Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

9662401708

ADDITIONAL MATHEMATICS **0606/22**

Paper 2 **May/June 2016**

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.

DC (KN/SW) 106860/4

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 **(i)** Given that $x^2 + 2kx + 4k - 3 = 0$ has no real roots, show that k satisfies $k^2 - 4k + 3 < 0$. [2]

(ii) Solve the inequality $k^2 - 4k + 3 < 0$. [2]

2 Variables x and y are related by the equation $y = \dfrac{5x - 1}{3 - x}$.

(i) Find $\dfrac{dy}{dx}$, simplifying your answer. [2]

(ii) Hence find the approximate change in x when y increases from 9 by the small amount 0.07. [3]

3 A team of 3 people is to be selected from 7 women and 6 men. Find the number of different teams that could be selected if there must be more women than men on the team. [3]

4 **Do not use a calculator in this question.**

The polynomial $p(x) = 2x^3 - 3x^2 + qx + 56$ has a factor $x - 2$.

(i) Show that $q = -30$. [1]

(ii) Factorise $p(x)$ completely and hence state all the solutions of $p(x) = 0$. [4]

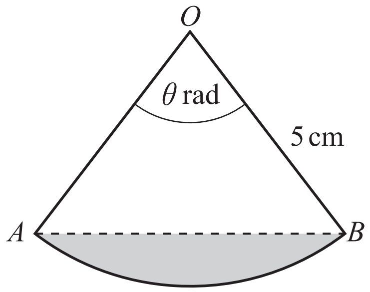
5 The coordinates of three points are $A(-2, 6)$, $B(6, 10)$ and $C(p, 0)$.

(i) Find the coordinates of M, the mid-point of AB. [2]

(ii) Given that CM is perpendicular to AB, find the value of the constant p. [2]

(iii) Find angle MCB. [3]

6



The diagram shows a sector of a circle with centre O and radius 5 cm. The length of the arc AB is 7 cm. Angle AOB is θ radians.

(i) Explain why θ must be greater than 1 radian. [1]

(ii) Find the value of θ. [2]

(iii) Calculate the area of the sector AOB. [2]

(iv) Calculate the area of the shaded segment. [2]

7 The matrix $\mathbf{A}$ is $\begin{pmatrix} 4 & 5 \\ 3 & 2 \end{pmatrix}$ and the matrix $\mathbf{B}$ is $\begin{pmatrix} 4 & 2 \\ 1 & 3 \end{pmatrix}$.

(i) Find the matrix $\mathbf{C}$ such that $\mathbf{C} = 3\mathbf{A} + \mathbf{B}$. [2]

(ii) Show that $\det(\mathbf{AB}) = \det\mathbf{A} \times \det\mathbf{B}$. [4]

(iii) Find the matrix $(\mathbf{AB})^{-1}$. [2]

8 Find the coordinates of the points of intersection of the curve $4 + \frac{5}{y} + \frac{3}{x} = 0$ and the line $y = 15x + 10$. [6]

9 **(a)** Find $\int \frac{x^3 + x^2 + 1}{x^2} \, dx$. [3]

(b) **(i)** Find $\int \sin(5x + \pi) \, dx$. [2]

(ii) Hence evaluate $\int_{-\frac{\pi}{5}}^{0} \sin(5x + \pi) \, dx$. [2]

10 **(a)** The graph of the curve $y = p(4^{2x}) - q(4^{x})$ passes through the points (0, 2) and (0.5, 14). Find the value of p and of q. [3]

(b) The variables x and y are connected by the equation $y = 10^{2x} - 2(10^{x})$. Using the substitution $u = 10^{x}$, or otherwise, find the exact value of x when $y = 24$. [3]

(c) Solve $\log_2(x+1) - \log_2 x = 3$. [3]

11 **(a)** A function f is defined, for all real x, by

$$\mathrm{f}(x) = x - x^2.$$

Find the greatest value of $\mathrm{f}(x)$ and the value of x for which this occurs. [3]

(b) The domain of $\mathrm{g}(x) = x - x^2$ is such that $\mathrm{g}^{-1}(x)$ exists. Explain why $x \geqslant 1$ is a suitable domain for $\mathrm{g}(x)$. [1]

(c) The functions h and k are defined by

$$\mathrm{h}: x \mapsto \lg(x+2) \qquad \text{for } x > -2,$$
$$\mathrm{k}: x \mapsto 5 + \sqrt{x-1} \qquad \text{for } 1 < x < 101.$$

(i) Find hk(10). [2]

(ii) Find $\mathrm{k}^{-1}(x)$, stating its domain and range. [5]

Question 12 is printed on the next page.

12 Solve the equation

(i) $8\sin^2 A + 2\cos A = 7$ for $0° \leqslant A \leqslant 180°$, [4]

(ii) $\operatorname{cosec}(3B + 1) = 2.5$ for $0 \leqslant B \leqslant \pi$ radians. [4]