Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

2806846665

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

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

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

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

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

Formulae for ΔABC

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

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

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

1 Show that $\dfrac{\cos A}{1+\sin A}+\dfrac{1+\sin A}{\cos A}$ can be written in the form $p\sec A$, where p is an integer to be found. [4]

2 **(a)** On the Venn diagrams below, draw sets A and B as indicated.

(i)

$A \cap B = \varnothing$

(ii)

$A \subset B$

[2]

(b) The universal set ℰ and sets P and Q are such that n(ℰ) = 20, $\mathrm{n}(P \cup Q) = 15$, $\mathrm{n}(P) = 13$ and $\mathrm{n}(P \cap Q) = 4$. Find

(i) $\mathrm{n}(Q)$, [1]

(ii) $\mathrm{n}\big((P \cup Q)'\big)$, [1]

(iii) $\mathrm{n}(P \cap Q')$. [1]

3 **(i)** Sketch the graph of $y = |(2x+1)(x-2)|$ for $-2 \leqslant x \leqslant 3$, showing the coordinates of the points where the curve meets the x- and y-axes. [3]

(ii) Find the non-zero values of k for which the equation $|(2x+1)(x-2)| = k$ has two solutions only. [2]

4 The region enclosed by the curve $y = 2\sin 3x$, the x-axis and the line $x = a$, where $0 < a < 1$ radian, lies entirely above the x-axis. Given that the area of this region is $\frac{1}{3}$ square unit, find the value of a. [6]

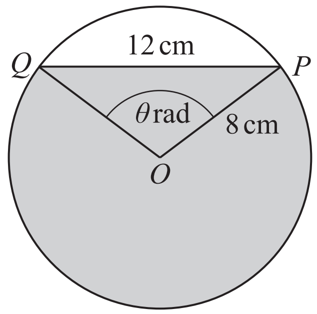
5 **(i)** Given that $2^{5x} \times 4^{y} = \frac{1}{8}$, show that $5x + 2y = -3$. [3]

(ii) Solve the simultaneous equations $2^{5x} \times 4^{y} = \frac{1}{8}$ and $7^{x} \times 49^{2y} = 1$. [4]

6 **(a)** Matrices **X**, **Y** and **Z** are such that $\mathbf{X} = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$, $\mathbf{Y} = \begin{pmatrix} 1 & 3 \\ 4 & 5 \\ 6 & 7 \end{pmatrix}$ and $\mathbf{Z} = \begin{pmatrix} 1 & 2 & 3 \end{pmatrix}$. Write down all the matrix products which are possible using any two of these matrices. Do not evaluate these products. [2]

(b) Matrices **A** and **B** are such that $\mathbf{A} = \begin{pmatrix} 5 & -2 \\ -4 & 1 \end{pmatrix}$ and $\mathbf{AB} = \begin{pmatrix} 3 & 9 \\ -6 & -3 \end{pmatrix}$. Find the matrix **B**. [5]

7 The diagram shows a circle, centre O, radius 8 cm. Points P and Q lie on the circle such that the chord $PQ = 12$ cm and angle $POQ = \theta$ radians.



(i) Show that $\theta = 1.696$, correct to 3 decimal places. [2]

(ii) Find the perimeter of the shaded region. [3]

(iii) Find the area of the shaded region. [3]

8 **(a)** **(i)** How many different 5-digit numbers can be formed using the digits 1, 2, 4, 5, 7 and 9 if no digit is repeated? [1]

(ii) How many of these numbers are even? [1]

(iii) How many of these numbers are less than 60 000 and even? [3]

(b) How many different groups of 6 children can be chosen from a class of 18 children if the class contains one set of twins who must not be separated? [3]

9 A solid circular cylinder has a base radius of r cm and a volume of $4000\,\text{cm}^3$.

(i) Show that the total surface area, $A\,\text{cm}^2$, of the cylinder is given by $A = \dfrac{8000}{r} + 2\pi r^2$. [3]

(ii) Given that r can vary, find the minimum total surface area of the cylinder, justifying that this area is a minimum. [6]

10 In this question **i** is a unit vector due East and **j** is a unit vector due North.
At 12 00 hours, a ship leaves a port *P* and travels with a speed of $26\,\text{km}\text{h}^{-1}$ in the direction $5\mathbf{i} + 12\mathbf{j}$.

(i) Show that the velocity of the ship is $(10\mathbf{i} + 24\mathbf{j})\,\text{km}\text{h}^{-1}$. [2]

(ii) Write down the position vector of the ship, relative to *P*, at 16 00 hours. [1]

(iii) Find the position vector of the ship, relative to *P*, *t* hours after 16 00 hours. [2]

At 16 00 hours, a speedboat leaves a lighthouse which has position vector $(120\mathbf{i} + 81\mathbf{j})\,\text{km}$, relative to *P*, to intercept the ship. The speedboat has a velocity of $(-22\mathbf{i} + 30\mathbf{j})\,\text{km}\text{h}^{-1}$.

(iv) Find the position vector, relative to *P*, of the speedboat *t* hours after 16 00 hours. [1]

(v) Find the time at which the speedboat intercepts the ship and the position vector, relative to *P*, of the point of interception. [4]

11 **(a)** Solve $\tan^2 x + 5\tan x = 0$ for $0° \leqslant x \leqslant 180°$. [3]

(b) Solve $2\cos^2 y - \sin y - 1 = 0$ for $0° \leqslant y \leqslant 360°$. [4]

(c) Solve $\sec\left(2z - \frac{\pi}{6}\right) = 2$ for $0 \leqslant z \leqslant \pi$ radians. [4]

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