UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4183751999

ADDITIONAL MATHEMATICS **0606/23**

Paper 2 **October/November 2012**

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.

Answer **all** 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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Total	

This document consists of **16** printed pages.

DC (LEO/JG) 50029/6

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 Solve the equation $|5x + 7| = 13$.

---

2 **(i)** Given that $\mathbf{A} = \begin{pmatrix} 7 & 8 \\ 4 & 6 \end{pmatrix}$, find the inverse matrix, $\mathbf{A}^{-1}$. [2]

(ii) Use your answer to part **(i)** to solve the simultaneous equations

$$7x + 8y = 39,$$
$$4x + 6y = 23.$$ [2]

---

3 Without using a calculator, simplify $\dfrac{(3\sqrt{3}-1)^2}{2\sqrt{3}-3}$, giving your answer in the form $\dfrac{a\sqrt{3}+b}{3}$, w[illegible] a and b are integers. [4]

4 The points X, Y and Z are such that $\overrightarrow{XY} = 3\overrightarrow{YZ}$. The position vectors of X and Z, relative to an origin O, are $\begin{pmatrix} 4 \\ -27 \end{pmatrix}$ and $\begin{pmatrix} 20 \\ -7 \end{pmatrix}$ respectively. Find the unit vector in the direction $\overrightarrow{OY}$. [5]

5 Find the set of values of m for which the line $y = mx + 2$ does not meet the curve $y = mx^2 + 7x + 11$.

6 **(a)** Given that $\cos x = p$, find an expression, in terms of p, for $\tan^2 x$.

(b) Prove that $(\cot\theta + \tan\theta)^2 = \sec^2\theta + \operatorname{cosec}^2\theta$. [3]

7 **(a)** Find $\int (x+3)\sqrt{x}\,\mathrm{d}x$.

(b) Find $\int \frac{20}{(2x+5)^2}\,\mathrm{d}x$ and hence evaluate $\int_0^{10} \frac{20}{(2x+5)^2}\,\mathrm{d}x$. [4]

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

The points *A* (4, 5), *B*(–2, 3), *C*(1, 9) and *D* are the vertices of a trapezium in which *BC* is parallel to *AD* and angle *BCD* is 90°. Find the area of the trapezium. [8]

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

x	1	2	3	4
y	9.41	1.29	–0.69	–1.77

It is known that x and y are related by the equation $y = \frac{a}{x^2} + bx$, where a and b are constants.

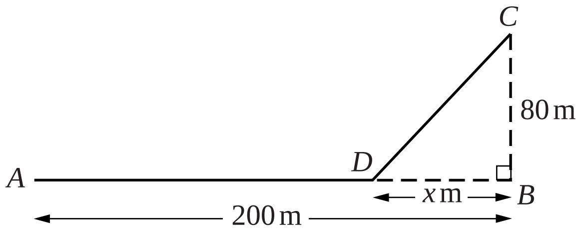
(i) A straight line graph is to be drawn to represent this information. Given that x^2y is plotted on the vertical axis, state the variable to be plotted on the horizontal axis. [1]

(ii) On the grid opposite, draw this straight line graph. [3]

(iii) Use your graph to estimate the value of a and of b. [3]

(iv) Estimate the value of y when x is 3.7. [2]

10



A track runs due east from A to B, a distance of 200 m. The point C is 80 m due north of B. A cyclist travels on the track from A to D, where D is x m due west of B. The cyclist then travels in a straight line across rough ground from D to C. The cyclist travels at 10 m s^{-1} on the track and at 6 m s^{-1} across rough ground.

(i) Show that the time taken, T s, for the cyclist to travel from A to C is given by

$$T = \frac{200 - x}{10} + \frac{\sqrt{(x^2 + 6400)}}{6}$$ [2]

(ii) Given that x can vary, find the value of x for which T has a stationary value and the corresponding value of T. [6]

11 **(a)** Solve $(2^{x-2})^{\frac{1}{2}} = 100$, giving your answer to 1 decimal place. [3]

(b) Solve $\log_y 2 = 3 - \log_y 256$. [4]

(c) Solve $\dfrac{6^{5z-2}}{36^z} = \dfrac{216^{z-1}}{36^{3-z}}$.

12 Answer only **one** of the following alternatives.

EITHER

(i) Express $4x^2 + 32x + 55$ in the form $(ax + b)^2 + c$, where a, b and c are constants and a is positive. [3]

The functions f and g are defined by

$\mathrm{f} : x \mapsto 4x^2 + 32x + 55$ for $x > -4$,

$\mathrm{g} : x \mapsto \dfrac{1}{x}$ for $x > 0$.

(ii) Find $\mathrm{f}^{-1}(x)$. [3]

(iii) Solve the equation $\mathrm{fg}(x) = 135$. [4]

OR

The functions h and k are defined by

$\mathrm{h} : x \mapsto \sqrt{2x - 7}$ for $x \geqslant c$,

$\mathrm{k} : x \mapsto \dfrac{3x - 4}{x - 2}$ for $x > 2$.

(i) State the least possible value of c. [1]

(ii) Find $h^{-1}(x)$. [2]

(iii) Solve the equation $\mathrm{k}(x) = x$. [3]

(iv) Find an expression for the function k^2, in the form $\mathrm{k}^2 : x \mapsto a + \dfrac{b}{x}$ where a and b are constants. [4]

Start your answer to Question 12 here.

Indicate which question you are answering.

EITHER	
OR	

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

Continue your answer here if necessary.