UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

ADDITIONAL MATHEMATICS **4037/13**

Paper 1 **October/November 2012**

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

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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1	
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Total	

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

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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

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

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

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

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

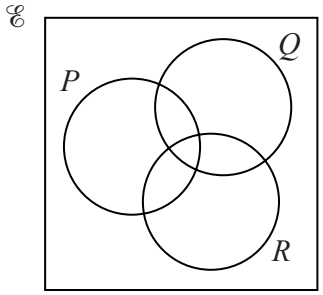
$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

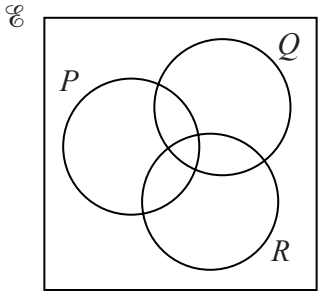
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1 **(a)** On the Venn diagrams below, shade the region corresponding to the set given below each Venn diagram.

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$P \cup (Q \cap R)$



$P \cap (Q \cup R)$

[2]

(b) It is given that sets $\mathscr{E}$, B, S and F are such that

$\mathscr{E}$ = {students in a school},

B = {students who are boys},

S = {students in the swimming team},

F = {students in the football team}.

Express each of the following statements in set notation.

(i) All students in the football team are boys. [1]

(ii) There are no students who are in both the swimming team and the football team. [1]

2 The rate of change of a variable x with respect to time t is $4\cos^2 t$.

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(i) Find the rate of change of x with respect to t when $t = \frac{\pi}{6}$. [1]

The rate of change of a variable y with respect to time t is $3\sin t$.

(ii) Using your result from part **(i)**, find the rate of change of y with respect to x when $t = \frac{\pi}{6}$. [3]

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3 A committee of 7 members is to be selected from 6 women and 9 men. Find the number of different committees that may be selected if

(i) there are no restrictions, [1]

(ii) the committee must consist of 2 women and 5 men, [2]

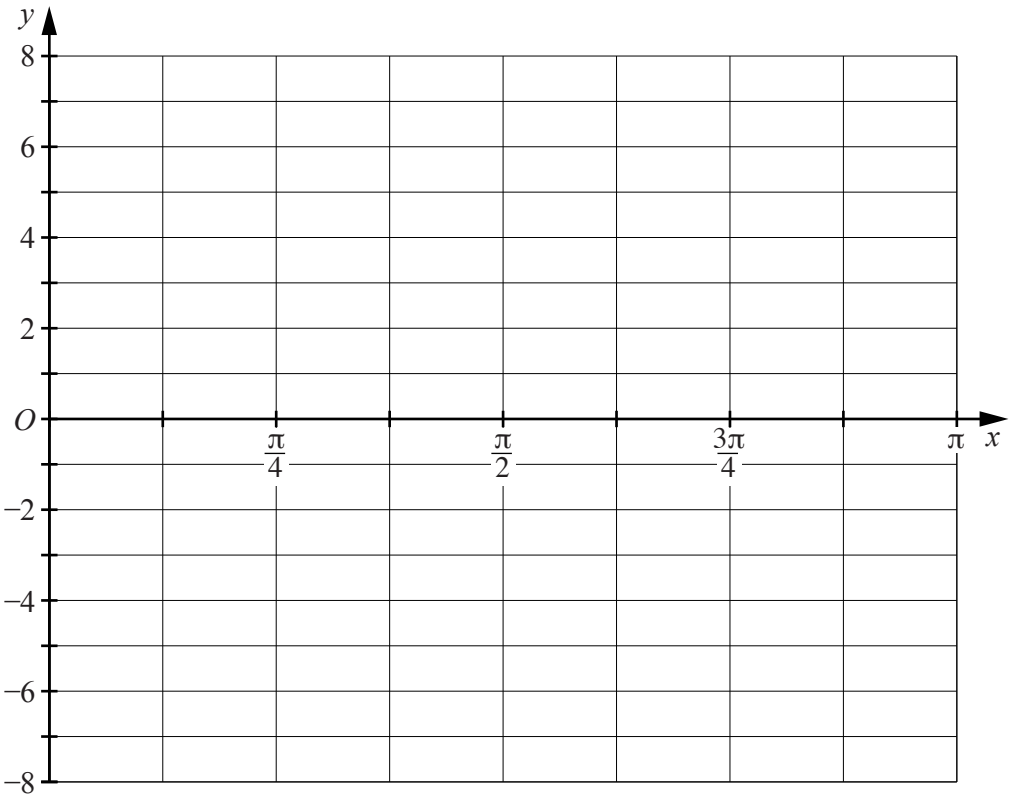
(iii) the committee must contain at least 1 woman. [3]

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4 **(i)** On the axes below sketch, for $0 \leqslant x \leqslant \pi$, the graphs of

$$y = \tan x \quad \text{and} \quad y = 1 + 3\sin 2x. \qquad [3]$$

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Write down

(ii) the coordinates of the stationary points on the curve $y = 1 + 3\sin 2x$ for $0 \leqslant x \leqslant \pi$, [2]

(iii) the number of solutions of the equation $\tan x = 1 + 3\sin 2x$ for $0 \leqslant x \leqslant \pi$. [1]

5 A pilot flies his plane directly from a point A to a point B, a distance of 450 km. The bearing of B from A is 030°. A wind of 80 km h^{-1} is blowing from the east. Given that the plane can travel at 320 km h^{-1} in still air, find

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(i) the bearing on which the plane must be steered, [4]

(ii) the time taken to fly from A to B. [4]

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6 In the expansion of $(p + x)^6$, where p is a positive integer, the coefficient of x^2 is equal to 1.5 times the coefficient of x^3.

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(i) Find the value of p. [4]

(ii) Use your value of p to find the term independent of x in the expansion of $(p + x)^6 \left(1 - \frac{1}{x}\right)^2$. [3]

7 A particle P moves along the x-axis such that its distance, x m, from the origin O at time t s is given by $x = \dfrac{t}{t^2 + 1}$ for $t \geqslant 0$.

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(i) Find the greatest distance of P from O. [4]

(ii) Find the acceleration of P at the instant when P is at its greatest distance from O. [3]

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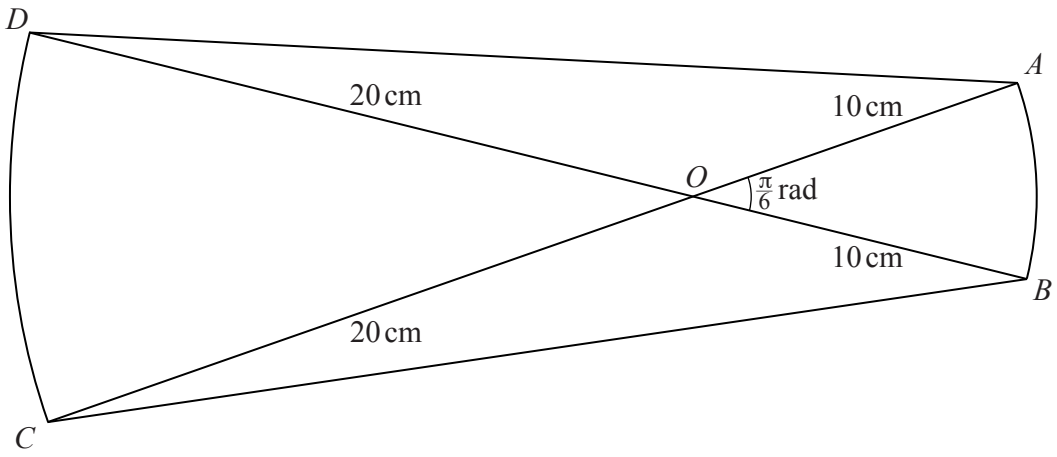
8 **(i)** Given that $3x^3 + 5x^2 + px + 8 \equiv (x - 2)(ax^2 + bx + c)$, find the value of each of the integers a, b, c and p. [5]

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(ii) Using the values found in part **(i)**, factorise completely $3x^3 + 5x^2 + px + 8$. [2]

9

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The diagram shows four straight lines, *AD, BC*, *AC* and *BD*. Lines *AC* and *BD* intersect at *O* such that angle *AOB* is $\frac{\pi}{6}$ radians. *AB* is an arc of the circle, centre *O* and radius 10 cm, and *CD* is an arc of the circle, centre *O* and radius 20 cm.

(i) Find the perimeter of *ABCD*. [4]

(ii) Find the area of *ABCD*. [4]

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10 **(i)** Solve $\tan^2 x - 2\sec x + 1 = 0$ for $0° \leqslant x \leqslant 360°$. [4]

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(ii) Solve $\cos^2 3y = 5\sin^2 3y$ for $0 \leqslant y \leqslant 2$ radians. [4]

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(iii) Solve $2\text{cosec}\left(z + \frac{\pi}{4}\right) = 5$ for $0 \leqslant z \leqslant 6$ radians. [4]

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

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EITHER

The tangent to the curve $y = 5e^x + 3e^{-x}$ at the point where $x = \ln\frac{3}{5}$, meets the x-axis at the point P.

(i) Find the coordinates of P. [5]

The area of the region enclosed by the curve $y = 5e^x + 3e^{-x}$, the y-axis, the positive x-axis and the line $x = a$ is 12 square units.

(ii) Show that $5e^{2a} - 14e^a - 3 = 0$. [3]

(iii) Hence find the value of a. [3]

OR

(i) Given that $y = \dfrac{3e^{2x}}{1 + e^{2x}}$, show that $\dfrac{dy}{dx} = \dfrac{Ae^{2x}}{(1 + e^{2x})^2}$, where A is a constant to be found. [4]

(ii) Find the equation of the tangent to the curve $y = \dfrac{3e^{2x}}{1 + e^{2x}}$ at the point where the curve crosses the y-axis. [3]

(iii) Using your result from part **(i)**, find $\displaystyle\int \frac{e^{2x}}{(1 + e^{2x})^2}\,dx$ and hence evaluate $\displaystyle\int_0^{\ln 3} \frac{e^{2x}}{(1 + e^{2x})^2}\,dx$. [4]

Start your answer to Question 11 here.

Indicate which question you are answering.

EITHER	
OR	

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Continue your answer here.

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