Cambridge IGCSE

**Cambridge International Examinations**
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*8262841617*

**ADDITIONAL MATHEMATICS** **0606/13**

Paper 1 **May/June 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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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*

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

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

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

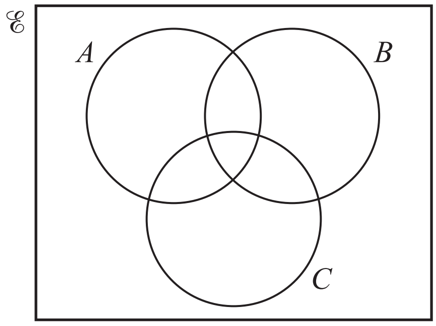
*Formulae for $\Delta ABC$*

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

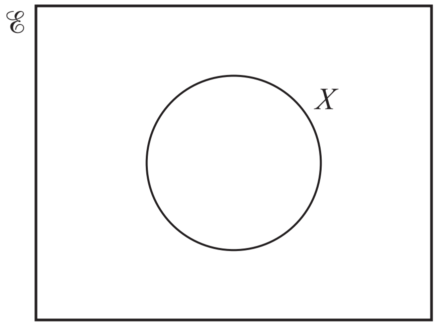
$$a^2 = b^2 + c^2 - 2bc \cos A$$

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

**1** **(a)** On the Venn diagram below, shade the region which represents $(A \cap B') \cup (C \cap B')$. [1]




**(b)** Complete the Venn diagram below to show the sets $Y$ and $Z$ such that $Z \subset X \subset Y$. [1]

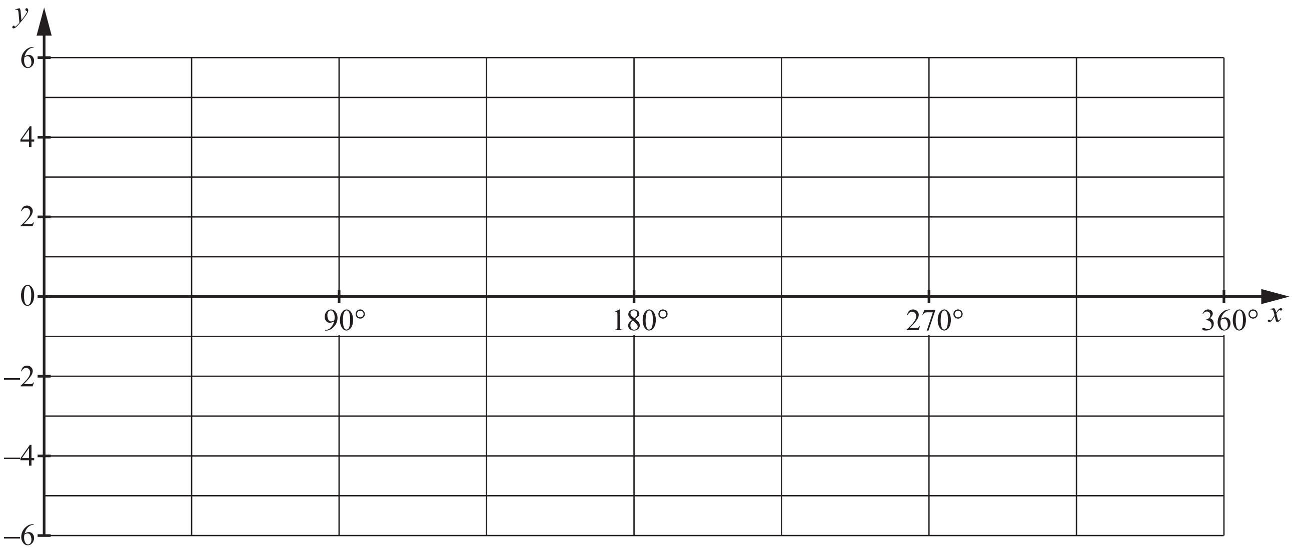



**2** Given that $y = 3 + 4\cos 9x$, write down

**(i)** the amplitude of $y$, [1]

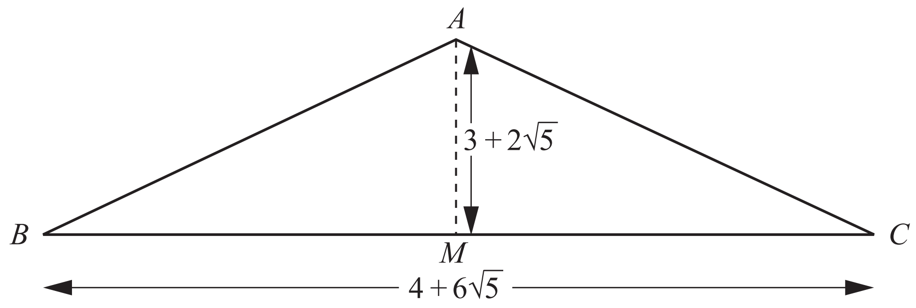
**(ii)** the period of $y$. [1]

**3** **(i)** On the axes below, sketch the graph of $y = 3\sin x - 2$ for $0° \leqslant \theta \leqslant 360°$. [3]




**(ii)** Given that $0 \leqslant |3\sin x - 2| \leqslant k$ for $0° \leqslant x \leqslant 360°$, write down the value of $k$. [1]

**4** In this question, all dimensions are in centimetres.




The diagram shows an isosceles triangle $ABC$, where $AB = AC$. The point $M$ is the mid-point of $BC$. Given that $AM = 3 + 2\sqrt{5}$ and $BC = 4 + 6\sqrt{5}$, find, **without using a calculator**,

**(i)** the area of triangle $ABC$, [2]

**(ii)** $\tan ABC$, giving your answer in the form $\dfrac{a + b\sqrt{5}}{c}$ where $a$, $b$ and $c$ are positive integers. [3]

5 The normal to the curve $y = \sqrt{4x + 9}$, at the point where $x = 4$, meets the $x$- and $y$-axes at the points $A$ and $B$. Find the coordinates of the mid-point of the line $AB$. [7]

**6** **(a)** Given that $\mathbf{A} = \begin{pmatrix} 3 & 1 \\ 2 & 4 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 5 & 1 \\ 2 & 4 \\ -1 & 0 \end{pmatrix}$ and $\mathbf{C} = \begin{pmatrix} -5 & 2 \\ 3 & 1 \end{pmatrix}$, find

**(i)** $\mathbf{A} + 3\mathbf{C}$, [2]

**(ii)** $\mathbf{BA}$. [2]

**(b)** **(i)** Given that $\mathbf{X} = \begin{pmatrix} 1 & -3 \\ 4 & -2 \end{pmatrix}$, find $\mathbf{X}^{-1}$. [2]

**(ii)** Hence find $\mathbf{Y}$, such that $\mathbf{XY} = \begin{pmatrix} 5 & -10 \\ 15 & 20 \end{pmatrix}$. [3]

**7** **(a)** Show that $\dfrac{\tan^2\theta + \sin^2\theta}{\cos\theta + \sec\theta} = \tan\theta \sin\theta$. [4]

**(b)** Given that $x = 3\sin\phi$ and $y = \dfrac{3}{\cos\phi}$, find the numerical value of $9y^2 - x^2y^2$. [3]

**8** It is given that $p(x) = 2x^3 + ax^2 + 4x + b$, where $a$ and $b$ are constants. It is given also that $2x + 1$ is a factor of $p(x)$ and that when $p(x)$ is divided by $x - 1$ there is a remainder of $-12$.

**(i)** Find the value of $a$ and of $b$. [5]

**(ii)** Using your values of $a$ and $b$, write $p(x)$ in the form $(2x + 1)q(x)$, where $q(x)$ is a quadratic expression. [2]

**(iii)** Hence find the exact solutions of the equation $p(x) = 0$. [2]

**9** It is given that $\int_{-k}^{k}(15\mathrm{e}^{5x} - 5\mathrm{e}^{-5x})\,\mathrm{d}x = 6$.

**(i)** Show that $\mathrm{e}^{5k} - \mathrm{e}^{-5k} = 3$. [5]

**(ii)** Hence, using the substitution $y = \mathrm{e}^{5k}$, or otherwise, find the value of $k$. [3]

**10** It is given that $y = (10x + 2)\ln(5x + 1)$.

**(i)** Find $\dfrac{dy}{dx}$. [4]

**(ii)** Hence show that $\int \ln(5x + 1)\,dx = \dfrac{(ax + b)}{5}\ln(5x + 1) - x + c$, where $a$ and $b$ are integers and $c$ is a constant of integration. [3]

**(iii)** Hence find $\int_0^{\frac{1}{5}} \ln(5x+1)\,dx$, giving your answer in the form $\dfrac{d+\ln f}{5}$, where $d$ and $f$ are integers. [2]

**11** A curve has equation $y = 6x - x\sqrt{x}$.

**(i)** Find the coordinates of the stationary point of the curve. [4]

**(ii)** Determine the nature of this stationary point. [2]

**(iii)** Find the approximate change in $y$ when $x$ increases from 4 to $4 + h$, where $h$ is small. [3]

**12** A particle moves in a straight line, such that its velocity, $v\ \text{ms}^{-1}$, $t$ s after passing a fixed point $O$, is given by $v = 2 + 6t + 3\sin 2t$.

**(i)** Find the acceleration of the particle at time $t$. [2]

**(ii)** Hence find the smallest value of $t$ for which the acceleration of the particle is zero. [2]

**(iii)** Find the displacement, $x$ m from $O$, of the particle at time $t$. [5]

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