Cambridge O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3958328647

ADDITIONAL MATHEMATICS **4037/13**

Paper 1 **October/November 2016**

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.

This document consists of **15** printed pages and **1** blank page.

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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

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

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

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

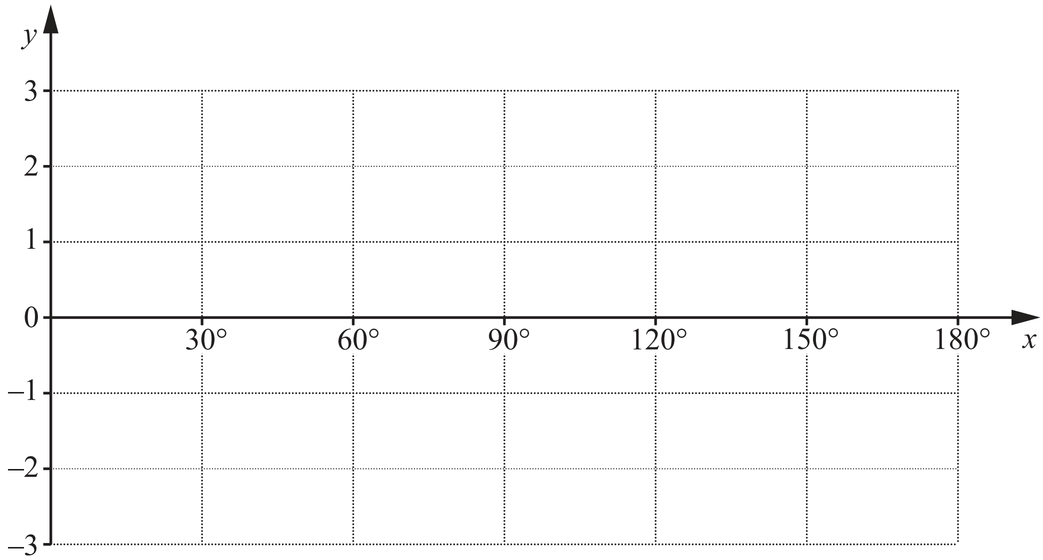
Formulae for ΔABC

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

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

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

1 On the axes below, sketch the graph of $y = |2\cos 3x|$ for $0 \leqslant x \leqslant 180°$. [3]



2 Express $\dfrac{4m\sqrt{m} - \dfrac{9}{\sqrt{m}}}{2\sqrt{m} + \dfrac{3}{\sqrt{m}}}$ in the form $Am + B$, where A and B are integers to be found. [3]

3 **(i)** Given that $3x^2 + p(1 - 2x) = -3$, show that, for x to be real, $p^2 - 3p - 9 \geqslant 0$. [3]

(ii) Hence find the set of values of p for which x is real, expressing your answer in exact form. [3]

4 **(i)** Find, in ascending powers of x, the first 3 terms in the expansion of $\left(2-\frac{x}{4}\right)^6$. [3]

(ii) Hence find the term independent of x in the expansion of $\left(4+\frac{2}{x}+\frac{3}{x^2}\right)\left(2-\frac{x}{4}\right)^6$. [3]

5 **(i)** Given that $\log_9 xy = \frac{5}{2}$, show that $\log_3 x + \log_3 y = 5$. [3]

(ii) Hence solve the equations

$$\log_9 xy = \frac{5}{2},$$

$$\log_3 x \times \log_3 y = -6.$$ [5]

6 **(i)** Find $\frac{\mathrm{d}}{\mathrm{d}x}(\ln(3x^2 - 11))$. [2]

(ii) Hence show that $\int \frac{x}{3x^2 - 11}\,\mathrm{d}x = p\ln(3x^2 - 11) + c$, where p is a constant to be found, and c is a constant of integration. [1]

(iii) Given that $\int_2^a \frac{x}{3x^2 - 11}\,\mathrm{d}x = \ln 2$, where $a > 2$, find the value of a. [4]

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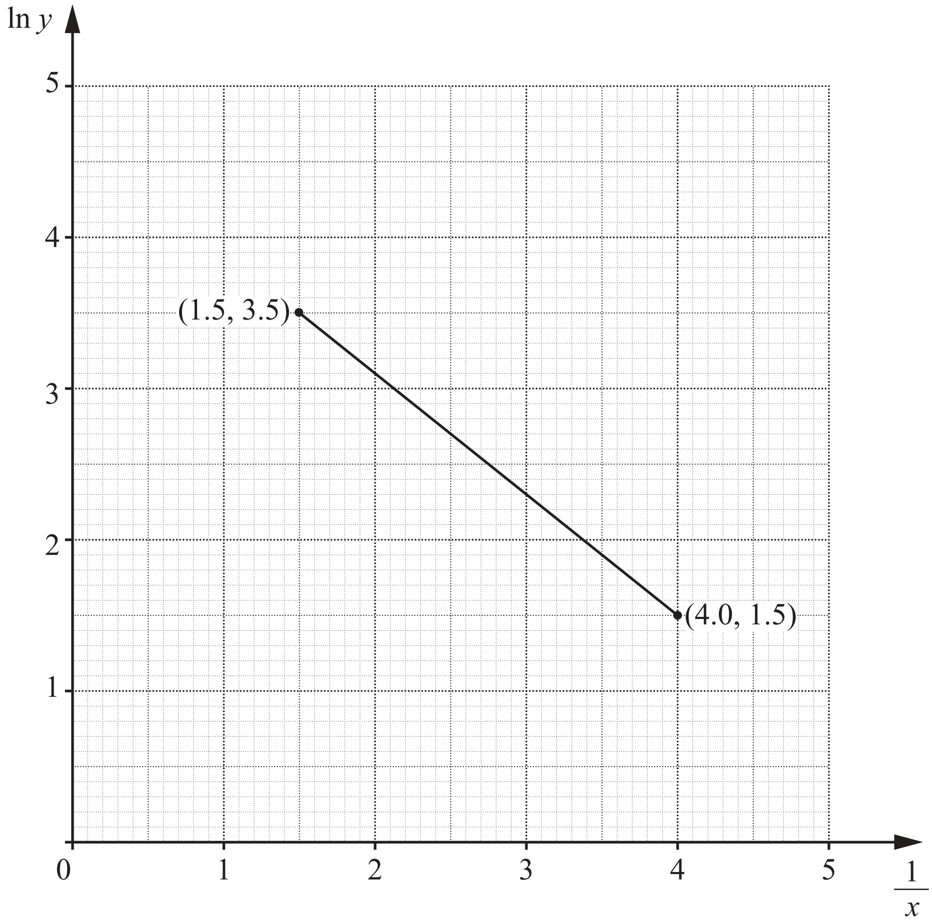

The variables x and y are such that when $\ln y$ is plotted against $\frac{1}{x}$ the straight line graph shown above is obtained.

(i) Given that $y = Ae^{\frac{b}{x}}$, find the value of A and of b. [4]

(ii) Find the value of y when $x = 0.32$. [2]

(iii) Find the value of x when $y = 20$. [2]

8 **(a)** **(i)** Show that $\dfrac{\operatorname{cosec}\theta}{\operatorname{cosec}\theta - \sin\theta} = \sec^2\theta$. [3]

(ii) Hence solve $\dfrac{\operatorname{cosec}\theta}{\operatorname{cosec}\theta - \sin\theta} = 4$ for $0° < \theta < 360°$. [3]

(b) Solve $\sqrt{3}\tan\left(x+\frac{\pi}{4}\right)=1$ for $0 < x < 2\pi$, giving your answers in terms of π. [3]

9 **(a)** A team of 5 students is to be chosen from a class of 10 boys and 8 girls. Find the number of different teams that may be chosen if

(i) there are no restrictions, [1]

(ii) the team must contain at least one boy and one girl. [4]

(b) A computer password, which must contain 6 characters, is to be chosen from the following 10 characters:

Symbols	?	!	*	
Numbers	3	5	7	
Letters	W	X	Y	Z

Each character may be used once only in any password. Find the number of possible passwords that may be chosen if

(i) there are no restrictions, [1]

(ii) each password must start with a letter and finish with a number, [2]

(iii) each password must contain at least one symbol. [3]

10 A curve $y = \mathrm{f}(x)$ is such that $\mathrm{f}'(x) = 6x - 8\mathrm{e}^{2x}$.

(i) Given that the curve passes through the point $P\ (0, -3)$, find the equation of the curve. [5]

The normal to the curve $y = \mathrm{f}(x)$ at P meets the line $y = 2 - 3x$ at the point Q.

(ii) Find the area of the triangle OPQ, where O is the origin. [5]

11 A particle moving in a straight line has a velocity of $v\,\text{ms}^{-1}$ such that, t s after leaving a fixed point, $v = 4t^2 - 8t + 3$.

(i) Find the acceleration of the particle when $t = 3$. [2]

(ii) Find the values of t for which the particle is momentarily at rest. [2]

(iii) Find the total distance the particle has travelled when $t = 1.5$. [5]

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