Cambridge Assessment International Education

# Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*1774634252*

**ADDITIONAL MATHEMATICS** **0606/12**

Paper 1 **February/March 2024**

**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 [ ].

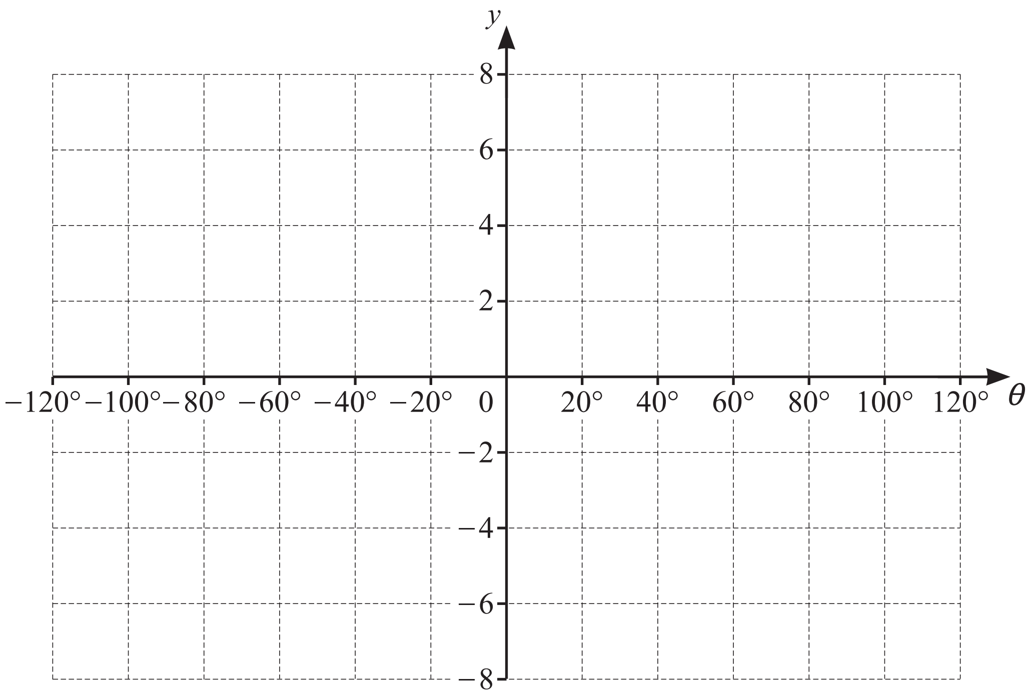
This document has **16** pages. Any blank pages are indicated.

**1** Given that $y = 2 + 4\cos 3\theta$, for $-120° \leqslant \theta \leqslant 120°$,

**(a)** write down the amplitude of $y$ [1]

**(b)** write down the period of $y$. [1]

**(c)** On the axes, sketch the graph of $y$. [3]



**2** **(a)** Given that $\log_p a + \log_p 12 - \log_p 6 = 3\log_p 4$, find the value of $a$. [3]

**(b)** Find the exact solutions of the equation $4\log_3 x = 9\log_x 3$. [4]

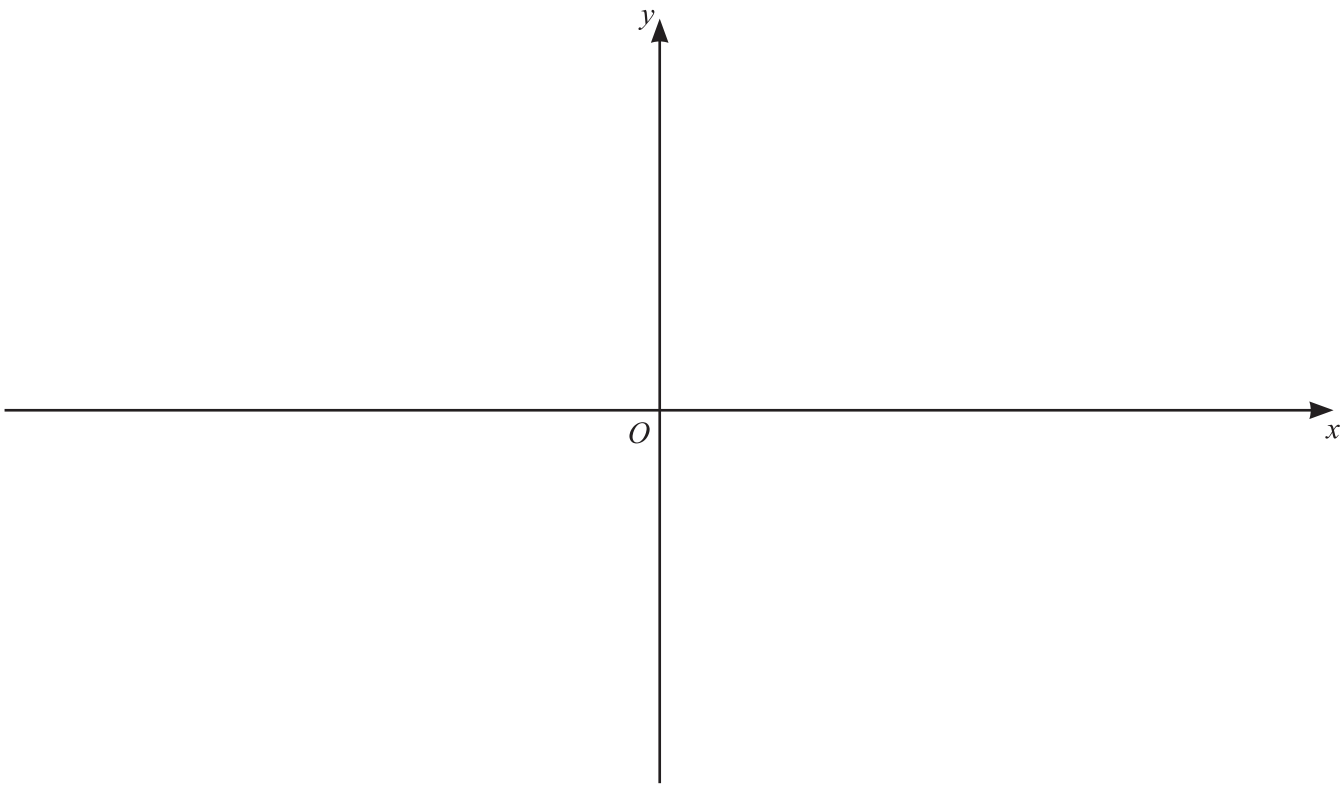
**3** The curve $C$ has equation $y = \ln(x^3 + 3)$. The normal to $C$ at the point where $x = 1$ meets the line $y = x$ at the point $P$. Find the exact coordinates of $P$. [7]

**4** A function f is such that $f(x) = 2 + e^{-3x}$, $x \in \mathbb{R}$.

**(a)** Write down the range of f. [1]

**(b)** Find an expression for $f^{-1}$. [2]

**(c)** On the axes, sketch the graphs of $y = f(x)$ and $y = f^{-1}(x)$, stating the coordinates of the points where the curves meet the coordinate axes. State the equations of any asymptotes. Label your curves. [4]



A function g is such that $g(x) = x^{\frac{3}{2}} + 4, \quad x \geqslant 0$.

**(d)** Find the exact solution of the equation $gf(x) = 12$. [4]

**5** The polynomial p is such that $p(x) = 5x^3 + ax^2 + 39x + b$, where $a$ and $b$ are constants.

**(a)** Given that $x + 3$ is a factor of both $p(x)$ and $p'(x)$, find the values of $a$ and $b$. [5]

**(b)** Hence solve the equation $p(x) = 0$.

You must show your working. [3]

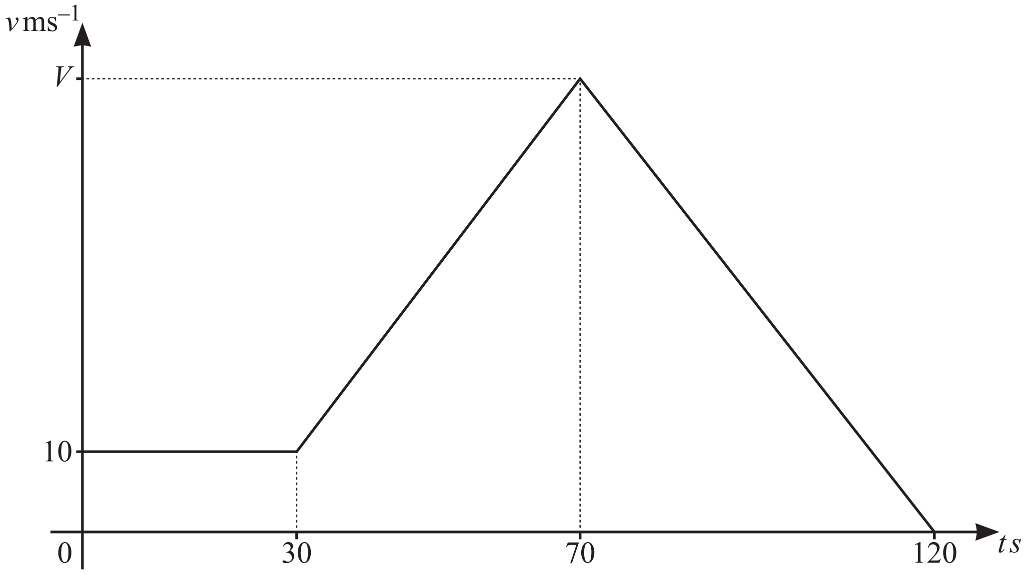
 

**(c)** Hence, using your values for $a$ and $b$, solve the equation

$$5\operatorname{cosec}^3 2\theta + a\operatorname{cosec}^2 2\theta + 39\operatorname{cosec} 2\theta + b = 0 \quad \text{for} \quad 0° \leqslant \theta \leqslant 360°.$$ [5]

**6** In this question all distances are in metres and all times are in seconds.

**(a)**




**(i)** The diagram shows the velocity–time ($v$–$t$) graph of a particle travelling in a straight line. The particle travels a distance of 2750 m in 120 s. Find the velocity, $V$, of the particle when $t = 70$. [2]

**(ii)** Find the acceleration of the particle for $70 < t < 120$. [2]

**(b)** A different particle moves in a straight line such that its velocity, $v\,\mathrm{ms}^{-1}$, $t$ seconds after leaving a fixed point $O$, is given by $v = t\left(t^2+5\right)^{\frac{1}{2}}$.

**(i)** Find the exact acceleration of the particle when $t = 2$. [4]

**(ii)** Explain why the particle does not change direction for $t > 0$. [1]

**7** **(a)** Find $\int_{2}^{4}(5x-2)^{-\frac{2}{3}}\,\mathrm{d}x$, giving your answer in exact form. [4]

**(b)** Find $\int_{0}^{\frac{1}{2}}\left(\frac{4}{2x+1}+\frac{8}{(2x+1)^{2}}\right)\mathrm{d}x$, giving your answer in the form $a+\ln b$, where $a$ and $b$ are integers. [5]

**8** **(a)** A 5-digit number is to be formed using 5 different numbers selected from 1, 2, 3, 4, 5, 6, 7, 8 and 9. No digit may be used more than once in any 5-digit number.

**(i)** Find how many 5-digit numbers can be formed. [1]

**(ii)** Find how many of these 5-digit numbers are greater than 50 000 and even. [3]

**(b)** A team of 9 people is to be chosen from 6 doctors, 4 dentists and 2 nurses. Find how many possible teams include at least 2 doctors, at least 2 dentists and at least 2 nurses. [3]

**9** **(a)** The first three terms of an arithmetic progression are $\lg\theta^2$, $\lg\theta^5$ and $\lg\theta^8$.

**(i)** Given that the sum to $n$ terms of this progression is $4732\lg\theta$, find the value of $n$. [5]

**(ii)** This sum is equal to $-14196$. Find the exact value of $\theta$. [1]

**(b)** The first three terms of a geometric progression are $\lg\phi^3$, $\lg\phi$ and $\lg\phi^{\frac{1}{3}}$.

**(i)** Determine whether this geometric progression has a sum to infinity. [2]

**(ii)** Find the *n*th term of this geometric progression, giving your answer in the form $3^A\lg\phi$, where $A$ is a function of $n$. [3]

**(iii)** Find the value of $\phi$, given that the 20th term is $3^{-18}$. [1]