Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 2 6 3 0 0 7 0 6 6 4 *

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **May/June 2023**

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 (LK/CGW) 313043/3

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 Variables x and y are such that when $\lg y$ is plotted against $\sqrt{x}$ a straight line passing through the points (1, 5) and (2.5, 8) is obtained. Show that $y = A \times b^{\sqrt{x}}$ where A and b are constants to be found. [4]

$y = A \times b^{\sqrt{x}} \rightarrow \lg y = \lg A + \lg b^{\sqrt{x}} \rightarrow \lg y = (\lg b)\sqrt{x} + \lg A$

$\lg b \rightarrow m$, $\lg A \rightarrow$ y-int

$(1, 5)$, $(2.5, 8)$ $m = \frac{8-5}{2.5-1} = \frac{3}{1.5} = 2$

$\lg y = 2\sqrt{x} + \lg A$

Sub $(1, 5)$ ($1 \rightarrow \sqrt{x}$, $5 \rightarrow \lg y$) $\longrightarrow 5 = 2(1) + \lg A \rightarrow \lg A = 3$

$\rightarrow \lg y = 2\sqrt{x} + 3$

$y = 10^{2\sqrt{x}+3} \rightarrow y = 10^3 \times 10^{2\sqrt{x}}$

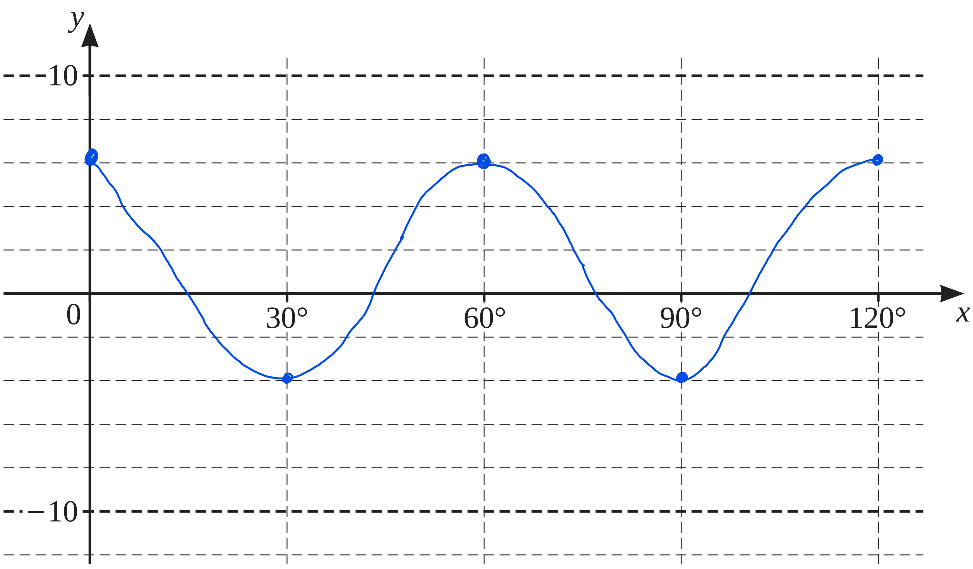
$y = 1000 \times (10^2)^{\sqrt{x}}$

$y = 1000 \times 100^{\sqrt{x}}$

$A = 1000$ $b = 100$

2 The function g is defined for $0° \leqslant x \leqslant 120°$ by $g(x) = 2 + 4\cos 6x$.

(a) On the axes, sketch the graph of $y = g(x)$. [3]



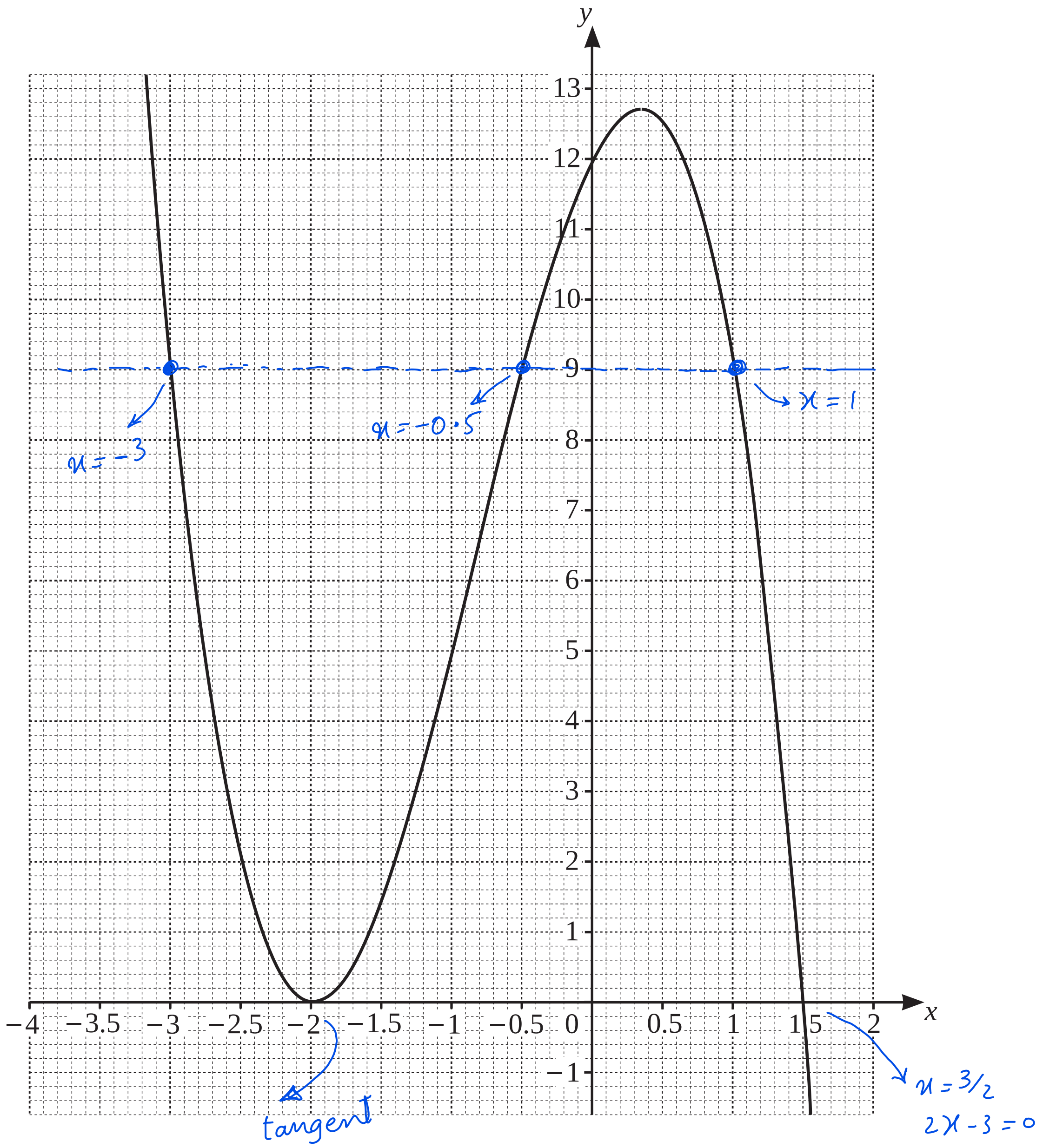
(b) State the amplitude of g. [1]

amplitude = 4

(c) State the period of g. [1]

$T = \frac{2\pi}{6} = \frac{\pi}{3} = 60°$

3



The diagram shows the graph of $y = \mathrm{h}(x)$ where $\mathrm{h}(x) = (x + a)^2(b + cx)$ and a, b and c are integers. The curve meets the x-axis at the points $(-2, 0)$ and $(1.5, 0)$ and the y-axis at the point $(0, 12)$.

(a) Find the values of a, b and c. [2]

$h(x) = k\,(x+2)^2(2x-3)$ from the graph $x = 0$, $y = 12$

$12 = k(0+2)^2(0-3) \to k = -1$

$h(x) = -(x+2)^2(2x-3) \to h(x) = (x+2)^2(3-2x)$ //

(b) Use the graph to solve the inequality $\mathrm{h}(x) \geqslant 9$. [3]

$-3 \leqslant x \leqslant -0.5$ or $x \geqslant 1$ //

4 **(a)** Solve the equation $5^{2y-1} = 6 \times 3^{y}$, giving your answer correct to 3 decimal places. [3]

$5^{2y} \cdot 5^{-1} = 6 \times 3^{y}$

$\frac{(5^2)^y}{5} = 6 \times 3^y \rightarrow \frac{25^y}{3^y} = 6 \times 5$

$\rightarrow \left(\frac{25}{3}\right)^y = 30 \rightarrow y = \log_{25/3} 30$

$\rightarrow y = 1.604$ ∗

(b) Solve the equation $e^{2x} - 4 + 3e^{-2x} = 0$, giving your answers in exact form. [4]

$e^{2x} - 4 + \frac{3}{e^{2x}} = 0$ $\quad e^{2x} = t$

$t - 4 + \frac{3}{t} = 0 \xrightarrow{\times t} t^2 - 4t + 3 = 0$

$\rightarrow (t-3)(t-1) = 0 \rightarrow \begin{cases} t = 3 \\ t = 1 \end{cases}$

$t = 3 \rightarrow e^{2x} = 3 \rightarrow 2x = \ln 3 \rightarrow x = \frac{1}{2} \ln 3$

$t = 1 \rightarrow e^{2x} = 1 \rightarrow 2x = 0 \rightarrow x = 0$