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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

ADDITIONAL MATHEMATICS **4037/01**

Paper 1 **May/June 2008**

2 hours

Additional Materials: Answer Booklet/Paper
Mathematical tables

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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 **6** printed pages and **2** blank pages.

SPA (SLM/DT) T44096/5

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

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

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

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

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 Express $\dfrac{8-3\sqrt{2}}{4+3\sqrt{2}}$ in the form $a+b\sqrt{2}$, where a and b are integers. [3]

2 A committee of 5 people is to be selected from 6 men and 4 women. Find

(i) the number of different ways in which the committee can be selected, [1]

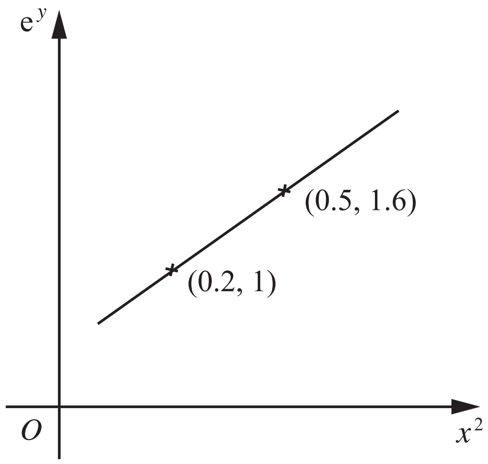
(ii) the number of these selections with more women than men. [4]

3 The line $y = 3x + k$ is a tangent to the curve $x^2 + xy + 16 = 0$.

(i) Find the possible values of k. [3]

(ii) For each of these values of k, find the coordinates of the point of contact of the tangent with the curve. [2]

4 Variables x and y are such that, when e^y is plotted against x^2, a straight line graph passing through the points (0.2, 1) and (0.5, 1.6) is obtained.



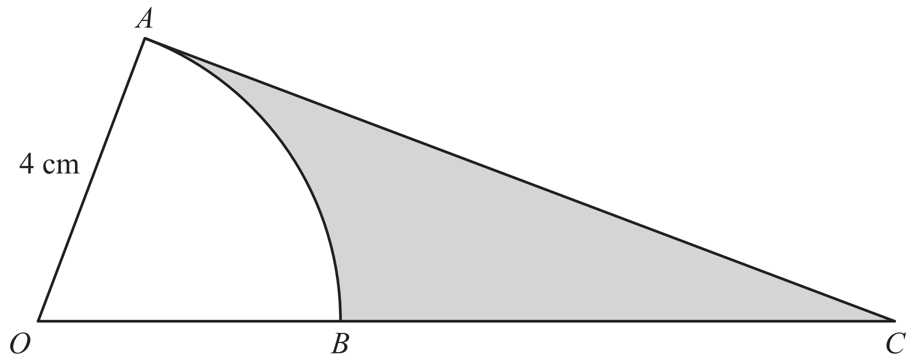
(i) Find the value of e^y when $x = 0$. [2]

(ii) Express y in terms of x. [3]

5 Variables x and y are connected by the equation $y = \dfrac{x}{\tan x}$. Given that x is increasing at the rate of 2 units per second, find the rate of increase of y when $x = \dfrac{\pi}{4}$. [5]

6 Solve the equation $x^2(2x + 3) = 17x - 12$. [6]

7



The diagram shows a sector OAB of a circle, centre O, radius 4 cm. The tangent to the circle at A meets the line OB extended at C. Given that the area of the sector OAB is $10\,\text{cm}^2$, calculate

(i) the angle AOB in radians, [2]

(ii) the perimeter of the shaded region. [4]

8 **(i)** Given that $\log_9 x = a\log_3 x$, find a. [1]

(ii) Given that $\log_{27} y = b\log_3 y$, find b. [1]

(iii) Hence solve, for x and y, the simultaneous equations

$$6\log_9 x + 3\log_{27} y = 8,$$
$$\log_3 x + 2\log_9 y = 2.$$

[4]

9 A curve is such that $\dfrac{dy}{dx} = 2\cos\left(2x - \dfrac{\pi}{2}\right)$. The curve passes through the point $\left(\dfrac{\pi}{2}, 3\right)$.

(i) Find the equation of the curve. [4]

(ii) Find the equation of the normal to the curve at the point where $x = \dfrac{3\pi}{4}$. [4]

10 In this question, **i** is a unit vector due east and **j** is a unit vector due north.

At 0900 hours a ship sails from the point P with position vector $(2\mathbf{i} + 3\mathbf{j})$ km relative to an origin O. The ship sails north-east with a speed of $15\sqrt{2}$ km h^{-1}.

(i) Find, in terms of **i** and **j**, the velocity of the ship. [2]

(ii) Show that the ship will be at the point with position vector $(24.5\mathbf{i} + 25.5\mathbf{j})$ km at 1030 hours. [1]

(iii) Find, in terms of **i**, **j** and t, the position of the ship t hours after leaving P. [2]

At the same time as the ship leaves P, a submarine leaves the point Q with position vector $(47\mathbf{i} - 27\mathbf{j})$ km. The submarine proceeds with a speed of 25 km h^{-1} due north to meet the ship.

(iv) Find, in terms of **i** and **j**, the velocity of the ship relative to the submarine. [2]

(v) Find the position vector of the point where the submarine meets the ship. [2]

11 Solve the equation

(i) $3\sin x + 5\cos x = 0$ for $0° < x < 360°$, [3]

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

(iii) $\sin(2z - 0.6) = 0.8$ for $0 < z < 3$ radians. [4]

[Question 12 is printed on the next page.]

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

EITHER

A curve has equation $y = (x^2 - 3)e^{-x}$.

(i) Find the coordinates of the points of intersection of the curve with the x-axis. [2]

(ii) Find the coordinates of the stationary points of the curve. [5]

(iii) Determine the nature of these stationary points. [3]

OR

A particle moves in a straight line such that its displacement, s m, from a fixed point O at a time t s, is given by

$$s = \ln(t + 1) \quad \text{for} \quad 0 \leqslant t \leqslant 3,$$

$$s = \tfrac{1}{2}\ln(t - 2) - \ln(t + 1) + \ln 16 \quad \text{for } t > 3.$$

Find

(i) the initial velocity of the particle, [2]

(ii) the velocity of the particle when $t = 4$, [2]

(iii) the acceleration of the particle when $t = 4$, [2]

(iv) the value of t when the particle is instantaneously at rest, [2]

(v) the distance travelled by the particle in the 4th second. [2]

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