UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER   CANDIDATE NUMBER

9273068136

ADDITIONAL MATHEMATICS **0606/23**

Paper 2 **October/November 2011**

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.

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Total	

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Mathematical Formulae

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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 inequality $x(2x - 1) > 15$. [3]

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2 **(i)** Given that $y = (12 - 4x)^5$, find $\frac{dy}{dx}$. [2]

(ii) Hence find the approximate change in y as x increases from 0.5 to $0.5 + p$, where p is small. [2]

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3 **(i)** Find the coefficient of x^3 in the expansion of $(1 - 2x)^7$. [2]

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(ii) Find the coefficient of x^3 in the expansion of $(1 + 3x^2)(1 - 2x)^7$. [3]

4 Without using a calculator, find the positive root of the equation

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$$(5 - 2\sqrt{2})x^2 - (4 + 2\sqrt{2})x - 2 = 0,$$

giving your answer in the form $a + b\sqrt{2}$, where a and b are integers. [6]

5 A school council of 6 people is to be chosen from a group of 8 students and 6 teachers. Calculate the number of different ways that the council can be selected if

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(i) there are no restrictions, [2]

(ii) there must be at least 1 teacher on the council and more students than teachers. [3]

After the council is chosen, a chairperson and a secretary have to be selected from the 6 council members.

(iii) Calculate the number of different ways in which a chairperson and a secretary can be selected. [1]

6 **(i)** In the space below sketch the graph of $y = |(2x + 3)(2x - 7)|$. [4]

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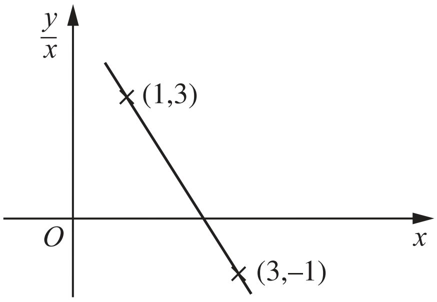
(ii) How many values of x satisfy the equation $|(2x + 3)(2x - 7)| = 2x$? [2]

7



The variables x and y are related in such a way that when $\frac{y}{x}$ is plotted against x a straight line is obtained, as shown in the graph. The line passes through the points (1, 3) and (3, –1).

(i) Express y in terms of x. [4]

(ii) Find the value of x and of y such that $\frac{y}{x} = -9$. [2]

8 A sector of a circle, of radius r cm, has a perimeter of 200 cm.

(i) Express the area, A cm^2, of the sector in terms of r. [3]

(ii) Given that r can vary, find the stationary value of A. [3]

9 An aircraft, whose speed in still air is $350\,\text{km}\,\text{h}^{-1}$, flies in a straight line from A to B, a distance of $480\,\text{km}$. There is a wind of $50\,\text{km}\,\text{h}^{-1}$ blowing from the north. The pilot sets a course of $130°$.

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(i) Calculate the time taken to fly from A to B. [5]

(ii) Calculate the bearing of B from A. [3]

10 The line $y = 2x + 10$ intersects the curve $2x^2 + 3xy - 5y + y^2 = 218$ at the points A and B. Find the equation of the perpendicular bisector of AB. [9]

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11 **(i)** Solve $4\cot\frac{1}{2}x = 1$, for $0° < x < 360°$. [3]

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(ii) Solve $3(1 - \tan y \cos y) = 5\cos^2 y - 2$, for $0° < y < 360°$. [5]

(iii) Solve $3\sec^2 z = 4$, for $0 < z < 2\pi$ radians. [3]

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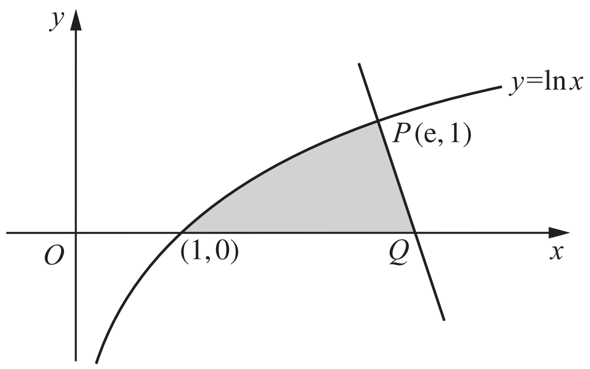
12 Answer only **one** of the following two alternatives.

EITHER



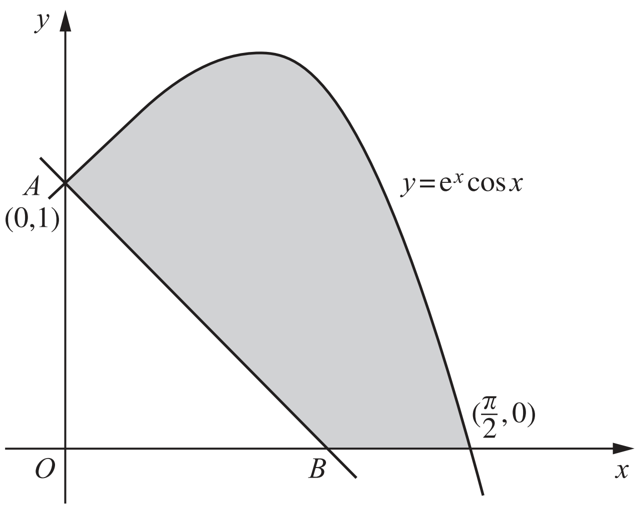
The diagram shows part of the curve $y = \ln x$ cutting the x-axis at the point (1, 0). The normal to the curve at the point P(e, 1) cuts the x-axis at the point Q.

(i) Show that Q is the point $\left(\mathrm{e} + \frac{1}{\mathrm{e}}, 0\right)$. [4]

(ii) Show that $\frac{\mathrm{d}}{\mathrm{d}x}(x \ln x) = 1 + \ln x$. [1]

(iii) Hence find $\int \ln x \,\mathrm{d}x$ and the area of the shaded region. [5]

OR



The diagram shows part of the curve $y = \mathrm{e}^x \cos x$, cutting the x-axis at the point $\left(\frac{\pi}{2}, 0\right)$. The normal to the curve at the point A(0, 1) cuts the x-axis at the point B.

(i) Find the coordinates of B. [4]

(ii) Show that $\frac{\mathrm{d}}{\mathrm{d}x}[\mathrm{e}^x(\cos x + \sin x)] = 2\mathrm{e}^x \cos x$. [2]

(iii) Hence find $\int \mathrm{e}^x \cos x \,\mathrm{d}x$ and the area of the shaded region. [4]

Start your answer to Question 12 here.

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Indicate which question you are answering.

EITHER	
OR	

Continue your answer here if necessary.

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