UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

ADDITIONAL MATHEMATICS **0606/02**

Paper 2 **October/November 2009**

2 hours

Additional Materials: Answer Booklet/Paper, Graph paper (2 sheets), Electronic calculator, Mathematical tables

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
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 soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
Write your answers on the separate Answer Booklet/Paper provided.
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 **5** printed pages and **3** blank pages.

UNIVERSITY *of* CAMBRIDGE International Examinations

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

$$\sin^2 A + \cos^2 A = 1.$$

$$\sec^2 A = 1 + \tan^2 A.$$

$$\text{cosec}^2 A = 1 + \cot^2 A.$$

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 A function f is defined by $\mathrm{f}: x \mapsto \mathrm{e}^{x-1}$, where $x > 0$.

(i) State the range of f. [1]

(ii) Find an expression for f^{-1}. [2]

(iii) State the domain of f^{-1}. [1]

2 **(i)** Find the first four terms, in ascending powers of x, in the expansion of $\left(2 - \frac{x}{2}\right)^6$. [4]

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

3 The table shows experimental values of the variables x and y which are related by the equation $y = \frac{a}{x^2} + \frac{b}{x}$, where a and b are constants.

x	2	4	6	8	10
y	6.24	2.82	1.79	1.33	1.05

(i) Using graph paper, plot x^2y against x and draw a straight line graph. [3]

(ii) Use your graph to estimate the value of a and of b. [4]

4 Find the coordinates and the nature of the stationary points of the curve $y = x^3 + 3x^2 - 45x + 60$. [7]

5 Relative to an origin O, the position vectors of points A and B are $\begin{pmatrix} 7 \\ 24 \end{pmatrix}$ and $\begin{pmatrix} 10 \\ 20 \end{pmatrix}$ respectively. Find

(i) the length of $\overrightarrow{OA}$, [2]

(ii) the length of $\overrightarrow{AB}$. [2]

Given that ABC is a straight line and that the length of $\overrightarrow{AC}$ is equal to the length of $\overrightarrow{OA}$, find

(iii) the position vector of the point C. [3]

6 **(i)** Given that $y = x\sqrt{4x + 12}$, show that $\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{k(x+2)}{\sqrt{4x+12}}$, where k is a constant to be found. [4]

(ii) Hence evaluate $\int_{-2}^{6} \frac{3x+6}{\sqrt{4x+12}}\,\mathrm{d}x$. [3]

7 **(i)** Using graph paper, draw the curve $y = \sin 2x$ for $0° \leqslant x \leqslant 360°$. [3]

In order to solve the equation $1 + \sin 2x = 2\cos x$ another curve must be added to your diagram.

(ii) Write down the equation of this curve and add this curve to your diagram. [3]

(iii) State the number of values of x which satisfy the equation $1 + \sin 2x = 2\cos x$ for $0° \leqslant x \leqslant 360°$. [1]

8 It is given that $\mathbf{A} = \begin{pmatrix} 2 & -1 \\ 4 & 3 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 1 & -3 \\ 2 & 0 \end{pmatrix}$ and $\mathbf{C} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$. Find

(i) $\mathbf{AB}$, [2]

(ii) $\mathbf{BC}$, [2]

(iii) $\mathbf{A}^{-1}$, and hence find the matrix $\mathbf{X}$ such that $\mathbf{AX} = \mathbf{B}$. [4]

9 A particle moves in a straight line so that, t seconds after passing through a fixed point O, its velocity, v ms^{-1}, is given by $v = \dfrac{20}{(2t + 4)^2}$. Find

(i) the velocity of the particle at O, [1]

(ii) the acceleration of the particle when $t = 3$, [3]

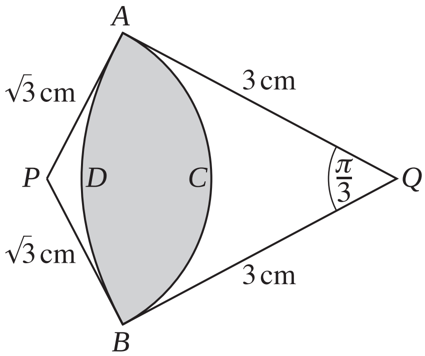
(iii) the distance travelled by the particle in the first 8 seconds. [4]

10 **(a)** Solve $\lg(7x - 3) + 2\lg 5 = 2 + \lg(x + 3)$. [4]

(b) Use the substitution $u = 3^x$ to solve the equation $3^{x+1} + 3^{2-x} = 28$. [5]

11 Answer only **one** of the following two alternatives.

EITHER



In the diagram, ACB is an arc of a circle with centre P, and ADB is an arc of a circle with centre Q. Angle $AQB = \frac{\pi}{3}$, $AQ = BQ = 3$ cm and $AP = BP = \sqrt{3}$ cm.

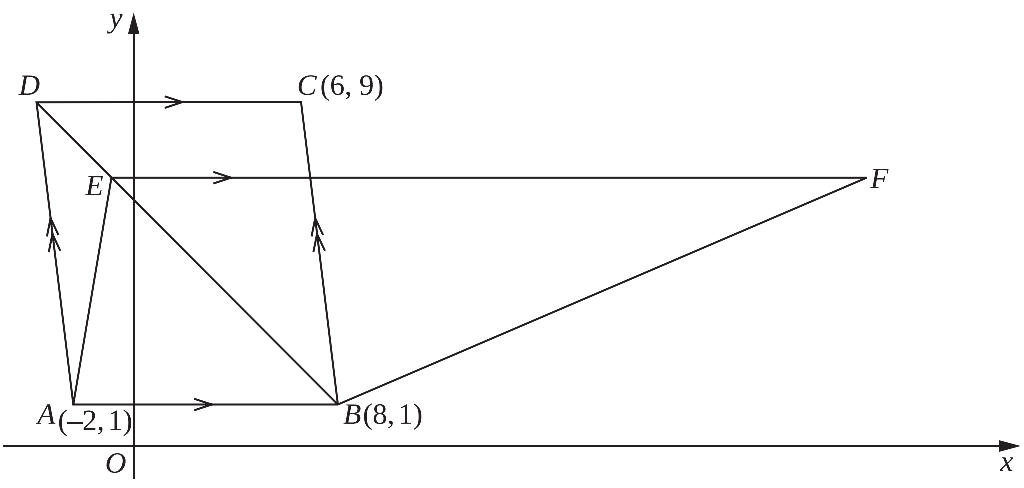
(i) Show that angle $APB = \frac{2\pi}{3}$. [2]

(ii) Find the perimeter of the shaded region. [3]

(iii) Find the area of the shaded region. [5]

OR

Solutions to this question by accurate drawing will not be accepted.



The diagram shows a parallelogram with vertices $A(-2, 1)$, $B(8, 1)$, $C(6, 9)$ and D.

(i) Find the coordinates of D. [2]

The point E lies on the diagonal DB such that $DE = \frac{1}{4}DB$.

(ii) Find the coordinates of E. [2]

The point F is such that EF is parallel to AB.
The area of trapezium $AEFB$ is $1\frac{1}{2} \times$ (the area of parallelogram $ABCD$).

(iii) Find the coordinates of F. [6]

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