Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 9 1 7 9 2 4 2 7 6 4 *

ADDITIONAL MATHEMATICS 0606/13

Paper 1

May/June 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.

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

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

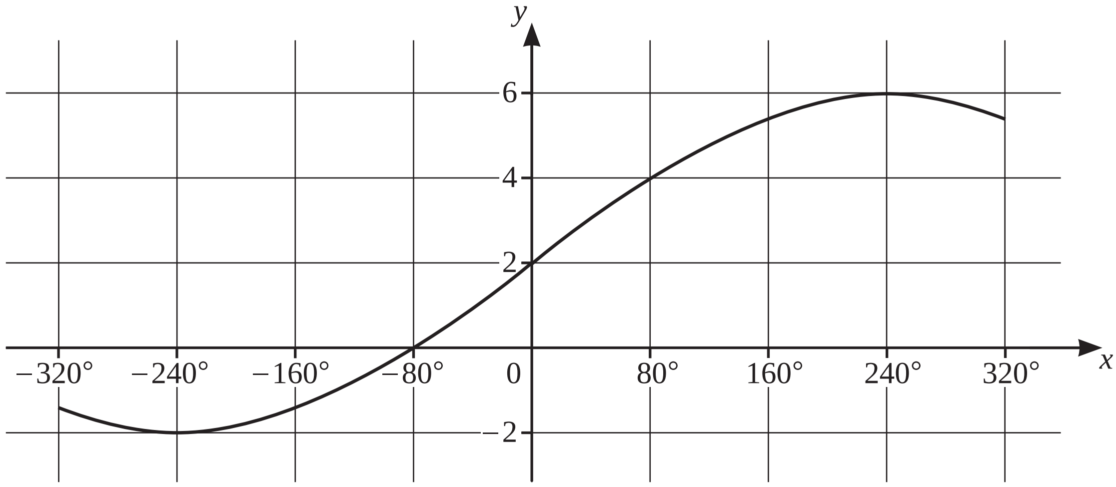
Formulae for ΔABC

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

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

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

1

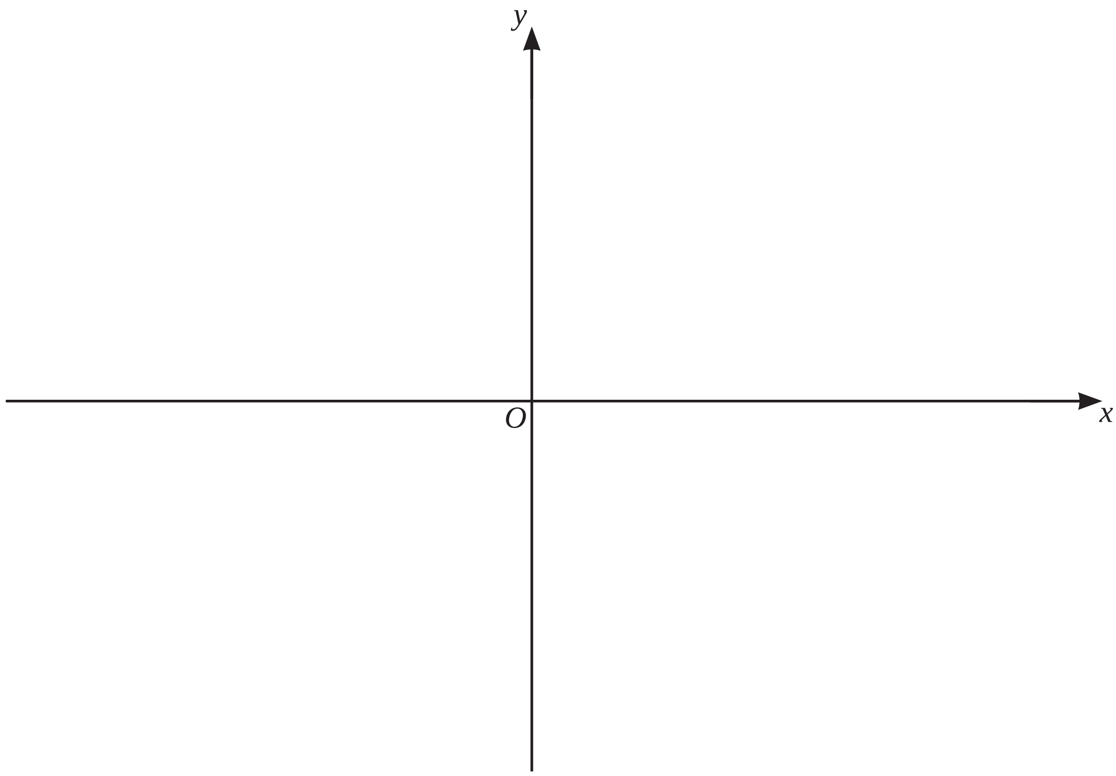


The diagram shows the graph of $y = a\sin bx + c$, for $-320° \leqslant x \leqslant 320°$, where a, b and c are constants. Find the values of a, b and c. [3]

2 Solve the equation $3\left(2^{2x+1}\right) - 11\left(2^{x}\right) + 3 = 0$, giving your answers correct to 2 decimal places. [4]

3 **(a)** Find the coordinates of the stationary points on the curve $y=(2x+1)^2(x-3)$. [4]

(b) On the axes, sketch the graph of $y=(2x+1)^2(x-3)$, stating the intercepts with the axes. [3]



(c) Write down the values of k for which the equation $(2x+1)^2(x-3)=k$ has exactly one solution. [2]

4 Find $\int_0^2 \left(1+e^{2x}\right)^2 dx$, giving your answer in exact form. [5]

5 When e^{2y} is plotted against x^3, a straight line graph that passes through the points (2, 5) and (6.4, 7.2) is obtained.

(a) Find y in terms of x. [4]

(b) Find the values of x for which y exists. [2]

6 It is given that $y = \frac{\ln\left(2x^2 + 1\right)}{x + 2}$, $x \neq -2$.

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$. [3]

(b) Given that x increases from 1 to $1 + h$, where h is small, find the approximate corresponding change in y. [2]

(c) When $x = 1$, the rate of change in y is 3 units per second. Find the corresponding rate of change in x. [2]

7 **(a)** A 6-digit number is to be formed using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. The 6-digit number cannot start with 0. Each digit can be used at most once in any 6-digit number. Find how many of these 6-digit numbers are divisible by 5. [3]

(b) The number of combinations of $(n+1)$ objects taken 13 at a time is equal to 16 times the number of combinations of n objects taken 12 at a time. Find the value of n. [3]

8 The line L is the normal to the curve $y = 3(5x+6)^{\frac{1}{2}}$ at the point where $x = 2$. The point $(-2, k)$, where k is a constant, lies on L. Find the exact value of k. [7]

9 In this question, all lengths are in metres, and time, t, is in seconds.

A particle P moves in a straight line such that, t seconds after leaving a fixed point O, its displacement, s, is given by $s = 4t - 4\cos 2t + 4$.

(a) Find the velocity, v, of P at time t. [2]

(b) On the axes, sketch the velocity–time graph for P for $0 \leqslant t \leqslant \pi$, stating the intercepts with the axes in exact form. [5]

(c) Find the acceleration of P at time t. [1]

(d) Find the times when the acceleration of P is zero for $0 \leqslant t \leqslant \pi$. Give your answers in terms of π. [2]

10 **(a)** In an arithmetic progression, the first term is a and the common difference is d. The sum of the first three terms of this arithmetic progression is 42. The product of the first three terms of this arithmetic progression is -6720.

(i) Show that $a(a+2d)=-480$. [3]

(ii) Hence, given that a is positive, find the values of a and d. [4]

(b) In a geometric progression, the 3rd term is $\frac{e^{4x}}{4}$ and the 10th term is $\frac{e^{11x}}{512}$. Find the first term and the common ratio. [5]

11 Solve the following simultaneous equations, giving your answers in exact form.

$$8\log_3 x + 12\log_{81} y = 5$$

$$4\log_9 x + 3\log_3 y = 2$$ [6]

12 Solve the equation $\sec\left(3\theta - \frac{\pi}{2}\right) = 2$ for $-\frac{\pi}{2} \leqslant \theta \leqslant \frac{\pi}{2}$. Give your answers in exact form. [5]

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