Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7690408726

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **October/November 2017**

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 Solve the inequality $(x-1)(x-5) > 12$. [4]

2 Show that $\dfrac{1}{1-\sin\theta} - \dfrac{1}{1+\sin\theta} = 2\tan\theta\sec\theta$. [4]

3 Solve the equation $\log_5(10x+5) = 2 + \log_5(x-7)$. [4]

4 Solve the following simultaneous equations for x and y, giving each answer in its simplest surd form.

$$\sqrt{3}x + y = 4$$

$$x - 2y = 5\sqrt{3}$$

[5]

5 **(i)** Find $\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{5}{3x+2}\right)$. [2]

(ii) Use your answer to part **(i)** to find $\int \frac{30}{(3x+2)^2}\,\mathrm{d}x$. [2]

(iii) Hence evaluate $\int_1^2 \frac{30}{(3x+2)^2}\,\mathrm{d}x$. [2]

6 It is given that $\mathbf{M} = \begin{pmatrix} 2 & p \\ -3 & q \end{pmatrix}$ where p and q are integers.

(i) If det $\mathbf{M} = 13$, find an equation connecting p and q. [1]

(ii) Given also that $\mathbf{M}^2 = \begin{pmatrix} 4-3p & 12 \\ -6-3q & -3p+q^2 \end{pmatrix}$, find a second equation connecting p and q. [2]

(iii) Find the value of p and of q. [4]

7 Find y in terms of x, given that $\dfrac{d^2y}{dx^2} = 6x + \dfrac{2}{x^3}$ and that when $x = 1$, $y = 3$ and $\dfrac{dy}{dx} = 1$. [6]

8 Given that $z = a + (a+3)\sqrt{3}$ and $z^2 = 79 + b\sqrt{3}$, find the value of each of the integers a and b. [6]

9 **(i)** Expand $(1 + x)^4$, simplifying all coefficients. [1]

(ii) Expand $(6 - x)^4$, simplifying all coefficients. [2]

(iii) Hence express $(6 - x)^4 - (1 + x)^4 = 175$ in the form $ax^3 + bx^2 + cx + d = 0$, where a, b, c and d are integers. [2]

(iv) Show that $x = 2$ is a solution of the equation in part **(iii)** and show that this equation has no other real roots. [5]

10 In this question **i** is a unit vector due east and **j** is a unit vector due north. Units of length and velocity are metres and metres per second respectively.

The initial position vectors of particles A and B, relative to a fixed point O, are $2\mathbf{i} + 4\mathbf{j}$ and $10\mathbf{i} + 14\mathbf{j}$ respectively. Particles A and B start moving at the same time. A moves with constant velocity $\mathbf{i} + \mathbf{j}$ and B moves with constant velocity $-2\mathbf{i} - 3\mathbf{j}$. Find

(i) the position vector of A after t seconds, [1]

(ii) the position vector of B after t seconds. [1]

It is given that X is the distance between A and B after t seconds.

(iii) Show that $X^2 = (8 - 3t)^2 + (10 - 4t)^2$. [3]

(iv) Find the value of t for which $(8-3t)^2+(10-4t)^2$ has a stationary value and the corresponding value of X. [4]

11 The line $y = kx + 3$, where k is a positive constant, is a tangent to the curve $x^2 - 2x + y^2 = 8$ at the point P.

(i) Find the value of k. [4]

(ii) Find the coordinates of P. [3]

(iii) Find the equation of the normal to the curve at P. [2]

12 **(i)** Differentiate $(\cos x)^{-1}$ with respect to x. [2]

(ii) Hence find $\frac{\mathrm{d}y}{\mathrm{d}x}$ given that $y = \tan x + 4(\cos x)^{-1}$. [2]

(iii) Using your answer to part **(ii)** find the values of x in the range $0 \leqslant x \leqslant 2\pi$ such that $\frac{\mathrm{d}y}{\mathrm{d}x} = 4$. [6]

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