Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 3 2 5 1 6 3 3 3 7 5 *

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **February/March 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.

DC (CE/SW) 202024/2

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

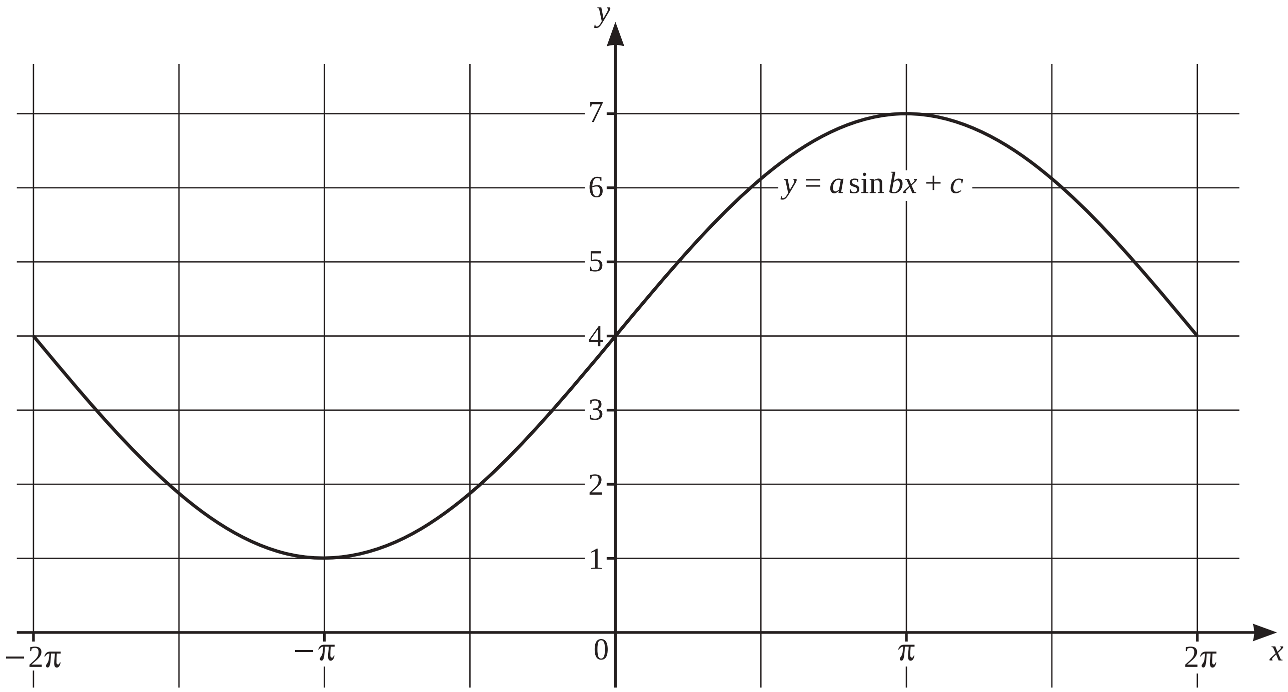
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

1 Find the exact solutions of the equation $3(\ln 5x)^2 + 2\ln 5x - 1 = 0$. [4]

2



The diagram shows the graph of $y = a\sin bx + c$ where x is in radians and $-2\pi \leqslant x \leqslant 2\pi$, where a, b and c are positive constants. Find the value of each of a, b and c. [3]

3 The line AB is such that the points A and B have coordinates $(-4, 6)$ and $(2, 14)$ respectively.

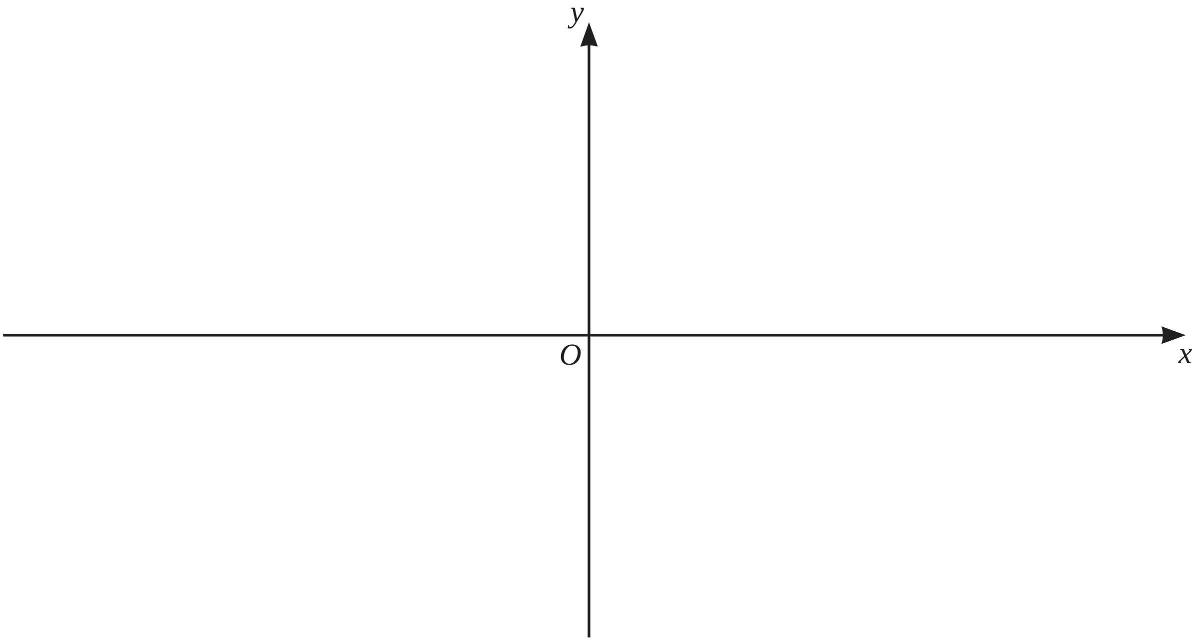
(a) The point C, with coordinates $(7, a)$ lies on the perpendicular bisector of AB. Find the value of a. [4]

(b) Given that the point D also lies on the perpendicular bisector of AB, find the coordinates of D such that the line AB bisects the line CD. [2]

4 **(a)** Show that $2x^2+5x-3$ can be written in the form $a(x+b)^2+c$, where a, b and c are constants. [3]

(b) Hence write down the coordinates of the stationary point on the curve with equation $y=2x^2+5x-3$. [2]

(c) On the axes below, sketch the graph of $y=\left|2x^2+5x-3\right|$, stating the coordinates of the intercepts with the axes. [3]



(d) Write down the value of k for which the equation $\left|2x^2+5x-3\right|=k$ has exactly 3 distinct solutions. [1]

5 In this question all lengths are in kilometres and time is in hours.

Boat A sails, with constant velocity, from a point O with position vector $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$. After 3 hours A is at the point with position vector $\begin{pmatrix} -12 \\ 9 \end{pmatrix}$.

(a) Find the position vector, $\overrightarrow{OP}$, of A at time t. [1]

At the same time as A sails from O, boat B sails from a point with position vector $\begin{pmatrix} 12 \\ 6 \end{pmatrix}$, with constant velocity $\begin{pmatrix} -5 \\ 8 \end{pmatrix}$.

(b) Find the position vector, $\overrightarrow{OQ}$, of B at time t. [1]

(c) Show that at time t $\left|\overrightarrow{PQ}\right|^2 = 26t^2 + 36t + 180$. [3]

(d) Hence show that A and B do not collide. [2]

6 **(a)** A geometric progression has first term 10 and sum to infinity 6.

(i) Find the common ratio of this progression. [2]

(ii) Hence find the sum of the first 7 terms, giving your answer correct to 2 decimal places. [2]

(b) The first three terms of an arithmetic progression are $\log_x 3$, $\log_x(3^2)$, $\log_x(3^3)$.

(i) Find the common difference of this progression. [1]

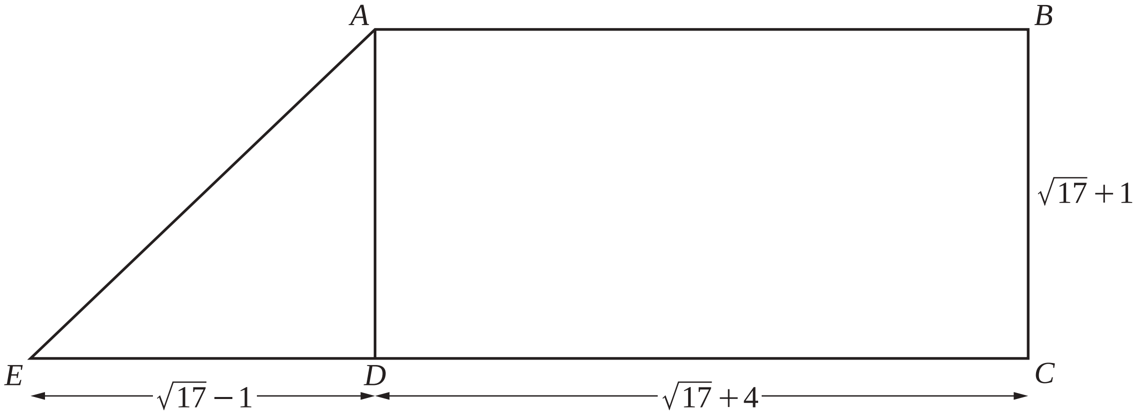
(ii) Find, in terms of n and $\log_x 3$, the sum to n terms of this progression. Simplify your answer. [2]

(iii) Given that the sum to n terms is $3081\log_x 3$, find the value of n. [2]

(iv) Hence, given that the sum to n terms is also equal to 1027, find the value of x. [2]

7 DO NOT USE A CALCULATOR IN THIS QUESTION

In this question all lengths are in centimetres.



The diagram shows a trapezium *ABCDE* such that *AB* is parallel to *EC* and *ABCD* is a rectangle. It is given that $BC = \sqrt{17}+1$, $ED = \sqrt{17}-1$ and $DC = \sqrt{17}+4$.

(a) Find the perimeter of the trapezium, giving your answer in the form $a+b\sqrt{17}$, where a and b are integers. [3]

(b) Find the area of the trapezium, giving your answer in the form $c+d\sqrt{17}$, where c and d are integers. [2]

(c) Find $\tan AED$, giving your answer in the form $\frac{e+f\sqrt{17}}{8}$, where e and f are integers. [2]

(d) Hence show that $\sec^2 AED = \frac{81+9\sqrt{17}}{32}$. [2]

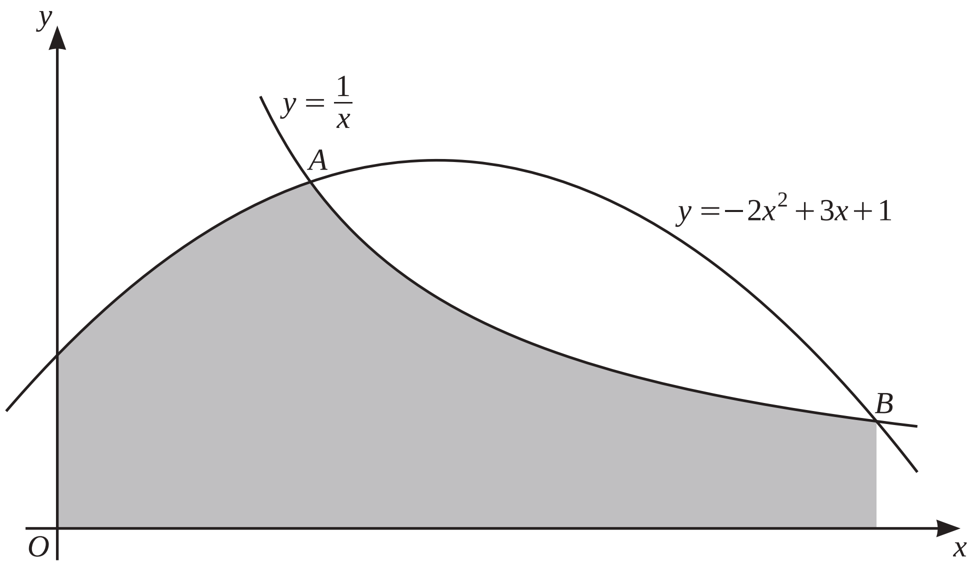
8 **(a)** **(i)** Show that $\sin x \tan x + \cos x = \sec x$. [3]

(ii) Hence solve the equation $\sin\frac{\theta}{2}\tan\frac{\theta}{2} + \cos\frac{\theta}{2} = 4$ for $0 \leqslant \theta \leqslant 4\pi$, where θ is in radians. [4]

(b) Solve the equation $\cot(y+38°)=\sqrt{3}$ for $0° \leqslant y \leqslant 360°$. [3]

9 The polynomial $p(x) = 2x^3 - 3x^2 - x + 1$ has a factor $2x - 1$.

(a) Find $p(x)$ in the form $(2x-1)q(x)$, where $q(x)$ is a quadratic factor. [2]



The diagram shows the graph of $y = \frac{1}{x}$ for $x > 0$, and the graph of $y = -2x^2 + 3x + 1$. The curves intersect at the points A and B.

(b) Using your answer to **part (a)**, find the exact x-coordinate of A and of B. [4]

(c) Find the exact area of the shaded region. [6]

Question 10 is printed on the next page.

10 A curve has equation $y = \dfrac{\left(2x^2+10\right)^{\frac{3}{2}}}{x-1}$ for $x > 1$.

(a) Show that $\dfrac{dy}{dx}$ can be written in the form $\dfrac{\left(2x^2+10\right)^{\frac{1}{2}}}{\left(x-1\right)^2}(Ax^2+Bx+C)$, where A, B and C are integers. [5]

(b) Show that, for $x > 1$, the curve has exactly one stationary point. Find the value of x at this stationary point. [4]