UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

ADDITIONAL MATHEMATICS **4037/12**

Paper 1 **May/June 2013**

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.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the 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.

This document consists of **17** printed pages and **3** blank pages.

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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

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

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

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

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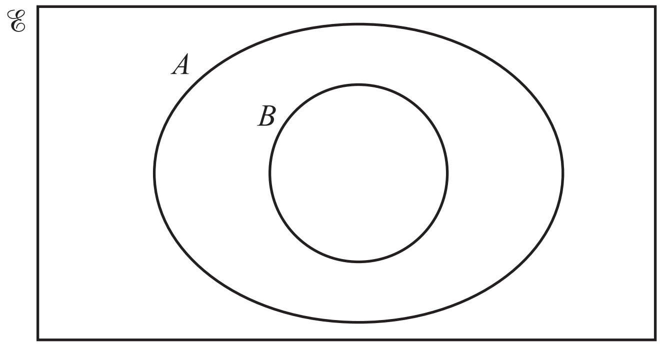
1



The Venn diagram shows the universal set ℰ, the set A and the set B. Given that $\mathrm{n}(B) = 5$, $\mathrm{n}(A') = 10$ and $\mathrm{n}(ℰ) = 26$, find

(i) $\mathrm{n}(A \cap B)$, [1]

(ii) $\mathrm{n}(A)$, [1]

(iii) $\mathrm{n}(B' \cap A)$. [1]

2 A 4-digit number is to be formed from the digits 1, 2, 5, 7, 8 and 9. Each digit may only be used once. Find the number of different 4-digit numbers that can be formed if

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(i) there are no restrictions, [1]

(ii) the 4-digit numbers are divisible by 5, [2]

(iii) the 4-digit numbers are divisible by 5 and are greater than 7000. [2]

3 Show that $(1 - \cos\theta - \sin\theta)^2 - 2(1 - \sin\theta)(1 - \cos\theta) = 0$. [3]

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4 Find the set of values of k for which the curve $y = 2x^2 + kx + 2k - 6$ lies above the x-axis for all values of x. [4]

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5 The line $3x + 4y = 15$ cuts the curve $2xy = 9$ at the points A and B. Find the length of the line AB. [6]

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6 The normal to the curve $y + 2 = 3\tan x$, at the point on the curve where $x = \dfrac{3\pi}{4}$, cuts the y-axis at the point P. Find the coordinates of P. [6]

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7 It is given that $f(x) = 6x^3 - 5x^2 + ax + b$ has a factor of $x + 2$ and leaves a remainder of 27 when divided by $x - 1$.

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(i) Show that $b = 40$ and find the value of a. [4]

(ii) Show that $f(x) = (x + 2)(px^2 + qx + r)$, where p, q and r are integers to be found. [2]

(iii) Hence solve $f(x) = 0$. [2]

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8 **(a)** Given that the matrix $\mathbf{A} = \begin{pmatrix} 4 & 2 \\ 3 & -5 \end{pmatrix}$, find

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

(ii) $3\mathbf{A} + 4\mathbf{I}$, where $\mathbf{I}$ is the identity matrix. [2]

(b) **(i)** Find the inverse matrix of $\begin{pmatrix} 6 & 1 \\ -9 & 3 \end{pmatrix}$. [2]

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(ii) Hence solve the equations

$$6x + y = 5,$$

$$-9x + 3y = \frac{3}{2}.$$ [3]

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9 **(i)** Given that n is a positive integer, find the first 3 terms in the expansion of $\left(1 + \frac{1}{2}x\right)^n$ in ascending powers of x. [2]

(ii) Given that the coefficient of x^2 in the expansion of $(1 - x)\left(1 + \frac{1}{2}x\right)^n$ is $\frac{25}{4}$, find the value of n. [5]

10 **(a)** **(i)** Find $\int \sqrt{2x-5}\,\mathrm{d}x$. [2]

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(ii) Hence evaluate $\int_3^{15} \sqrt{2x-5}\,\mathrm{d}x$. [2]

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(b) **(i)** Find $\frac{d}{dx}(x^3 \ln x)$. [2]

(ii) Hence find $\int x^2 \ln x \, dx$. [3]

11 **(a)** Solve $\cos 2x + 2\sec 2x + 3 = 0$ for $0° \leqslant x \leqslant 360°$. [5]

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(b) Solve $2\sin^2\left(y - \frac{\pi}{6}\right) = 1$ for $0 \leqslant y \leqslant \pi$. [4]

12 A particle P moves in a straight line such that, t s after leaving a point O, its velocity $v\,\text{m}\,\text{s}^{-1}$ is given by $v = 36t - 3t^2$ for $t \geqslant 0$.

(i) Find the value of t when the velocity of P stops increasing. [2]

(ii) Find the value of t when P comes to instantaneous rest. [2]

(iii) Find the distance of P from O when P is at instantaneous rest. [3]

(iv) Find the speed of P when P is again at O. [4]

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