



CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

4037/23

October/November 2021

2 hours

You must answer on the question paper.

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 [].

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 $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

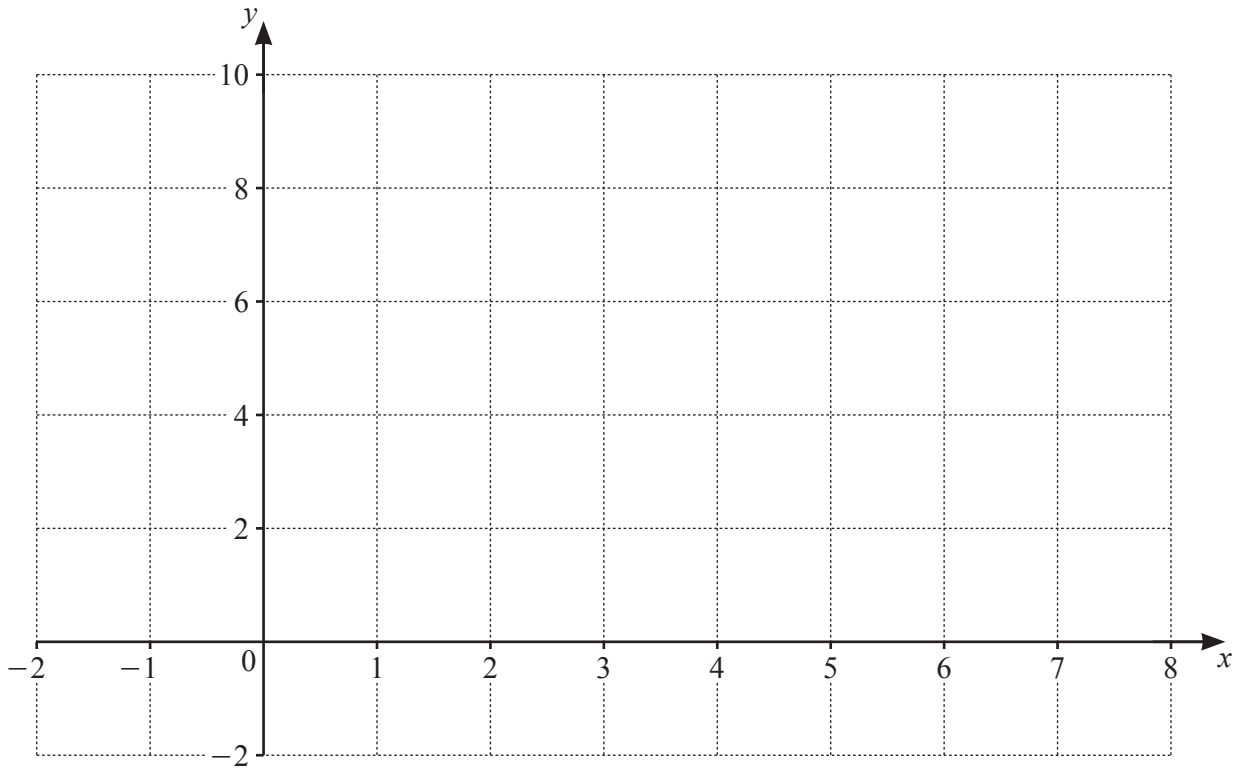
2. TRIGONOMETRY*Identities*

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

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



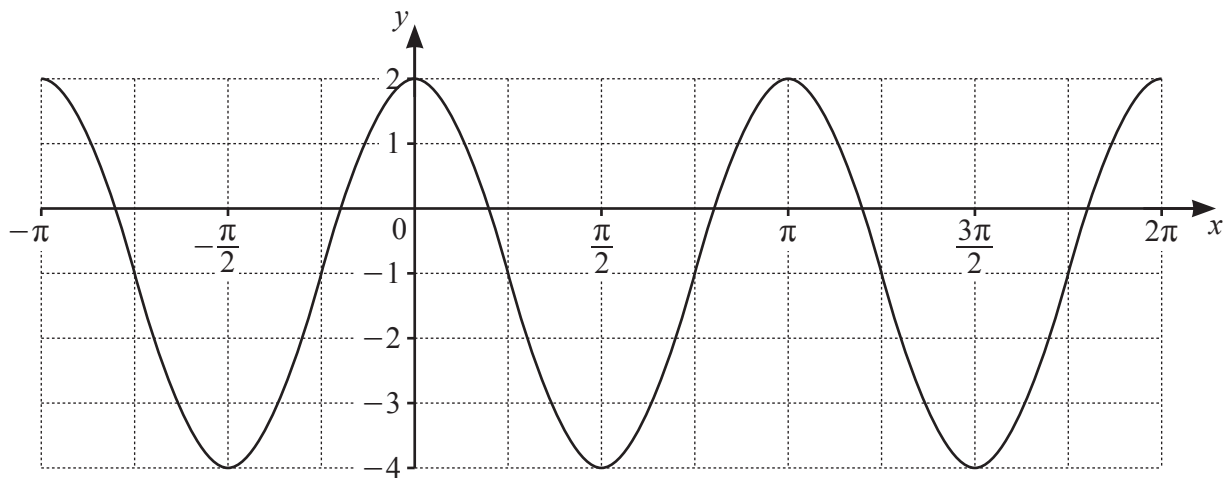
- (a) On the axes draw the graphs of $y = |x - 5|$ and $y = 6 - |2x - 7|$. [4]
- (b) Use your graphs to solve the inequality $|x - 5| > 6 - |2x - 7|$. [2]

- 2 Solve the following simultaneous equations. Give your answers in the form $a + b\sqrt{3}$, where a and b are rational.

$$\begin{aligned}x + y &= 3 \\ 2x - \sqrt{3}y &= 5\end{aligned}$$

[5]

3



- (a) The curve has equation $y = a \cos bx + c$ where a , b and c are integers. Find the values of a , b and c . [3]

- (b) Another curve has equation $y = 2 \sin 3x + 4$. Write down

(i) the amplitude, [1]

(ii) the period in radians. [1]

4 (a) Solve the equation $\log_6(2x-3) = \frac{1}{2}$. Give your answer in exact form. [2]

(b) Solve the equation $\ln 2u - \ln(u-4) = 1$. Give your answer in exact form. [3]

(c) Solve the equation $\frac{3^v}{27^{2v-5}} = 9$. [3]

5 (a) Show that $\frac{1}{\operatorname{cosec} x - 1} + \frac{1}{\operatorname{cosec} x + 1} = 2 \tan x \sec x$. [4]

(b) Hence solve the equation $\frac{1}{\operatorname{cosec} x - 1} + \frac{1}{\operatorname{cosec} x + 1} = 5 \operatorname{cosec} x$ for $0^\circ < x < 360^\circ$. [4]

6 It is given that $x = 2 + \sec \theta$ and $y = 5 + \tan^2 \theta$.

(a) Express y in terms of x . [2]

(b) Find $\frac{dy}{dx}$ in terms of x . [1]

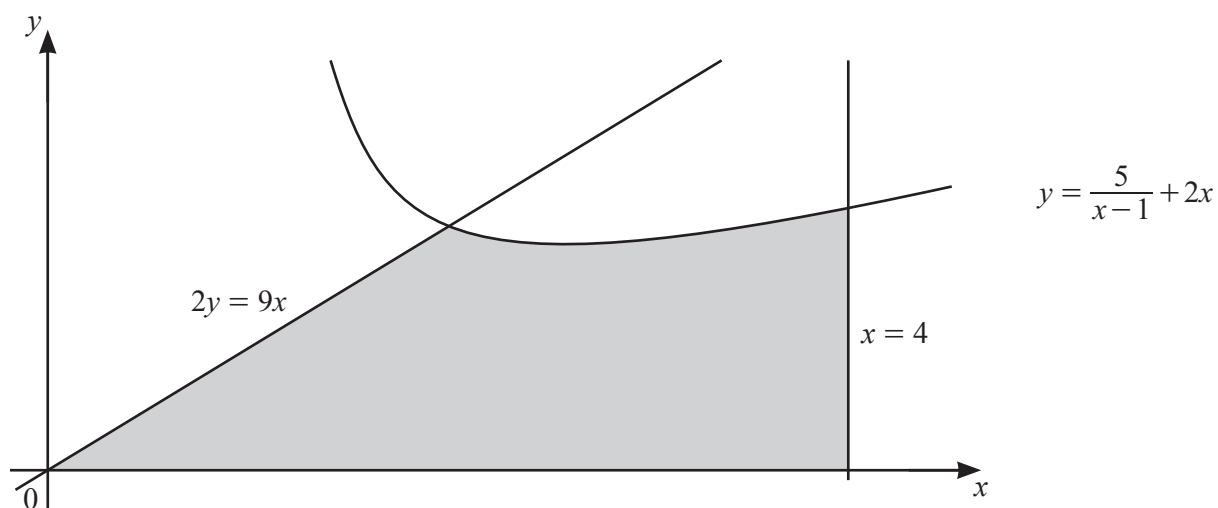
(c) A curve has the equation found in **part (a)**. Find the equation of the tangent to the curve when $\theta = \frac{\pi}{3}$. [4]

- 7 The vector $\mathbf{p}$ has magnitude 39 and is in the direction $-5\mathbf{i} + 12\mathbf{j}$. The vector $\mathbf{q}$ has magnitude 34 and is in the direction $15\mathbf{i} - 8\mathbf{j}$.

(a) Write both $\mathbf{p}$ and $\mathbf{q}$ in terms of $\mathbf{i}$ and $\mathbf{j}$. [4]

(b) Find the magnitude of $\mathbf{p} + \mathbf{q}$ and the angle this vector makes with the positive x -axis. [4]

8



The diagram shows part of the curve $y = \frac{5}{x-1} + 2x$, and the straight lines $x = 4$ and $2y = 9x$.

- (a) Find the coordinates of the stationary point on the curve $y = \frac{5}{x-1} + 2x$. [5]

- (b) Given that the curve and the line $2y = 9x$ intersect at the point $(2, 9)$, find the area of the shaded region. [5]

- 9 An arithmetic progression has first term a and common difference d . The third term is 13 and the tenth term is 41.

(a) Find the value of a and of d . [4]

(b) Find the number of terms required to give a sum of 2555. [4]

- (c) Given that S_n is the sum to n terms, show that $S_{2k} - S_k = 3k(1 + 2k)$. [4]

- 10 (a)** It is given that $f(x) = 4x^3 - 4x^2 - 15x + 18$. Find the equation of the normal to the curve $y = f(x)$ at the point where $x = 1$. [5]

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

It is also given that $x + a$, where a is an integer, is a factor of $f(x)$. Find a and hence solve the equation $f(x) = 0$. [6]

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.