GradeMax

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.

DC (PQ/CT) 327629/3
© UCLES 2024

[Turn over

GradeMax

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

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

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

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

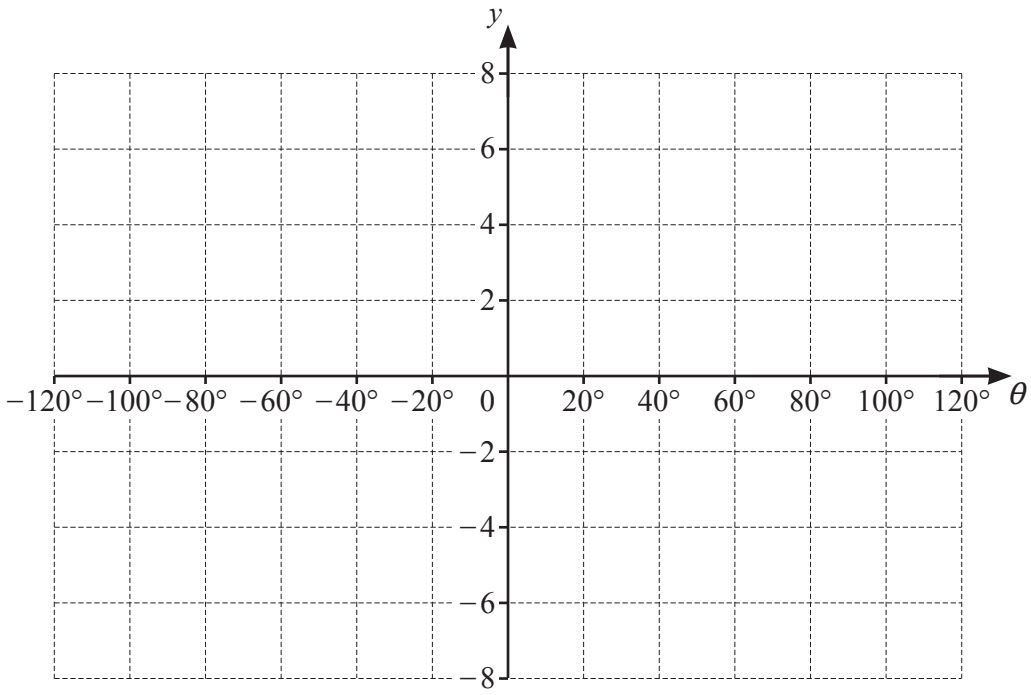
© UCLES 2024

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]



© UCLES 2024

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]

GradeMax

3 The curve C has equation $y = \ln\left(x^3 + 3\right)$. 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]

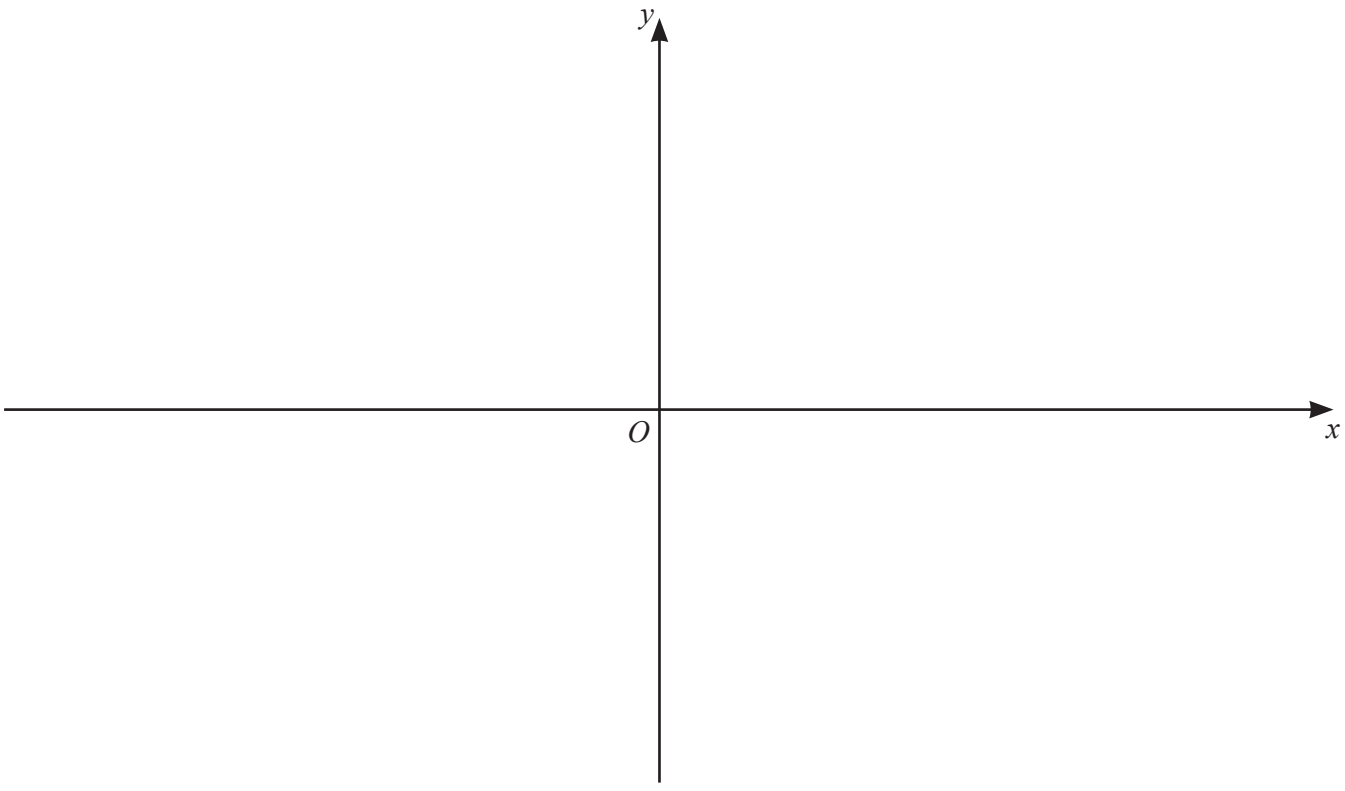
GradeMax

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

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

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

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



© UCLES 2024

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]

GradeMax

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

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

(b) Hence solve the equation $\mathrm{p}(x) = 0$.

You must show your working. [3]

© UCLES 2024

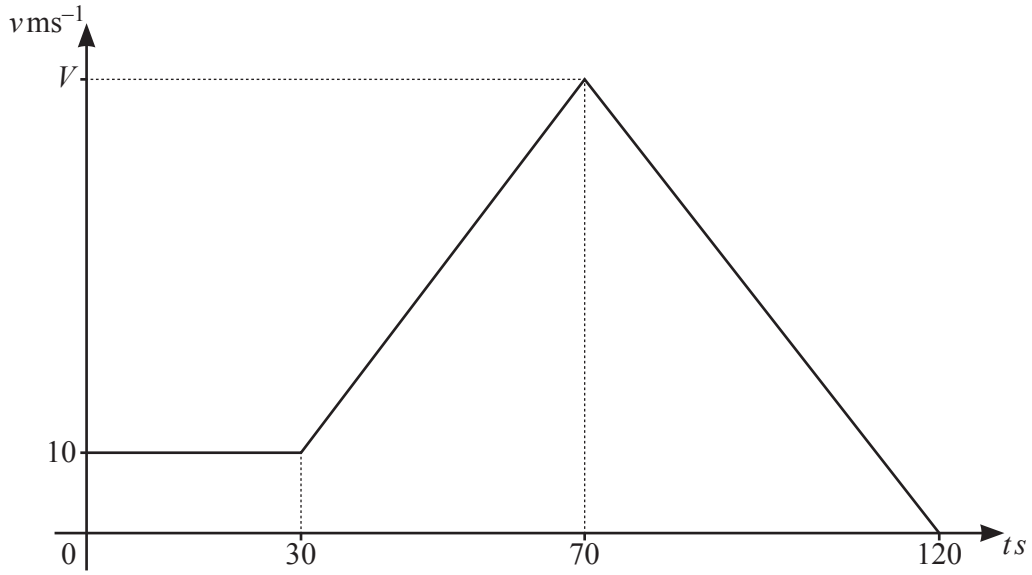
(c) Hence, using your values for a and b, solve the equation

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

GradeMax

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]

© UCLES 2024

(b) A different particle moves in a straight line such that its velocity, v 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]

© UCLES 2024

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]

© UCLES 2024

GradeMax

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]

© UCLES 2024

[Turn over

GradeMax

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 θ. [1]

© UCLES 2024

GradeMax

(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 nth 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 ϕ, given that the 20th term is 3^{-18}. [1]

© UCLES 2024

GradeMax

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 Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

© UCLES 2024