GradeMax

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

9129444551

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 2022**

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 (CE/SG) 303194/2
© UCLES 2022

[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

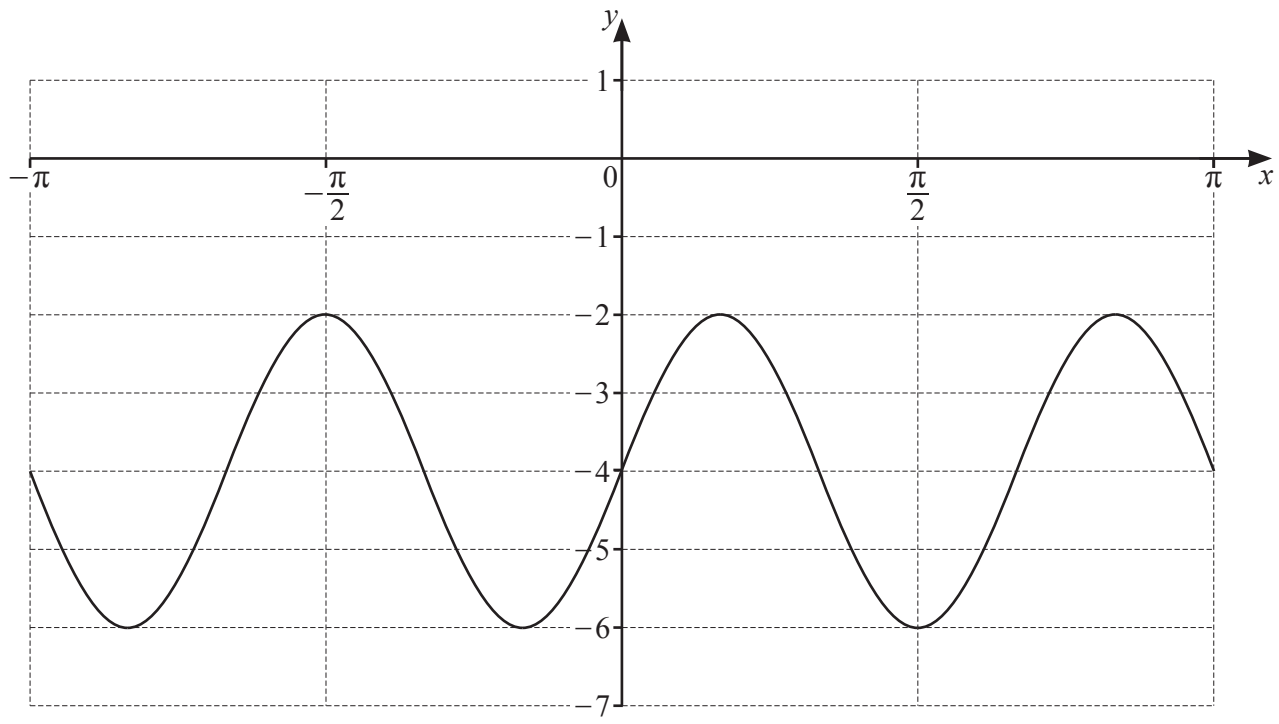
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

© UCLES 2022

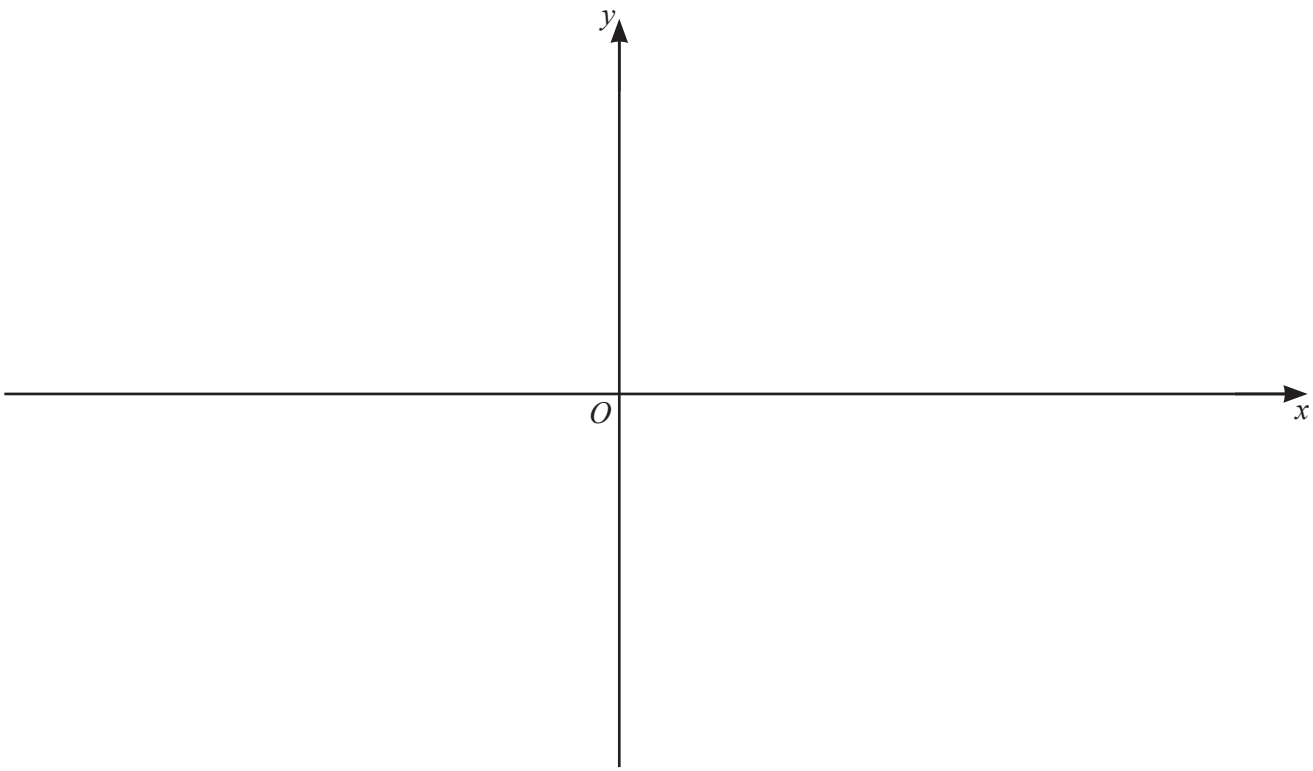
1



The diagram shows the graph of $y = a\sin bx + c$, where a, b and c are integers. Find the values of a, b and c. [3]

GradeMax

2 **(a)** On the axes, draw the graph of $y = |3x^2 + 13x - 10|$, stating the coordinates of the points where the graph meets the axes. [4]



(b) Find the set of values of the constant k such that the equation $k = |3x^2 + 13x - 10|$ has exactly 2 distinct roots. [4]

© UCLES 2022

GradeMax

3 Write $\dfrac{\sqrt{(9p^2q)} \times r^{-3}}{(2p)^3 q^{-1} \sqrt[5]{r}}$ in the form $kp^a q^b r^c$, where k, a, b and c are constants. [4]

4 Solve the equation $3\sin\left(2x + \frac{\pi}{4}\right) = \sqrt{3}\cos\left(2x + \frac{\pi}{4}\right)$, for $0 \leqslant x \leqslant \pi$. [5]

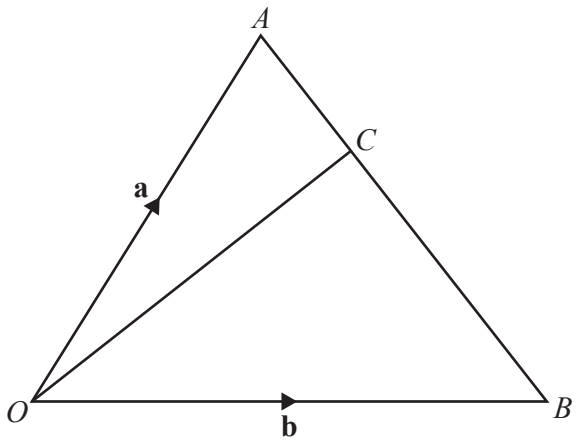
© UCLES 2022

[Turn over

GradeMax

5 **(a)** Find the vector with magnitude 200 in the direction of $\begin{pmatrix} 7 \\ -24 \end{pmatrix}$. [2]

(b)



The diagram shows triangle AOB such that $\overrightarrow{OA} = \mathbf{a}$, and $\overrightarrow{OB} = \mathbf{b}$. The point C lies on the line AB such that $AC : AB = 1 : 3$. Find the vector $\overrightarrow{OC}$ in terms of **a** and **b**, giving your answer in its simplest form. [3]

© UCLES 2022

GradeMax

(c) Given the vector equation $p\begin{pmatrix}2\\1\end{pmatrix}+q\begin{pmatrix}2\\4\end{pmatrix}=5\begin{pmatrix}-p+1\\p+q\end{pmatrix}$, find the values of p and q. [3]

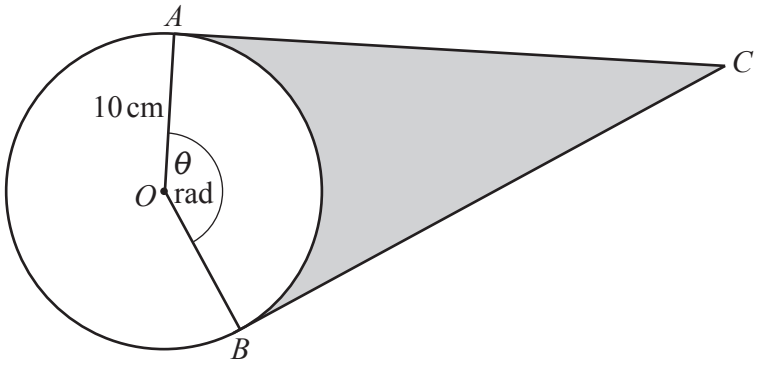
6 A group of 15 people includes 3 brothers. A team of 6 people is to be chosen from this group. The three brothers must not be separated. Find the number of possible teams that can be chosen. [3]

© UCLES 2022

[Turn over

GradeMax

7



The diagram shows a circle, centre O, radius 10 cm. The points A and B lie on the circumference of the circle. The tangent at A and the tangent at B meet at the point C. The angle AOB is θ radians. The length of the minor arc AB is 28 cm.

(a) Find the value of θ. [1]

(b) Find the perimeter of the shaded region. [3]

© UCLES 2022

(c) Find the area of the shaded region. [3]

GradeMax

8 A function $f(x)$ is such that $f(x) = \ln(2x+3) + \ln 4$, for $x > a$, where a is a constant.

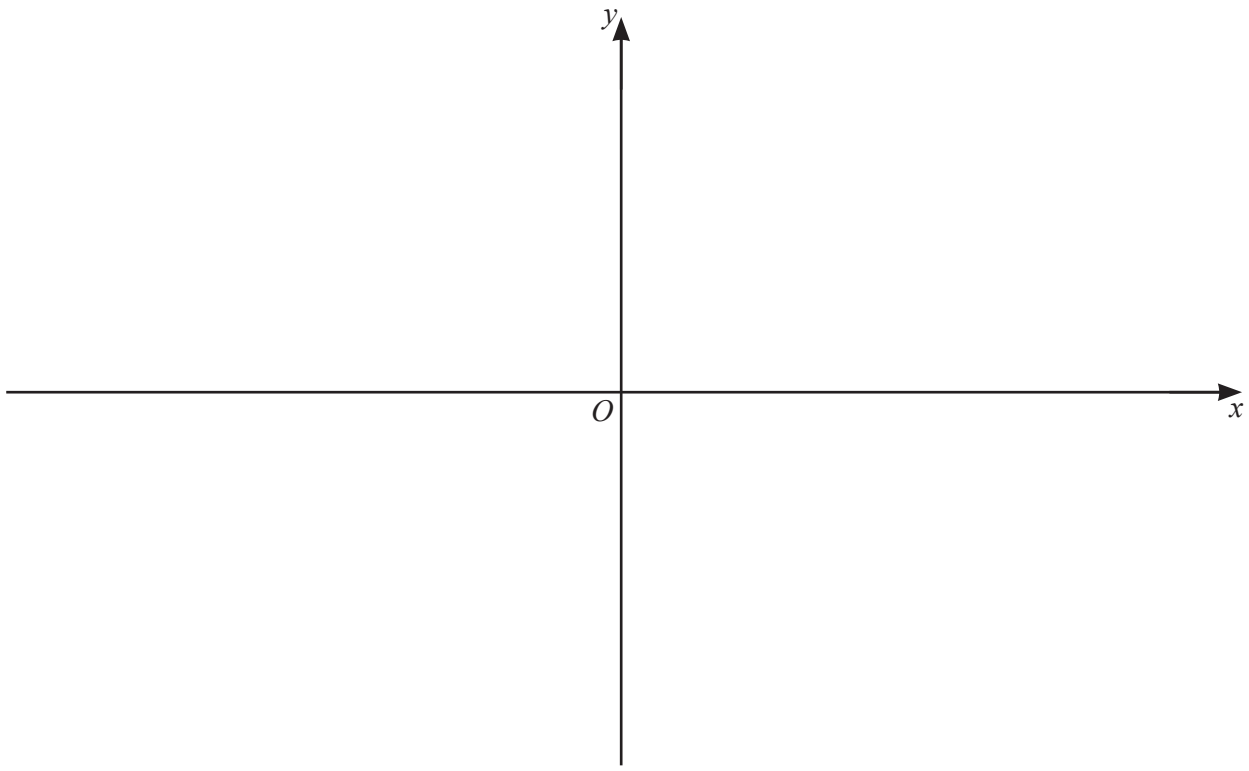
(a) Write down the least possible value of a. [1]

(b) Using your value of a, write down the range of f. [1]

(c) Using your value of a, find $f^{-1}(x)$, stating its range. [4]

© UCLES 2022

(d) On the axes below, sketch the graphs of $y = \mathrm{f}(x)$ and $y = \mathrm{f}^{-1}(x)$, stating the exact intercepts of each graph with the coordinate axes. Label each of your graphs. [4]



9 **(a)** Show that $\frac{1}{2x+1} - \frac{1}{(2x+1)^2} + \frac{4}{4x-1} = \frac{24x^2+14x+4}{(2x+1)^2(4x-1)}$. [2]

(b) Hence find $\int_{\frac{1}{2}}^{1} \frac{24x^2+14x+4}{(2x+1)^2(4x-1)}\,\mathrm{d}x$, giving your answer in the form $\frac{1}{2}\ln p + q$, where p and q are rational numbers. [7]

© UCLES 2022

GradeMax

10 The first three terms of an arithmetic progression are $\lg x$, $\lg x^5$, $\lg x^9$, where $x > 0$.

(a) Show that the sum to n terms of this arithmetic progression can be written as $n(pn-1)\lg x$, where p is an integer. [4]

(b) Hence find the value of n for which the sum to n terms is equal to $4950\lg x$. [2]

(c) Given that this sum to n terms is also equal to -14850, find the exact value of x. [2]

© UCLES 2022

[Turn over

GradeMax

11 A particle P moves in a straight line such that, t seconds after passing through a fixed point O, its displacement, s metres, is given by $s = \dfrac{(2t+1)^{\frac{3}{2}}}{t+1} - 1$.

(a) Show that the velocity of P at time t can be written in the form $\dfrac{(2t+1)^{\frac{1}{2}}}{(t+1)^2}(a+bt)$, where a and b are integers to be found. [5]

(b) Show that P is never at instantaneous rest after passing through O. [1]

© UCLES 2022

GradeMax

12 The first three terms, in descending powers of x, of the expansion of $\left(ax+\frac{2}{5}\right)^5\left(1-\frac{b}{x}\right)^2$, can be written as $32x^5-160x^4+cx^3$, where a, b and c are constants. Find the exact values of a, b and c. [9]

© UCLES 2022

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 2022