Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

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.

DC (PQ/FC) 212424/3

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 ΔABC

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

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

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

1 Solve the 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 $y = \dfrac{2 + \sin 3x}{x + 1}$.

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

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

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

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

$$5^{x-2} = 3 \times 2^{2x+3}$$ [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 $x > 1$.

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

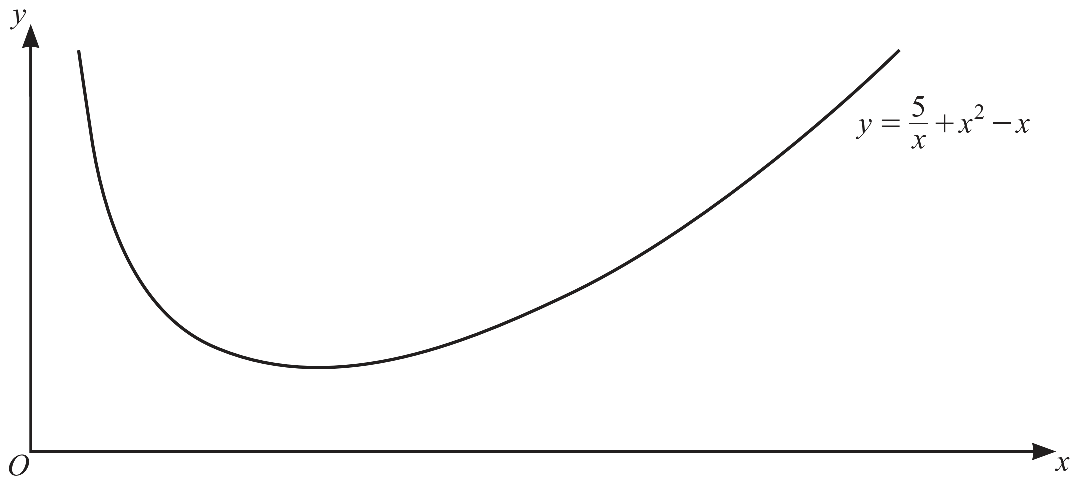
(a) Find $fg(x)$. [2]

(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^3. The curved surface area of the cone is 4π cm^2.

(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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