



CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

0606/21

October/November 2021

2 hours

No additional materials are needed.

- 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.

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].

DC (PQ/FC) 212424/3
© UCLES 2021

[Turn over

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

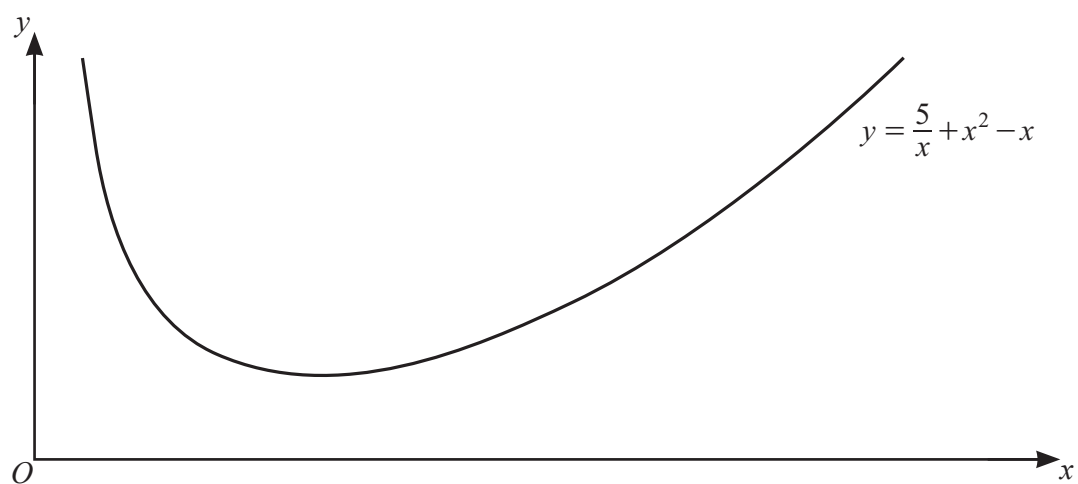
[2]

(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 cm³. The curved surface area of the cone is 4π cm².

(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]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.