



# Cambridge IGCSE™

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**ADDITIONAL MATHEMATICS**

**0606/23**

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*      $u_n = ar^{n-1}$

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

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

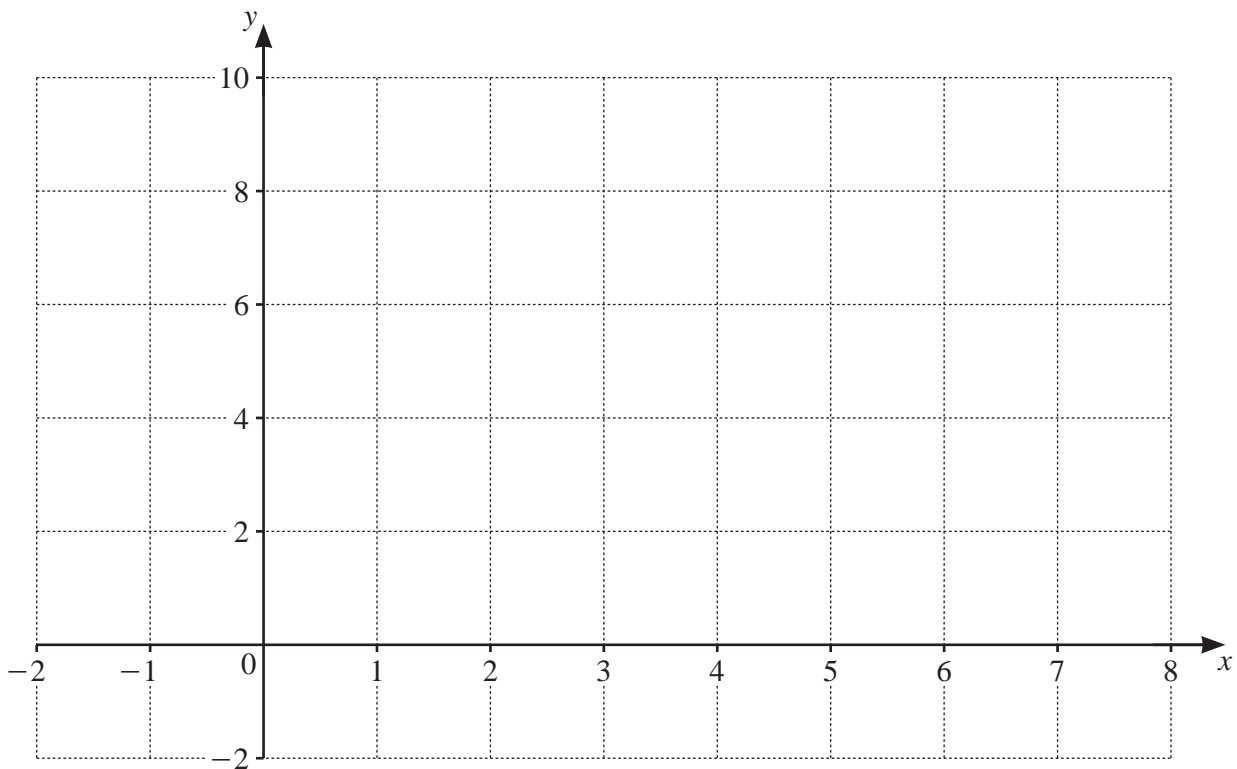
**2. TRIGONOMETRY***Identities*

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

*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



(a) On the axes draw the graphs of  $y = |x-5|$  and  $y = 6-|2x-7|$ . [4]

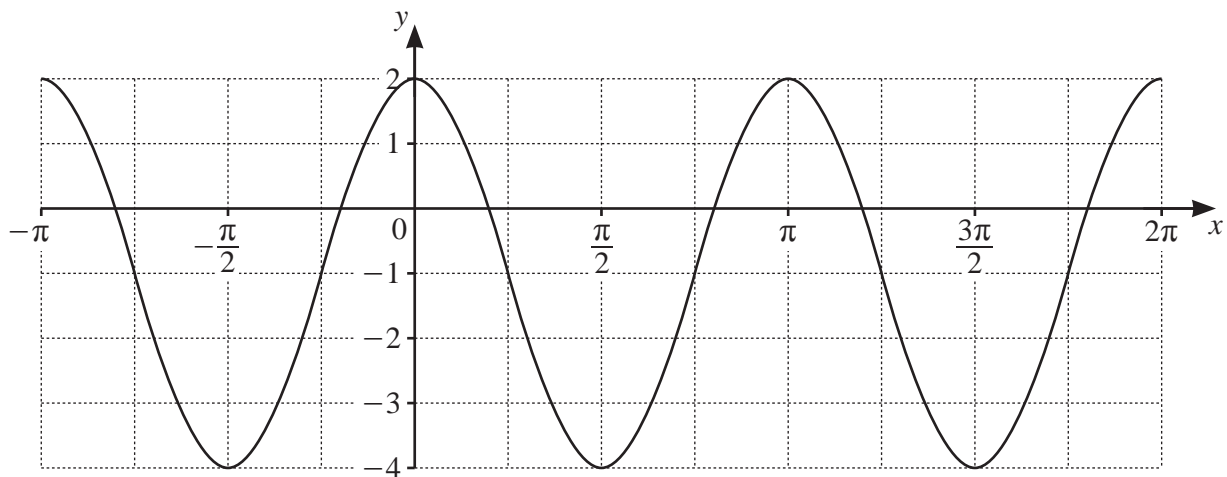
(b) Use your graphs to solve the inequality  $|x-5| > 6-|2x-7|$ . [2]

4

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

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

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]

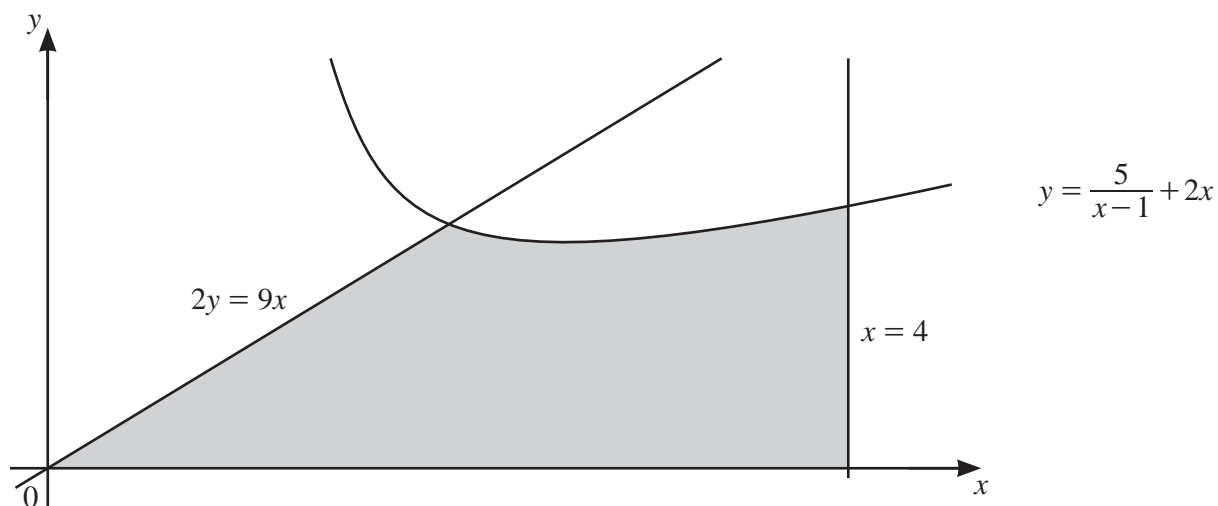


7 The vector  $\mathbf{p}$  has magnitude 39 and is in the direction  $-5\mathbf{i} + 12\mathbf{j}$ . The vector  $\mathbf{q}$  has magnitude 34 and is in the direction  $15\mathbf{i} - 8\mathbf{j}$ .

(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]

11

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

## 12

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]

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