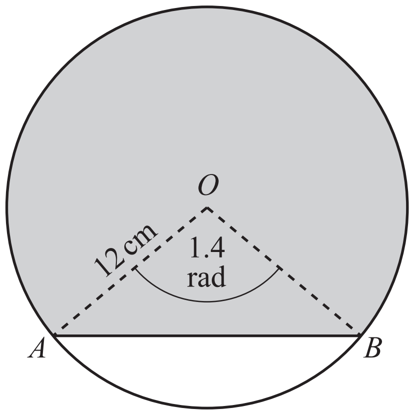
(iv) Estimate the value of x for which $2y = 25x$. [2]

9



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

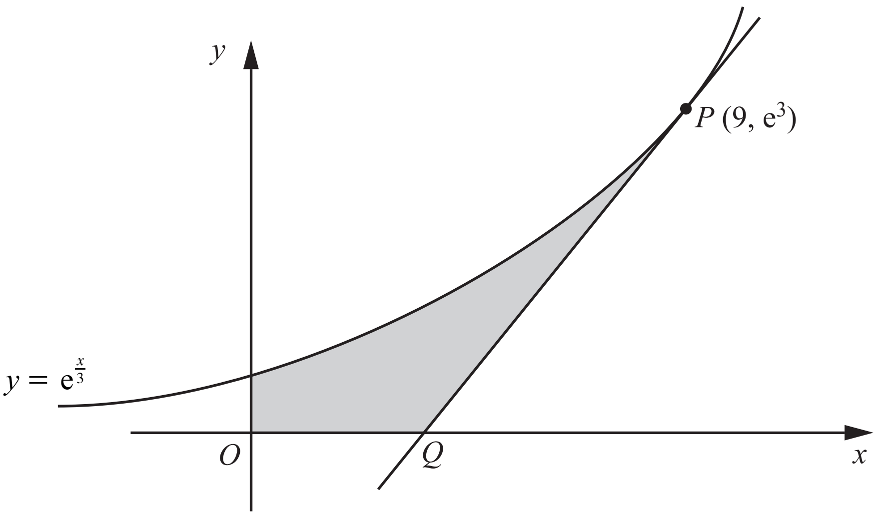


The diagram shows a circle with centre O and a chord AB. The radius of the circle is 12 cm and angle AOB is 1.4 radians.

(i) Find the perimeter of the shaded region. [5]

(ii) Find the area of the shaded region.

11



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

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12 **(a)** Solve the equation $2\operatorname{cosec} x + \dfrac{7}{\cos x} = 0$ for $0° \leqslant x \leqslant 360°$.

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

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