

# Cambridge IGCSE™

CANDIDATE  
NAME

CENTRE  
NUMBER

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## 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.

**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*

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \dots + \binom{n}{r}a^{n-r}b^r + \dots + b^n$$

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*

$$\begin{aligned}\sin^2 A + \cos^2 A &= 1 \\ \sec^2 A &= 1 + \tan^2 A \\ \operatorname{cosec}^2 A &= 1 + \cot^2 A\end{aligned}$$

*Formulae for  $\triangle ABC$* 

$$\begin{aligned}\frac{a}{\sin A} &= \frac{b}{\sin B} = \frac{c}{\sin C} \\ a^2 &= b^2 + c^2 - 2bc \cos A \\ \Delta &= \frac{1}{2}bc \sin A\end{aligned}$$

- 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  $\log_3(11x-8) = 1 + \frac{2}{\log_x 3}$  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]

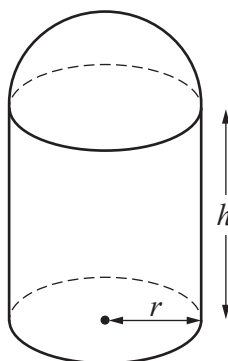
7 (a) Show that  $\frac{\sin x}{1 - \cos x} + \frac{1 - \cos x}{\sin x} = 2 \operatorname{cosec} x$ . [4]

(b) Hence solve the equation  $\frac{\sin x}{1 - \cos x} + \frac{1 - \cos x}{\sin x} = 3 \sin x - 1$  for  $0^\circ < x < 360^\circ$ . [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  $2\pi r h$ .

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  $300 \text{ cm}^2$ .

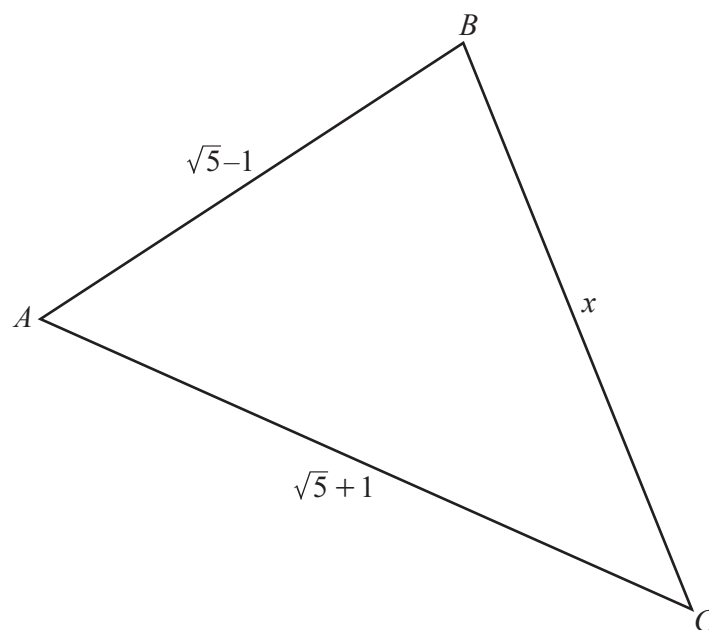
(a) Find an expression for  $h$  in terms of  $r$ . [2]

(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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