Cambridge Assessment International Education

# Cambridge IGCSE™

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| CANDIDATE NAME | | | | | | | | | |
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*2445269796*

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

Paper 1 **May/June 2021**

**2 hours**

You must answer on the question paper.

No additional materials are needed.

**INSTRUCTIONS**

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

**INFORMATION**

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.


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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 $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

*Arithmetic series* $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

*Geometric series* $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

### 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** Find the possible values of the constant $k$ such that the equation $kx^2 + 4kx + 3k + 1 = 0$ has two different real roots. [4]

**2** **(a)** Find $\frac{\mathrm{d}}{\mathrm{d}x}\left(x^2 \mathrm{e}^{3x}\right)$. [3]

**(b)** **(i)** Find $\frac{\mathrm{d}}{\mathrm{d}x}\left(3x^2+4\right)^{\frac{1}{3}}$. [2]

**(ii)** Hence find $\int_0^2 x\left(3x^2+4\right)^{-\frac{2}{3}}\,\mathrm{d}x$. [3]

**3** Solve the equation $\operatorname{cosec}^2\theta + 2\cot^2\theta = 2\cot\theta + 9$, where $\theta$ is in radians and $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$. [5]

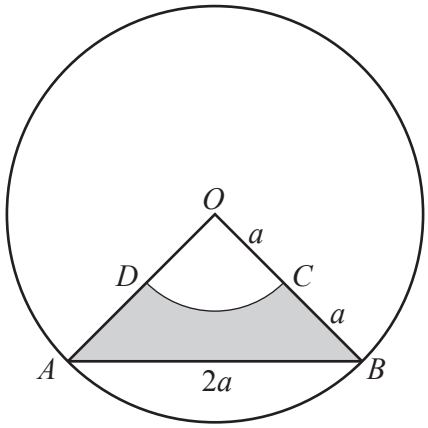
**4** **(a)** Find the first three non-zero terms in the expansion of $\left(2-\frac{x^2}{4}\right)^6$ in ascending powers of $x$. Simplify each term. [3]

**(b)** Hence find the term independent of $x$ in the expansion of $\left(2-\frac{x^2}{4}\right)^6\left(3-\frac{1}{x^2}\right)^2$. [3]

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**5** When $e^{y}$ is plotted against $x^2$ a straight line graph passing through the points $(2.24, 5)$ and $(4.74, 10)$ is obtained. Find $y$ in terms of $x$. [5]

**6**




The diagram shows a circle, centre $O$, radius $2a$. The points $A$ and $B$ lie on the circumference of the circle. The points $C$ and $D$ are the mid-points of the lines $OB$ and $OA$ respectively. The arc $DC$ is part of a circle centre $O$. The chord $AB$ is of length $2a$.

**(a)** Find angle $AOB$, giving your answer in radians in terms of $\pi$. [1]

**(b)** Find, in terms of $a$ and $\pi$, the perimeter of the shaded region $ABCD$. [2]

**(c)** Find, in terms of $a$ and $\pi$, the area of the shaded region $ABCD$. [3]

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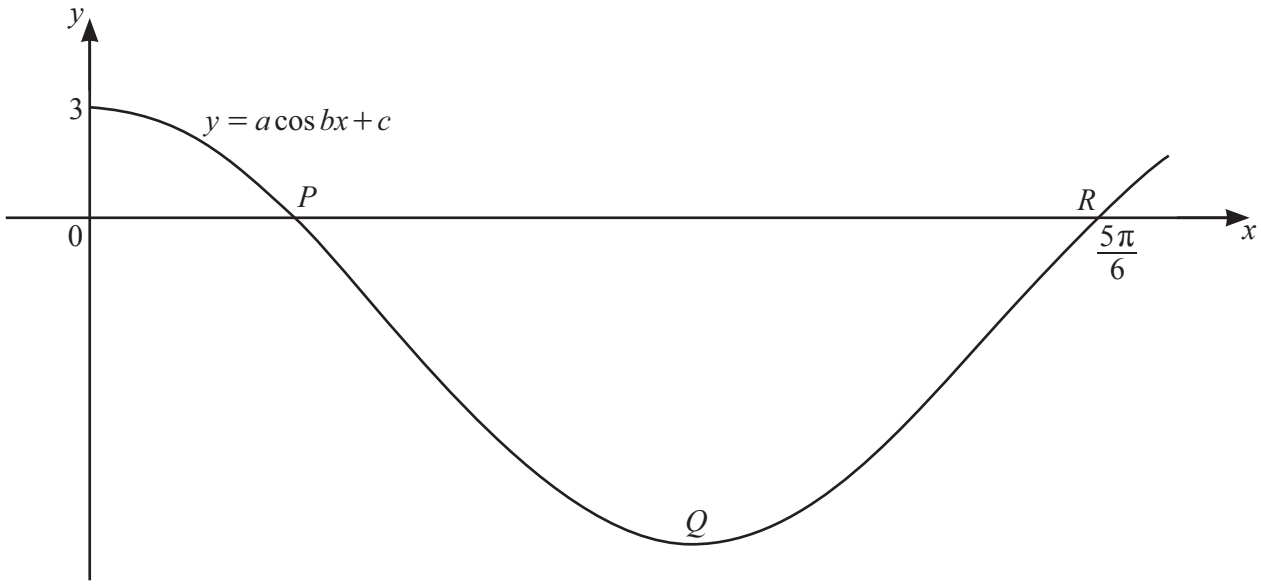
**7** **(a)** A committee of 8 people is to be formed from 5 teachers, 4 doctors and 3 police officers. Find the number of different committees that could be chosen if

**(i)** all 4 doctors are on the committee, [2]

**(ii)** there are at least 2 teachers on the committee. [3]

**(b)** Given that ${}^{n}\mathrm{P}_{5} = 6 \times {}^{n-1}\mathrm{P}_{4}$, find the value of $n$. [3]

**8**




The graph shows the curve $y = a\cos bx + c$, for $0 \leqslant x \leqslant 2.8$, where $a$, $b$ and $c$ are constants and $x$ is in radians. The curve meets the $y$-axis at (0, 3) and the $x$-axis at the point $P$ and point $R\left(\frac{5\pi}{6}, 0\right)$.

The curve has a minimum at point $Q$. The period of $a\cos bx + c$ is $\pi$ radians.

**(a)** Find the value of each of $a$, $b$ and $c$. [4]

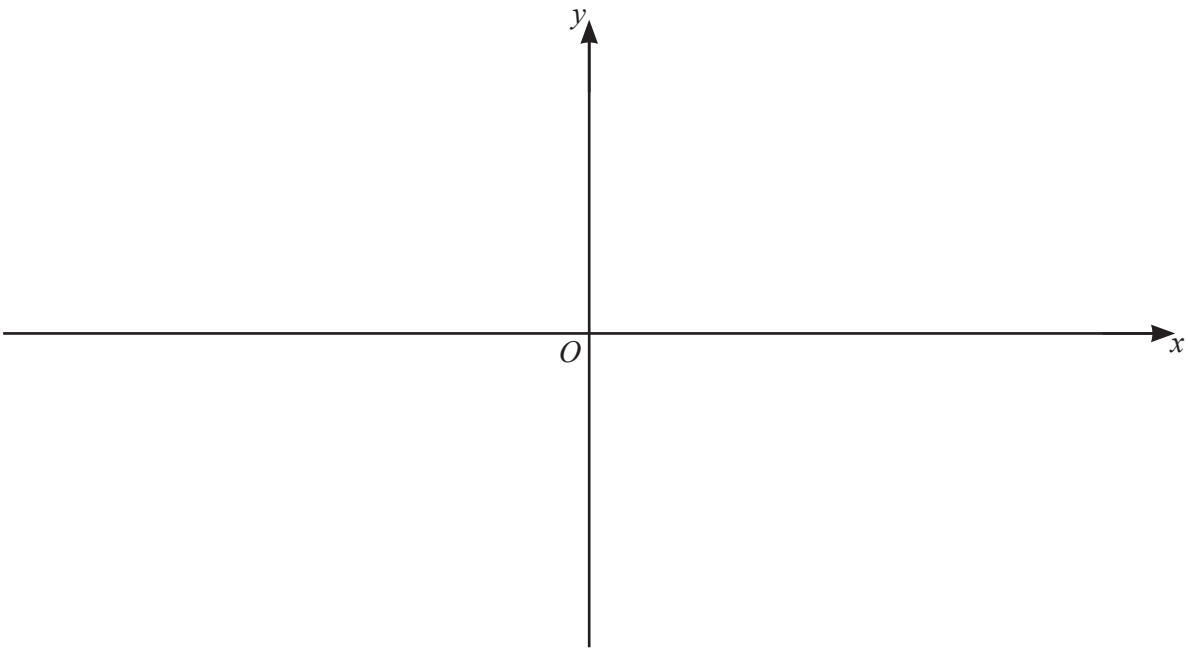
**(b)** Find the coordinates of $P$. [1]

**(c)** Find the coordinates of $Q$. [2]

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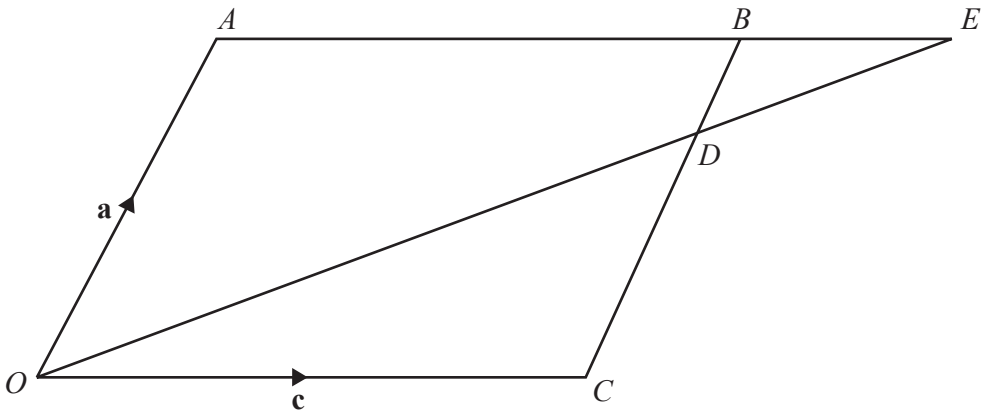
**9** **(a)** Show that the equation of the curve $y = (x^2 - 4)(x - 2)$ can be written as $y = x^3 + ax^2 + bx + 8$, where $a$ and $b$ are integers. Hence find the exact coordinates of the stationary points on the curve. [4]

**(b)** On the axes, sketch the graph of $y = |(x^2 - 4)(x - 2)|$, stating the intercepts with the coordinate axes. [4]




**(c)** Find the possible values of the constant $k$ for which $|(x^2 - 4)(x - 2)| = k$ has exactly 4 different solutions. [2]

**10**




The diagram shows the parallelogram $OABC$, such that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$. The point $D$ lies on $CB$ such that $CD : DB = 3 : 1$. When extended, the lines $AB$ and $OD$ meet at the point $E$. It is given that $\overrightarrow{OE} = h\overrightarrow{OD}$ and $\overrightarrow{BE} = k\overrightarrow{AB}$, where $h$ and $k$ are constants.

**(a)** Find $\overrightarrow{DE}$ in terms of **a**, **c** and $h$. [4]

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**(b)** Find $\overrightarrow{DE}$ in terms of **a**, **c** and $k$. [1]

**(c)** Hence find the value of $h$ and of $k$. [4]

**11** The line $x+2y=10$ intersects the two lines satisfying the equation $|x+y|=2$ at the points $A$ and $B$.

**(a)** Show that the point $C(-5,20)$ lies on the perpendicular bisector of the line $AB$. [8]

**(b)** The point $D$ also lies on this perpendicular bisector. $M$ is the mid-point of $AB$. The distance $CD$ is three times the distance of $CM$. Find the possible coordinates of $D$. [4]

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