Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

2540009585

ADDITIONAL MATHEMATICS **4037/12**

Paper 1 **May/June 2015**

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, 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.

DC (LEG/JG) 107046/1

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 Given that the graph of $y = (2k + 5)x^2 + kx + 1$ does not meet the x-axis, find the possible values of k. [4]

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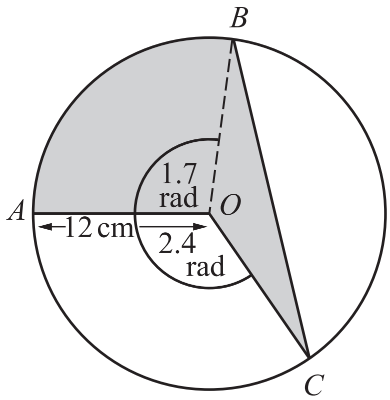
2 Show that $\dfrac{\tan\theta + \cot\theta}{\operatorname{cosec}\theta} = \sec\theta$. [4]

3 Find the inverse of the matrix $\begin{pmatrix} 4 & 2 \\ 5 & 3 \end{pmatrix}$ and hence solve the simultaneous equations

$$4x + 2y - 8 = 0,$$
$$5x + 3y - 9 = 0.$$

[5]

4



The diagram shows a circle, centre O, radius 12 cm. The points A, B and C lie on the circumference of this circle such that angle AOB is 1.7 radians and angle AOC is 2.4 radians.

(i) Find the area of the shaded region. [4]

(ii) Find the perimeter of the shaded region. [5]

5 **(a)** A security code is to be chosen using 6 of the following:

- the letters A, B and C
- the numbers 2, 3 and 5
- the symbols * and $.

None of the above may be used more than once. Find the number of different security codes that may be chosen if

(i) there are no restrictions, [1]

(ii) the security code starts with a letter and finishes with a symbol, [2]

(iii) the two symbols are next to each other in the security code. [3]

(b) Two teams, each of 4 students, are to be selected from a class of 8 boys and 6 girls. Find the number of different ways the two teams may be selected if

(i) there are no restrictions, [2]

(ii) one team is to contain boys only and the other team is to contain girls only. [2]

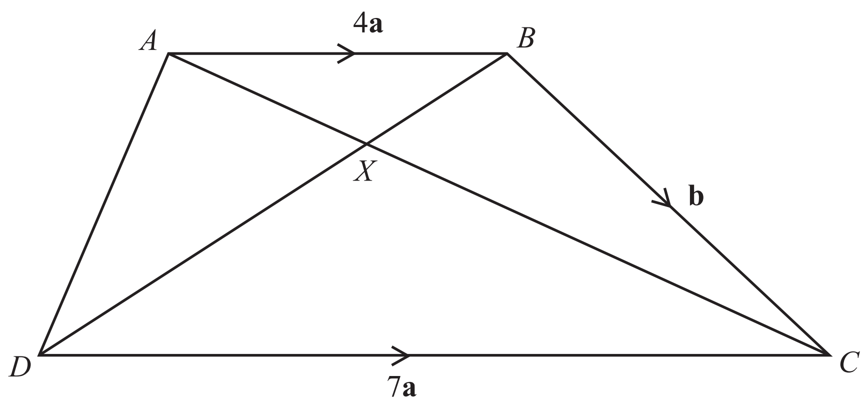
6 A particle moves in a straight line such that its displacement, x m, from a fixed point O after t s, is given by $x = 10\ln(t^2 + 4) - 4t$.

(i) Find the initial displacement of the particle from O. [1]

(ii) Find the values of t when the particle is instantaneously at rest. [4]

(iii) Find the value of t when the acceleration of the particle is zero. [5]

7



In the diagram $\overrightarrow{AB} = 4\mathbf{a}$, $\overrightarrow{BC} = \mathbf{b}$ and $\overrightarrow{DC} = 7\mathbf{a}$. The lines AC and DB intersect at the point X. Find, in terms of **a** and **b**,

(i) $\overrightarrow{DA}$, [1]

(ii) $\overrightarrow{DB}$. [1]

Given that $\overrightarrow{AX} = \lambda\overrightarrow{AC}$, find, in terms of **a**, **b** and λ,

(iii) $\overrightarrow{AX}$, [1]

(iv) $\overrightarrow{DX}$. [2]

Given that $\overrightarrow{DX} = \mu\overrightarrow{DB}$,

(v) find the value of λ and of μ. [4]

8 **(i)** Find $\int (10e^{2x} + e^{-2x})\,dx$. [2]

(ii) Hence find $\int_{-k}^{k} (10e^{2x} + e^{-2x})\,dx$ in terms of the constant k. [2]

(iii) Given that $\int_{-k}^{k} (10e^{2x} + e^{-2x})\,dx = -60$, show that $11e^{2k} - 11e^{-2k} + 120 = 0$. [2]

(iv) Using a substitution of $y = e^{2k}$ or otherwise, find the value of k in the form $a \ln b$, where a and b are constants. [3]

9 A curve has equation $y = 4x + 3\cos 2x$. The normal to the curve at the point where $x = \frac{\pi}{4}$ meets the x- and y-axes at the points A and B respectively. Find the exact area of the triangle AOB, where O is the origin. [8]

10 **(a)** Solve $2\cos 3x = \sec 3x$ for $0° \leqslant x \leqslant 120°$. [3]

(b) Solve $3\,\mathrm{cosec}^2 y + 5\cot y - 5 = 0$ for $0° \leqslant y \leqslant 360°$. [5]

Question 10(c) is printed on the next page.

(c) Solve $2\sin\left(z+\frac{\pi}{3}\right)=1$ for $0 \leqslant z \leqslant 2\pi$ radians. [4]