



# Cambridge IGCSE™

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**ADDITIONAL MATHEMATICS**

**0606/21**

Paper 2

**October/November 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.

**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 inequality  $(x+5)(x-2) > 3x+6$ .

[3]

2 Solve the following simultaneous equations.

$$xy + x^2 = 15$$

$$y + 3x = 11$$

[5]

3 A curve has equation  $y = \frac{2 + \sin 3x}{x + 1}$ .

(a) Show that the exact value of  $\frac{dy}{dx}$  at the point where  $x = \frac{\pi}{6}$  can be written as  $\frac{k}{\left(\frac{\pi}{6} + 1\right)^2}$ , where  $k$  is an integer. [5]

(b) Find the equation of the normal to the curve at the point where  $x = 0$ . [4]

4 Find rational values  $a$  and  $b$  such that  $\frac{a}{\sqrt{5}+2} + \frac{b}{\sqrt{5}-2} = 1$ . [5]

5 It is given that  $y = 3 \tan^2 x$  for  $0^\circ < x < 360^\circ$ .

(a) Show that  $\frac{dy}{dx} = m \tan x \sec^2 x$  where  $m$  is an integer to be found. [2]

(b) Find all values of  $x$  such that  $\frac{dy}{dx} = 3 \sec x \operatorname{cosec} x$ . [5]

- 6 Find the values of  $m$  for which the line  $y = mx - 2$  does not touch or cut the curve  $y = (m + 1)x^2 + 8x + 1$ .

[6]

- 7 (a) Use logarithms to solve the following equation, giving your answer correct to 1 decimal place.

$$5^{x-2} = 3 \times 2^{2x+3} \quad [4]$$

- (b) Solve the equation  $\log_3(y^2 + 11) - 2 = \log_3(y - 1)$ . [5]



8 Marc chooses 5 people from 4 men, 4 women and 2 children.

Find the number of ways that Marc can do this

(a) if there are no restrictions, [1]

(b) if at least 2 men are chosen, [3]

(c) if at least 1 man, at least 1 woman and at least 1 child are chosen. [3]

9 The following functions are defined for  $x > 1$ .

$$f(x) = \frac{x+3}{x-1} \quad g(x) = 1+x^2$$

(a) Find  $fg(x)$ .

[2]

(b) Find  $g^{-1}(x)$ .

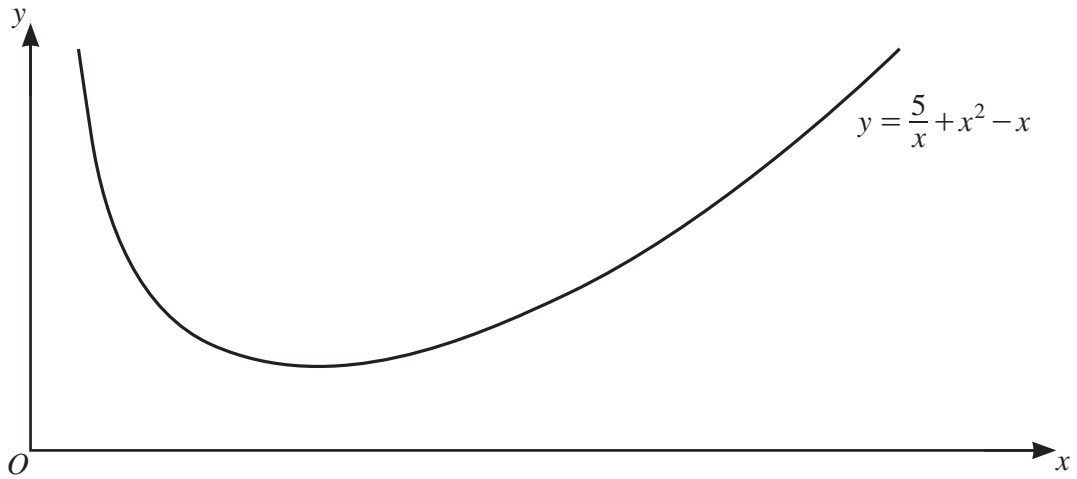
[2]

(c) **DO NOT USE A CALCULATOR IN THIS PART OF THE QUESTION.**

Solve the equation  $f(x) = g(x)$ .

[5]

10



The diagram shows part of the curve  $y = \frac{5}{x} + x^2 - x$ .

- (a) Find, in the form  $y = mx + c$ , the equation of the tangent to the curve at the point where  $x = 1$ . [5]

- (b) Find the exact area enclosed by the curve, the  $x$ -axis, and the lines  $x = 1$  and  $x = 3$ . [4]

- 11** The volume,  $V$ , of a cone with base radius  $r$  and vertical height  $h$  is given by  $\frac{1}{3}\pi r^2 h$ .  
The curved surface area of a cone with base radius  $r$  and slant height  $l$  is given by  $\pi r l$ .

A cone has base radius  $r$  cm, vertical height  $h$  cm and volume  $V$  cm<sup>3</sup>. The curved surface area of the cone is  $4\pi$  cm<sup>2</sup>.

(a) Show that  $h^2 = \frac{16}{r^2} - r^2$ . [4]

(b) Show that  $V = \frac{\pi}{3}\sqrt{16r^2 - r^6}$ . [2]

- (c) Given that  $r$  can vary and that  $V$  has a maximum value, find the value of  $r$  that gives the maximum volume. [5]

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