Cambridge IGCSE

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

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| CANDIDATE NAME | |
| CENTRE NUMBER | |
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**ADDITIONAL MATHEMATICS** **0606/13**

Paper 1 **October/November 2018**

**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*

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

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

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

*Formulae for $\Delta ABC$*

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

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

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

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**1** **(a)** In the expansion of $(2+px)^5$ the coefficient of $x^3$ is equal to $-\frac{8}{25}$. Find the value of the constant $p$. [3]

View solution

**(b)** Find the term independent of $x$ in the expansion of $\left(2x^2+\frac{1}{4x^2}\right)^8$. [3]

View solution

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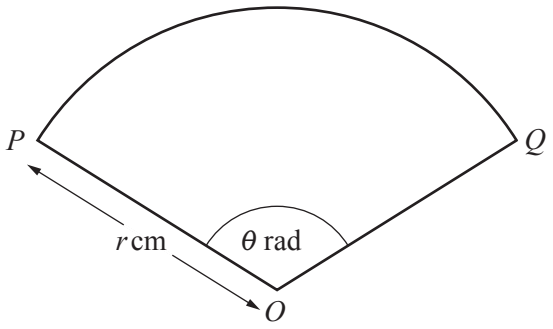
**2**




The diagram shows a sector $POQ$ of a circle, centre $O$, radius $r$ cm, where angle $POQ = \theta$ radians. The perimeter of the sector is 20 cm.

**(i)** Show that the area, $A$ cm$^2$, of the sector is given by $A = 10r - r^2$. [3]

View solution

It is given that $r$ can vary and that $A$ has a maximum value.

**(ii)** Find the value of $\theta$ for which $A$ has a maximum value. [3]

View solution

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

In this question, all lengths are in centimetres.

A triangle $ABC$ is such that angle $B = 90°$, $AB = 5\sqrt{3} + 5$ and $BC = 5\sqrt{3} - 5$.

**(i)** Find, in its simplest surd form, the length of $AC$. [3]

View solution

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

View solution

**4** In this question, the units of $x$ are radians and the units of $y$ are centimetres.

It is given that $y = (1 + \cos 3x)^{10}$.

**(i)** Find the value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $x = \frac{\pi}{2}$. [4]

View solution

Given also that $y$ is increasing at a rate of $6\,\mathrm{cm\,s^{-1}}$ when $x = \frac{\pi}{2}$,

**(ii)** find the corresponding rate of change of $x$. [2]

View solution

**5** **(i)** Show that $\log_9 4 = \log_3 2$. [2]

View solution

**(ii)** Hence solve $\log_9 4 + \log_3 x = 3$. [3]

View solution

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**6** A particle $P$ is moving in a straight line such that its displacement, $s$ m, from a fixed point $O$ at time $t$ s, is given by $s = 12e^{-0.5t} + 4t - 12$.

**(i)** Find the value of $t$ when $P$ is instantaneously at rest. [3]

View solution

**(ii)** Find an expression for the acceleration of $P$ at time $t$ s. [2]

View solution

**(iii)** Find the value of $s$ when the acceleration of $P$ is $0.3\,\text{ms}^{-2}$. [3]

View solution

**(iv)** Explain why the acceleration of the particle will always be positive. [1]

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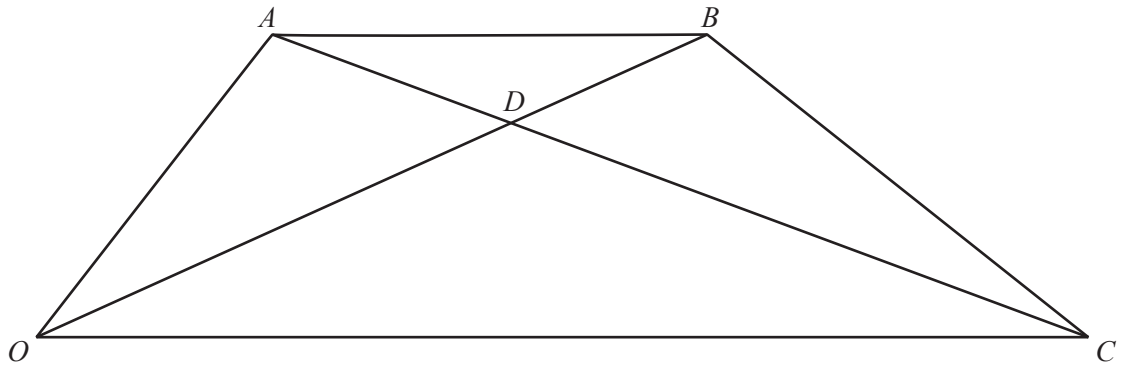
**7**




The diagram shows a quadrilateral $OABC$. The point $D$ lies on $OB$ such that $\overrightarrow{OD} = 2\overrightarrow{DB}$ and $\overrightarrow{AD} = m\overrightarrow{AC}$, where $m$ is a scalar quantity.

$$\overrightarrow{OA} = \mathbf{a} \qquad \overrightarrow{OB} = \mathbf{b} \qquad \overrightarrow{OC} = \mathbf{c}$$

**(i)** Find $\overrightarrow{AD}$ in terms of $m$, $\mathbf{a}$ and $\mathbf{c}$. [1]

View solution

**(ii)** Find $\overrightarrow{AD}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. [2]

View solution

**(iii)** Given that $15\mathbf{a} = 16\mathbf{b} - 9\mathbf{c}$, find the value of $m$. [3]

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**8** $\mathrm{f}(x) = 5 + \sin\frac{x}{4}$ for $0 \leqslant x \leqslant 2\pi$ radians

$\mathrm{g}(x) = x - \frac{\pi}{3}$ for $x \in \mathbb{R}$

**(i)** Write down the range of $\mathrm{f}(x)$. [2]

View solution

**(ii)** Find $\mathrm{f}^{-1}(x)$ and write down its range. [3]

View solution

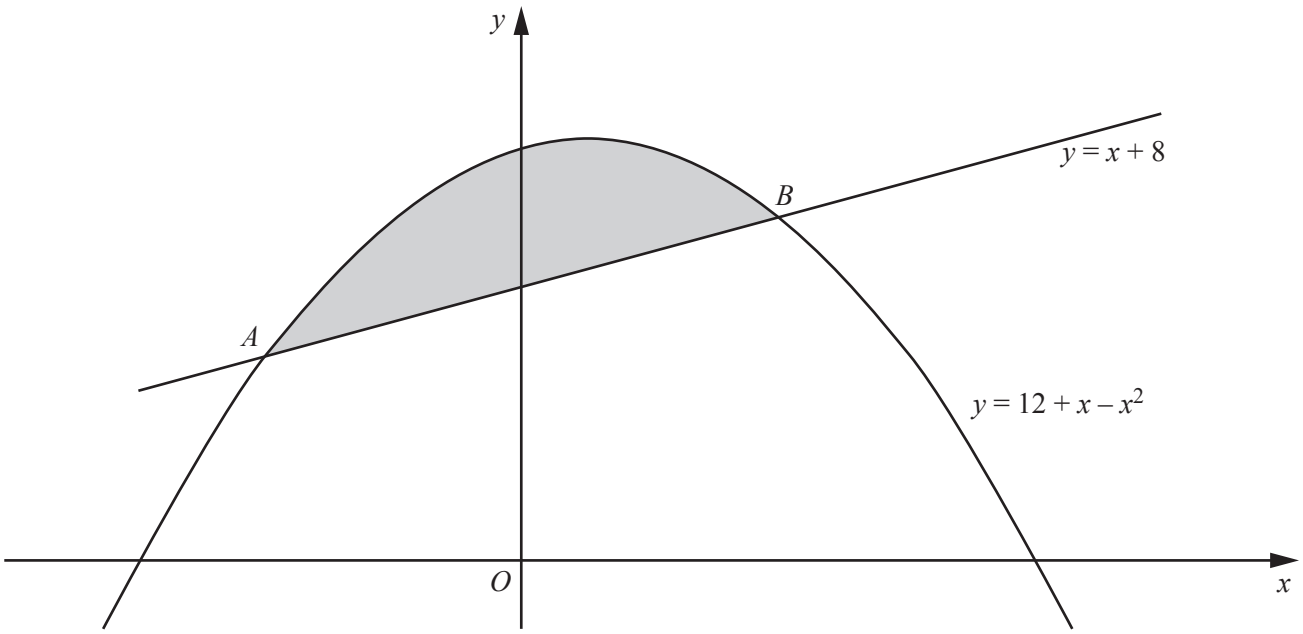
**(iii)** Solve $2\mathrm{fg}(x) = 11$. [4]

View solution

**9** Find the equation of the normal to the curve $y = \dfrac{\ln(3x^2 + 1)}{x^2}$ at the point where $x = 2$, giving your answer in the form $y = mx + c$, where $m$ and $c$ are correct to 2 decimal places. You must show all your working. [8]

View solution

**10**




The diagram shows the curve $y = 12 + x - x^2$ intersecting the line $y = x + 8$ at the points $A$ and $B$.

**(i)** Find the coordinates of the points $A$ and $B$. [3]

View solution

**(ii)** Find $\int (12 + x - x^2)\,\mathrm{d}x$. [2]

View solution

**(iii)** Showing all your working, find the area of the shaded region. [4]

View solution

**11** The polynomial $\mathrm{p}(x) = ax^3 + 17x^2 + bx - 8$ is divisible by $2x - 1$ and has a remainder of $-35$ when divided by $x + 3$.

**(i)** By finding the value of each of the constants $a$ and $b$, verify that $a = b$. [4]

View solution

Using your values of $a$ and $b$,

**(ii)** find $\mathrm{p}(x)$ in the form $(2x - 1)\mathrm{q}(x)$, where $\mathrm{q}(x)$ is a quadratic expression, [2]

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**(iii)** factorise $\mathrm{p}(x)$ completely, [1]

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**(iv)** solve $a\sin^3\theta + 17\sin^2\theta + b\sin\theta - 8 = 0$ for $0° < \theta < 180°$. [3]

View solution

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