Cambridge Assessment International Education

# Cambridge IGCSE™

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| CANDIDATE NAME | | | | | | | | | |
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*1552216622*

**ADDITIONAL MATHEMATICS** **0606/22**

Paper 2 **February/March 2020**

**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. 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 values of $x$ for which $12x^2 - 20x + 5 < (2x+1)(x-1)$. [4]

**2** Variables $x$ and $y$ are such that, when $\lg y$ is plotted against $x^3$, a straight line graph passing through the points (6, 7) and (10, 9) is obtained. Find $y$ as a function of $x$. [4]

**3** Find the exact solution of $3^{2x} - 3^{x+1} - 4 = 0$. [4]

**4** The position vectors of three points, $A$, $B$ and $C$, relative to an origin $O$, are $\begin{pmatrix} -5 \\ -7 \end{pmatrix}$, $\begin{pmatrix} 10 \\ -4 \end{pmatrix}$ and $\begin{pmatrix} x \\ y \end{pmatrix}$ respectively. Given that $\overrightarrow{AC} = 4\overrightarrow{BC}$, find the unit vector in the direction of $\overrightarrow{OC}$. [5]

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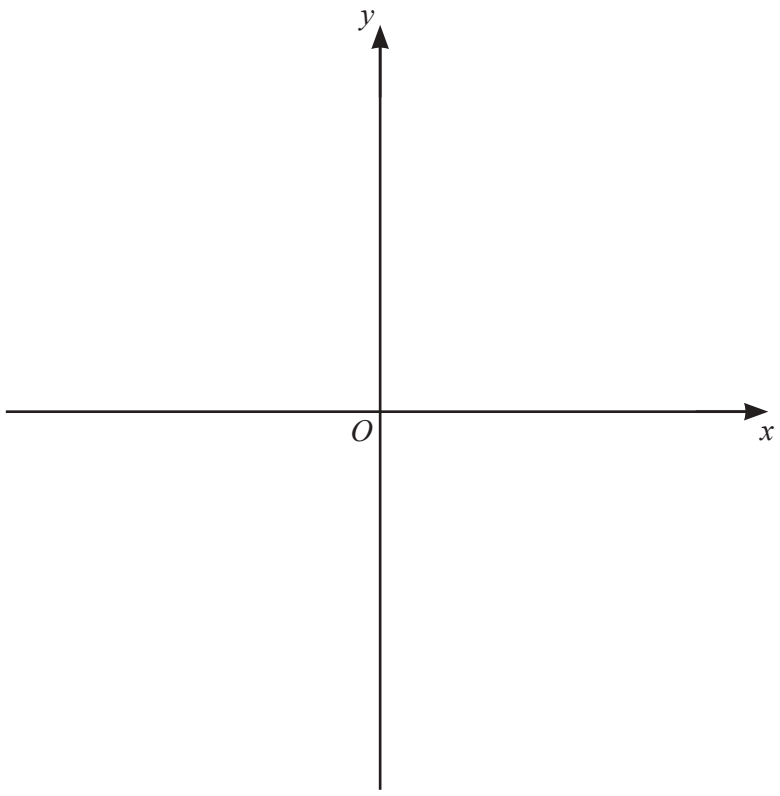
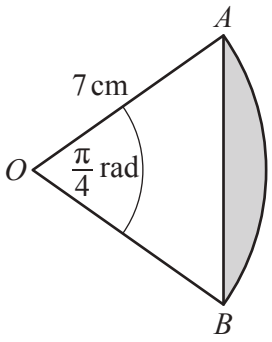
**5** **(a)** On the axes below, sketch the graph of $y = |5x - 7|$, showing the coordinates of the points where the graph meets the coordinate axes. [3]




**(b)** Solve $5|5x - 7| - 1 = 14$. [3]

**6** **(a)** A circle has a radius of 6 cm. A sector of this circle has a perimeter of $2(6+5\pi)$ cm. Find the area of this sector. [4]

**(b)**




The diagram shows the sector $AOB$ of a circle with centre $O$ and radius 7 cm.
Angle $AOB = \frac{\pi}{4}$ radians. Find the perimeter of the shaded region. [3]

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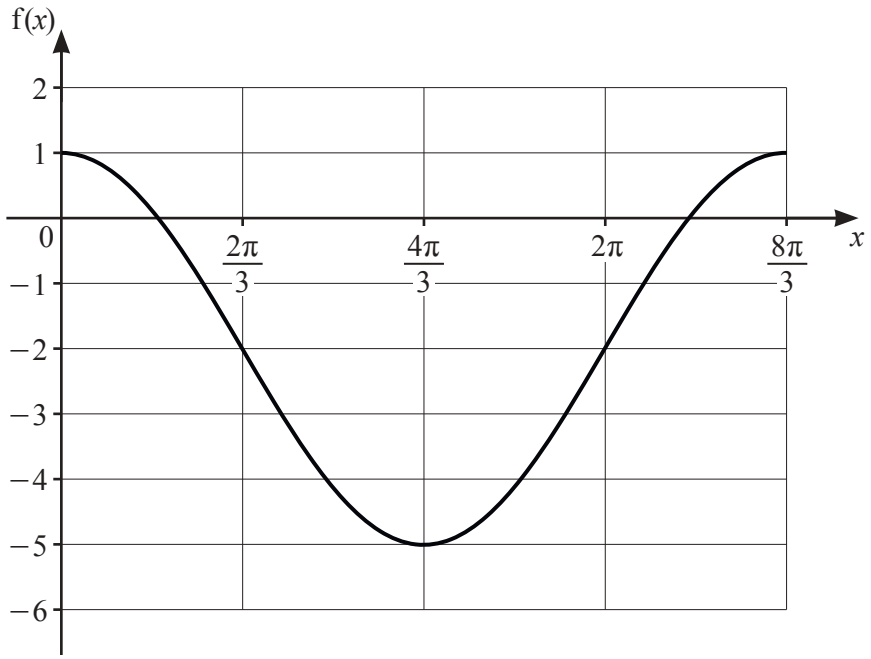
**7** Find the coordinates of the points of intersection of the curves $x^2 = 5y - 1$ and $y = x^2 - 2x + 1$. [5]

**8**




The diagram shows the graph of $f(x) = a\cos bx + c$ for $0 \leqslant x \leqslant \frac{8\pi}{3}$ radians.

**(a)** Explain why f is a function. [1]

**(b)** Write down the range of f. [1]

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

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**9** Variables $x$ and $y$ are such that $y = \dfrac{e^{3x}\sin x}{x^2}$. Use differentiation to find the approximate change in $y$ as $x$ increases from 0.5 to $0.5 + h$, where $h$ is small. [6]

**10 (a)** $g(x) = 3 + \frac{1}{x}$ for $x \geqslant 1$.

**(i)** Find an expression for $g^{-1}(x)$. [2]

**(ii)** Write down the range of $g^{-1}$. [1]

**(iii)** Find the domain of $g^{-1}$. [2]

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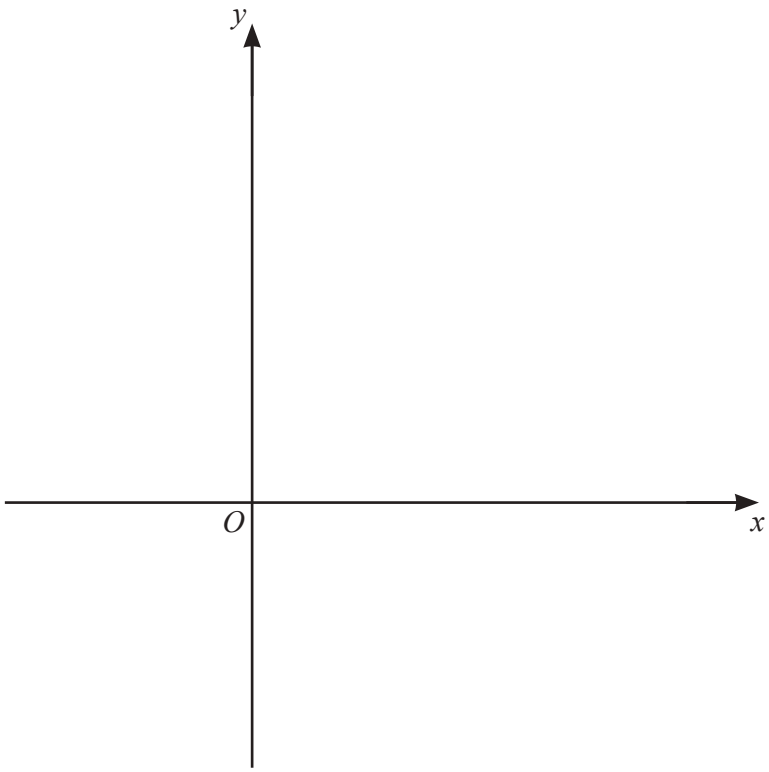
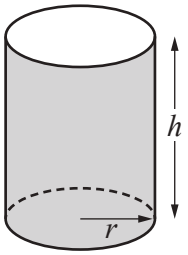
**(b)** $\mathrm{h}(x) = 2\ln(3x-1)$ for $x \geqslant \frac{2}{3}$.

The graph of $y = \mathrm{h}(x)$ intersects the line $y = x$ at two distinct points. On the axes below, sketch the graph of $y = \mathrm{h}(x)$ and hence sketch the graph of $y = \mathrm{h}^{-1}(x)$. [4]



**11**




A container is a circular cylinder, open at one end, with a base radius of $r$ cm and a height of $h$ cm. The volume of the container is 1000 $cm^3$. Given that $r$ and $h$ can vary and that the total outer surface area of the container has a minimum value, find this value. [8]

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**12** A particle $P$ moves in a straight line such that, $t$ seconds after passing through a fixed point $O$, its acceleration, $a$ ms$^{-2}$, is given by $a = -6$. When $t = 0$, the velocity of $P$ is 18 ms$^{-1}$.

**(a)** Find the time at which $P$ comes to instantaneous rest. [3]

**(b)** Find the distance travelled by $P$ in the 3rd second. [3]

**13 (a)** The sum of the first two terms of a geometric progression is 10 and the third term is 9.

**(i)** Find the possible values of the common ratio and the first term. [5]

**(ii)** Find the sum to infinity of the convergent progression. [1]

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**(b)** In an arithmetic progression, $u_1 = -10$ and $u_4 = 14$. Find $u_{100} + u_{101} + u_{102} + \ldots + u_{200}$, the sum of the 100th to the 200th terms of the progression. [4]

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