Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

9104538921

ADDITIONAL MATHEMATICS **0606/23**

Paper 2 **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 **16** printed pages.

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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

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

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

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

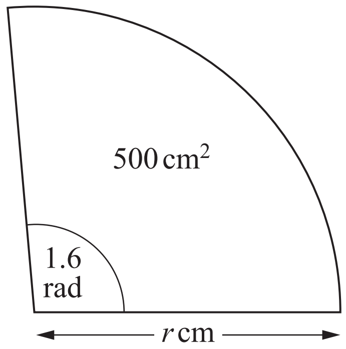
Formulae for ΔABC

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

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

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

1



The diagram shows a sector of a circle of radius r cm. The angle of the sector is 1.6 radians and the area of the sector is $500\,\text{cm}^2$.

(i) Find the value of r. [2]

(ii) Hence find the perimeter of the sector. [2]

2 Using the substitution $u = \log_3 x$, solve, for x, the equation $\log_3 x - 12\log_x 3 = 4$. [5]

3 In a motor racing competition, the winning driver in each race scores 5 points, the second and third placed drivers score 3 and 1 points respectively. Each team has two members. The results of the drivers in one team, over a number of races, are shown in the table below.

Driver	1^{st} place	2^{nd} place	3^{rd} place
Alan	3	1	4
Brian	1	4	0

(i) Write down two matrices whose product under matrix multiplication will give the number of points scored by each of the drivers. Hence calculate the number of points scored by Alan and by Brian. [3]

(ii) The points scored by Alan and by Brian are added to give the number of points scored by the team. Using your answer to part **(i)**, write down two matrices whose product would give the number of points scored by the team. [1]

4 **(a)** Illustrate the following statements using the Venn diagrams below.

(i) $A \cup B = A$ **(ii)** $A \cap B \cap C = \varnothing$ [2]

(b) It is given that ℰ is the set of integers between 1 and 100 inclusive. S and C are subsets of ℰ, where S is the set of square numbers and C is the set of cube numbers. Write the following statements using set notation.

(i) 50 is not a cube number. [1]

(ii) 64 is both a square number and a cube number. [1]

(iii) There are 90 integers between 1 and 100 inclusive which are not square numbers. [1]

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

(i) Show that $(2\sqrt{2}+4)^2 - 8(2\sqrt{2}+3) = 0$. [2]

(ii) Solve the equation $(2\sqrt{2}+3)x^2 - (2\sqrt{2}+4)x + 2 = 0$, giving your answer in the form $a + b\sqrt{2}$ where a and b are integers. [3]

6 Find the coordinates of the points of intersection of the curve $\frac{8}{x} - \frac{10}{y} = 1$ and the line $x + y = 9$. [6]

7 **(a)** Prove that $\dfrac{\tan\theta + \cot\theta}{\sec\theta + \operatorname{cosec}\theta} = \dfrac{1}{\sin\theta + \cos\theta}$. [3]

(b) Given that $\tan x = -\dfrac{5}{12}$ and $90° < x < 180°$, find the exact value of $\sin x$ and of $\cos x$, giving each answer as a fraction. [3]

Answer $\sin x =$ $\cos x =$

[Turn over

8 A curve is such that $\frac{dy}{dx} = 6x^2 - 8x + 3$.

(i) Show that the curve has no stationary points. [2]

Given that the curve passes through the point $P(2, 10)$,

(ii) find the equation of the tangent to the curve at the point P, [2]

(iii) find the equation of the curve. [4]

9 **Solutions to this question by accurate drawing will not be accepted.**
The points $A(2, 11)$, $B(-2, 3)$ and $C(2, -1)$ are the vertices of a triangle.

(i) Find the equation of the perpendicular bisector of *AB*. [4]

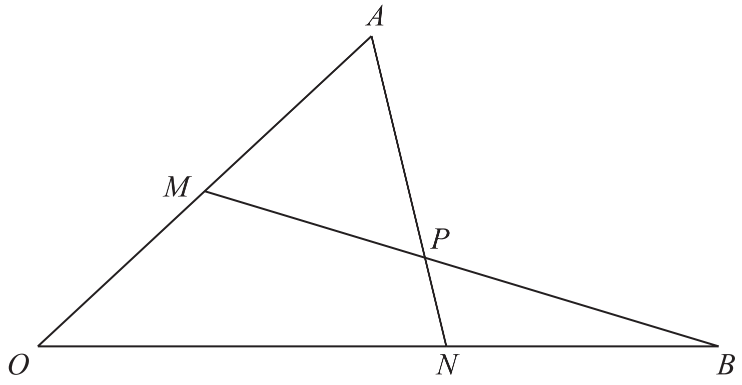
The line through *A* parallel to *BC* intersects the perpendicular bisector of *AB* at the point *D*.

(ii) Find the area of the quadrilateral *ABCD*. [6]

10 **(i)** Given that $y = \dfrac{2x}{\sqrt{x^2 + 21}}$, show that $\dfrac{dy}{dx} = \dfrac{k}{\sqrt{(x^2 + 21)^3}}$, where k is a constant to be found. [5]

(ii) Hence find $\int \frac{6}{\sqrt{(x^2+21)^3}}\,dx$ and evaluate $\int_2^{10} \frac{6}{\sqrt{(x^2+21)^3}}\,dx$. [3]

11



In the diagram $\overrightarrow{OA} = 2\mathbf{a}$ and $\overrightarrow{OB} = 5\mathbf{b}$. The point M is the midpoint of OA and the point N lies on OB such that $ON:NB = 3:2$.

(i) Find an expression for the vector $\overrightarrow{MB}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. [2]

The point P lies on AN such that $\overrightarrow{AP} = \lambda\overrightarrow{AN}$.

(ii) Find an expression for the vector $\overrightarrow{AP}$ in terms of λ, $\mathbf{a}$ and $\mathbf{b}$. [2]

(iii) Find an expression for the vector $\overrightarrow{MP}$ in terms of λ, **a** and **b**. [2]

(iv) Given that M, P and B are collinear, find the value of λ. [4]

Question 12 is printed on the next page.

12 The function f is such that $f(x) = 2 + \sqrt{x-3}$ for $4 \leqslant x \leqslant 28$.

(i) Find the range of f. [2]

(ii) Find $f^2(12)$. [2]

(iii) Find an expression for $f^{-1}(x)$. [2]

The function g is defined by $g(x) = \frac{120}{x}$ for $x \geqslant 0$.

(iv) Find the value of x for which $gf(x) = 20$. [3]