Cambridge Assessment International Education

# Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*1130745556*

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

Paper 2 **October/November 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. Any blank pages are indicated.

DC (KN/CT) 303196/2

***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* $\Delta ABC$

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

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

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

**1** Solve the following simultaneous equations.

$$x + 5y = -4$$
$$3y - xy = 6$$

[5]

**2** Solve the equation $4e^{2x-3} = 7e^{5-x}$. [4]

**3** In this question $a$ and $b$ are constants.

The normal to the curve $y = \frac{a}{x} + 3x - 2$ at the point where $x = 1$ has equation $y = -\frac{1}{4}x + b$.
Find the values of $a$ and $b$. [6]

4 Solve the equation $\log_3(11x-8) = 1+\dfrac{2}{\log_x 3}$ given that $x > 1$. [5]

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

Find the $x$-coordinates of the points of intersection of the curves $y = 7x^3 - 7x^2 - 17x - 4$ and $y = x^3 - 2x^2 - 4x - 16$. [5]

**6** A 4-digit code is to be formed using 4 different numbers selected from 2, 3, 4, 5, 6, 7, 8 and 9. Find how many possible codes there are if the code forms

**(a)** a number that is odd and greater than 5000, [3]

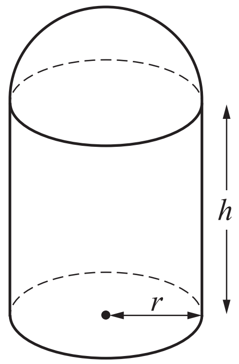
**(b)** a number greater than 5000 with a last digit that is prime. [3]

**7** **(a)** Show that $\dfrac{\sin x}{1-\cos x}+\dfrac{1-\cos x}{\sin x}=2\operatorname{cosec} x$ . [4]

**(b)** Hence solve the equation $\dfrac{\sin x}{1-\cos x}+\dfrac{1-\cos x}{\sin x}=3\sin x-1$ for $0° < x < 360°$. [4]

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

The volume of a cylinder with radius $r$ and height $h$ is $\pi r^2 h$ and its curved surface area is $2\pi rh$.
The volume of a sphere with radius $r$ is $\frac{4}{3}\pi r^3$ and its surface area is $4\pi r^2$.



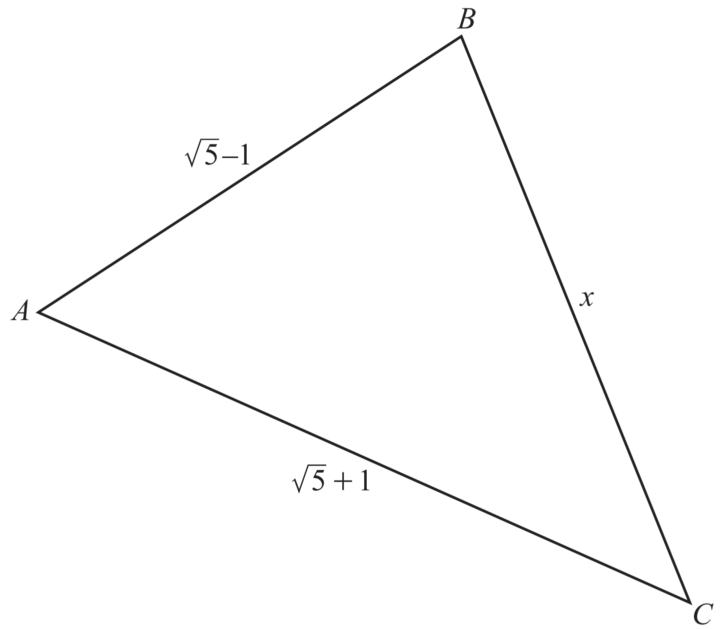

The diagram shows a solid object in the shape of a cylinder of base radius $r$ and height $h$, with a hemisphere of radius $r$ on top. The total surface area of the object is $300\,\text{cm}^2$.

**(a)** Find an expression for $h$ in terms of $r$. [2]

**(b)** Show that the volume, $V$, of the object is $150r - \frac{5}{6}\pi r^3$. [3]

**(c)** Find the maximum volume of the object as $r$ varies. [5]

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




The diagram shows triangle $ABC$ which has area $\frac{2\sqrt{5}}{3}\text{cm}^2$. Angle $A$ is acute.

**(a)** Find the exact value of $\sin A$. [3]

**(b)** Find the exact value of $\cos A$ and hence find the exact value of $x$. [5]

**(c)** Find the exact value of $\sin B$. [3]

**10** **(a)** A geometric progression has third term 4.5 and sixth term 15.1875. Find the first term and the common ratio. [4]

**(b)** Find the sum of ten terms of the progression, starting with the sixteenth term. Give your answer to the nearest integer. [4]

**11** The coordinates of points $A$ and $B$ are $(-5, 6)$ and $(4, -6)$ respectively. The point $C$ lies on the line $AB$, between $A$ and $B$, such that $\frac{AC}{CB} = \frac{1}{2}$.

**(a)** Find the coordinates of $C$. [2]

**(b)** The line $CD$ is perpendicular to $AB$. Find the equation of $CD$ in the form $y = mx + c$. [4]

**(c)** The length of *BD* is $\sqrt{125}$. Find the coordinates of the two possible positions of point *D*. [6]

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