Cambridge Assessment International Education

# Cambridge IGCSE™

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| CANDIDATE NAME | | | | | | | | | |
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*1223544829*

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

Paper 2 **May/June 2022**

**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.


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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 $\Delta ABC$*

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

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

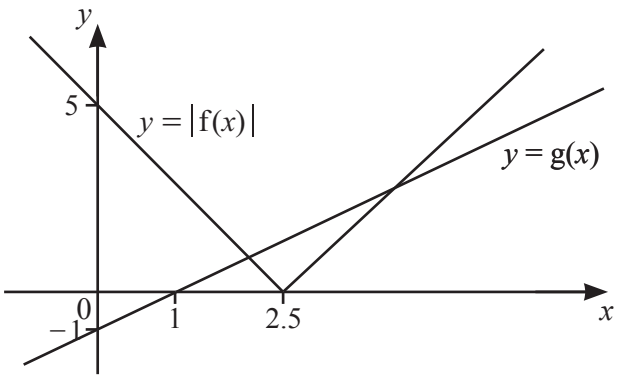
$$\Delta = \frac{1}{2}bc\sin A$$

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**1 DO NOT USE A CALCULATOR IN THIS QUESTION.**

A curve has equation $y = \dfrac{6+\sqrt{x}}{3+\sqrt{x}}$ where $x \geqslant 0$. Find the exact value of $y$ when $x = 6$. Give your answer in the form $a + b\sqrt{c}$, where $a$, $b$ and $c$ are integers. [3]

**2**




The diagram shows the graphs of $y = |\mathrm{f}(x)|$ and $y = \mathrm{g}(x)$, where $y = \mathrm{f}(x)$ and $y = \mathrm{g}(x)$ are straight lines. Solve the inequality $|\mathrm{f}(x)| \leqslant \mathrm{g}(x)$. [5]

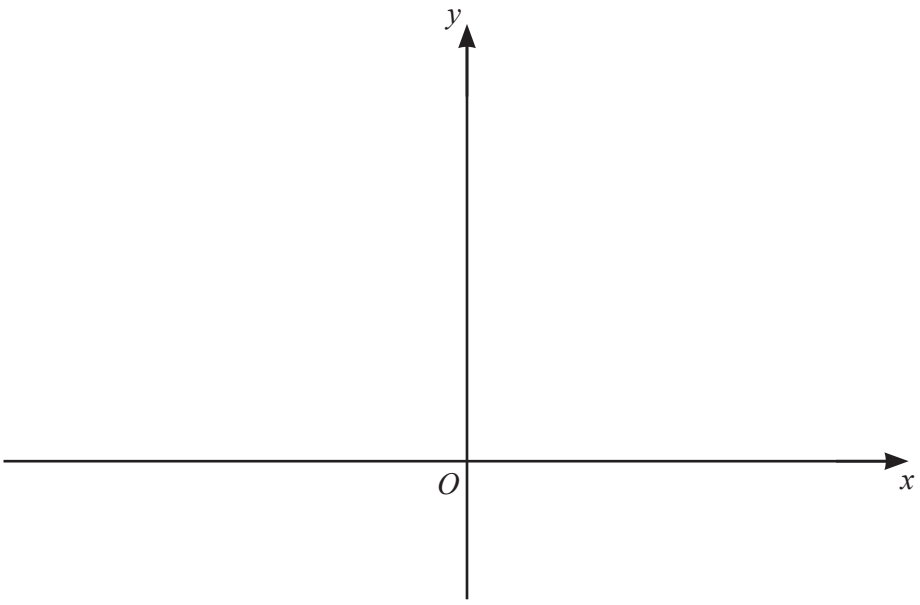
**3** Find the possible values of $k$ for which the equation $kx^2 + (k+5)x - 4 = 0$ has real roots. [5]

**4** Variables $x$ and $y$ are related by the equation $y = 1 + \frac{2}{x} + \frac{1}{x^2}$ where $x > 0$. Use differentiation to find the approximate change in $x$ when $y$ increases from 4 by the small amount 0.01. [5]

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**5** **(a)** Solve the equation $\dfrac{625^{\frac{x^3-1}{2}}}{125^{x^3}} = 5$. [3]

**(b)** On the axes, sketch the graph of $y = 4e^x + 3$ showing the values of any intercepts with the coordinate axes. [2]



**6** **(a)** In this question, **i** is a unit vector due east and **j** is a unit vector due north.

A cyclist rides at a speed of $4\,\text{ms}^{-1}$ on a bearing of 015°. Write the velocity vector of the cyclist in the form $x\mathbf{i} + y\mathbf{j}$, where $x$ and $y$ are constants. [2]

**(b)** A vector of magnitude 6 on a bearing of 300° is added to a vector of magnitude 2 on a bearing of 230° to give a vector **v**. Find the magnitude and bearing of **v**. [5]

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**7** Differentiate $y = \dfrac{e^{4x}\tan x}{\ln x}$ with respect to $x$. [4]

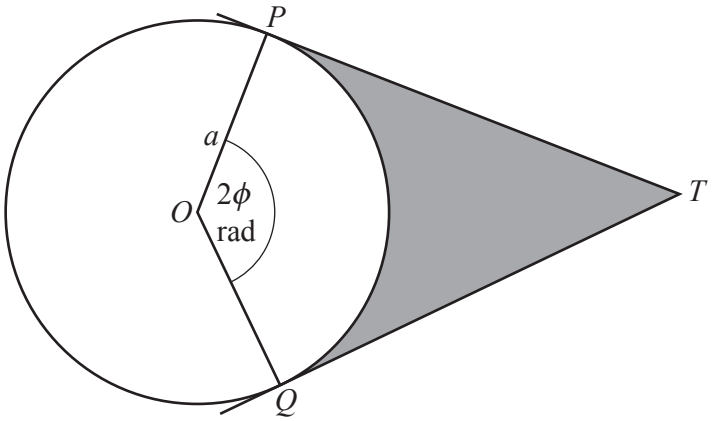
**8** The function f is defined by $\mathrm{f}(x) = 3\sin^2 x - 2\cos x$ for $2 \leqslant x \leqslant 4$, where $x$ is in radians.

**(a)** Find the $x$-coordinate of the stationary point on the curve $y = \mathrm{f}(x)$. [5]

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**(b)** Solve the equation $f(x) = 1 - 3\cos x$. [5]

**9** In this question all lengths are in centimetres.




The diagram shows a circle, centre $O$, radius $a$. The lines $PT$ and $QT$ are tangents to the circle at $P$ and $Q$ respectively. Angle $POQ$ is $2\phi$ radians.

**(a)** In the case when the area of the sector $OPQ$ is equal to the area of the shaded region, show that $\tan\phi = 2\phi$. [4]

**(b)** In the case when the perimeter of the sector $OPQ$ is equal to half the perimeter of the shaded region, find an expression for $\tan\phi$ in terms of $\phi$. [3]

**10** **(a)** A geometric progression has first term $a$ and common ratio $r$, where $r > 0$. The second term of this progression is 8. The sum of the third and fourth terms is 160.

**(i)** Show that $r$ satisfies the equation $r^2 + r - 20 = 0$. [4]

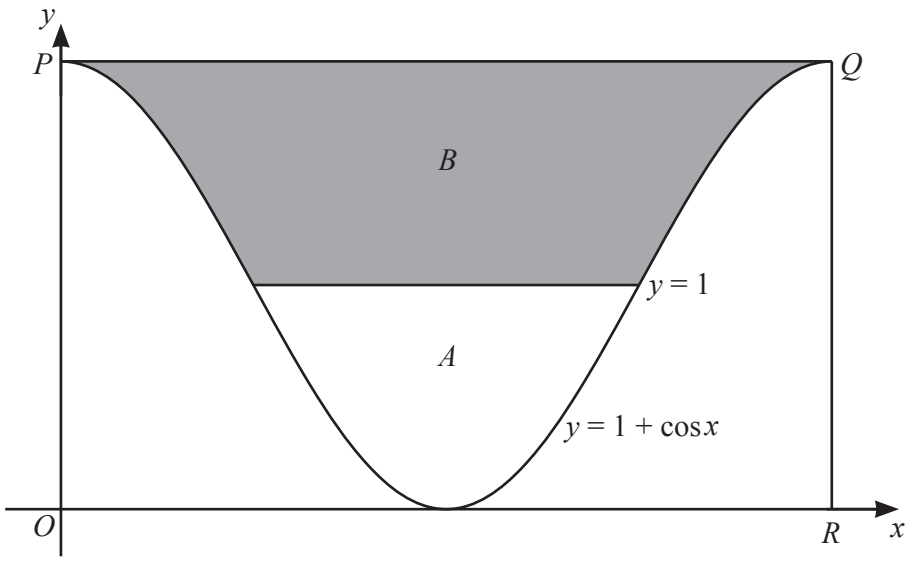
**(ii)** Find the value of $a$. [3]

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**(b)** An arithmetic progression has first term $p$ and common difference 2. The $q$th term of this progression is 14.
A different arithmetic progression has first term $p$ and common difference 4. The sum of the first $q$ terms of this progression is 168.

Find the values of $p$ and $q$. [6]

**11**




The diagram shows part of the line $y = 1$ and one complete period of the curve $y = 1 + \cos x$, where $x$ is in radians. The line $PQ$ is a tangent to the curve at $P$ and at $Q$. The line $QR$ is parallel to the $y$-axis. Area $A$ is enclosed by the line $y = 1$ and the curve. Area $B$ is enclosed by the line $y = 1$, the line $PQ$ and the curve.

Given that area $A$ : area $B$ is $1 : k$ find the exact value of $k$. [9]

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Continuation of working space for Question 11.

**Question 12 is printed on the next page.**

**12** A curve is such that $\frac{d^2y}{dx^2} = \left(\frac{\sqrt{x}+1}{\sqrt[4]{x}}\right)^2$. Given that the gradient of the curve is $\frac{4}{3}$ at the point $(1, -1)$, find the equation of the curve. [7]

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