Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

7584337320

ADDITIONAL MATHEMATICS **4037/11**

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.

DC (CE/JG) 342259

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 $\quad u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $\quad u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

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

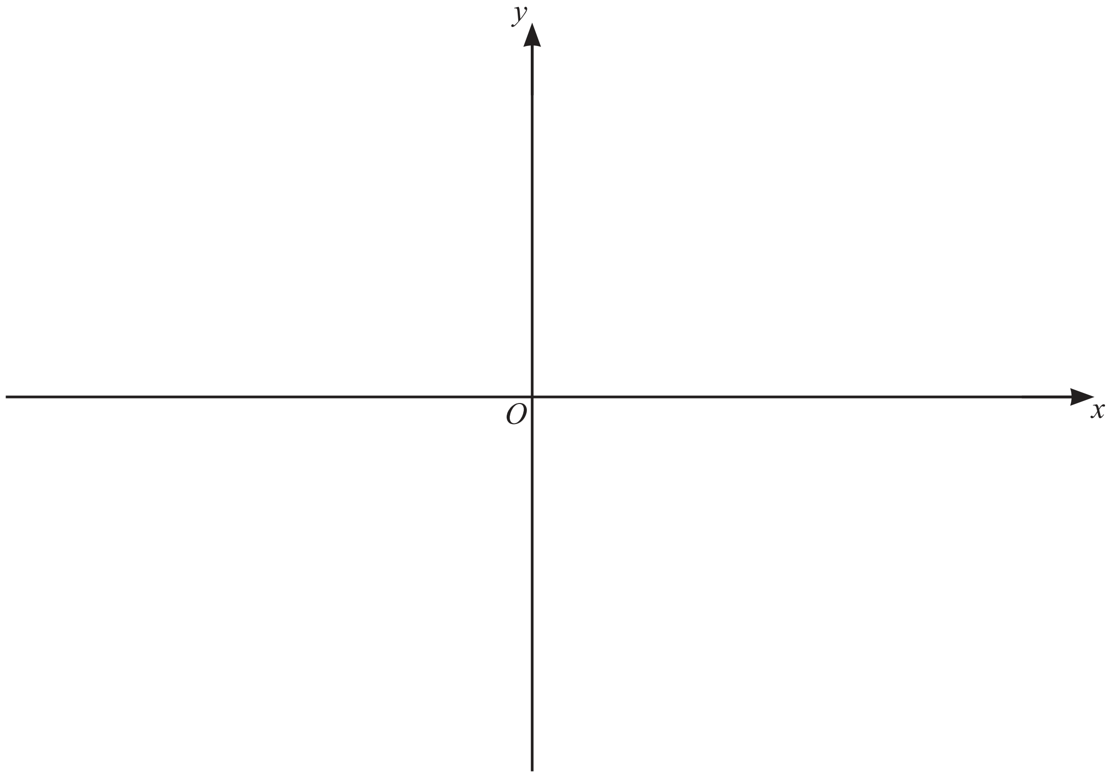
Formulae for ΔABC

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

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

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

1 **(a)** On the axes, sketch the graph of $y = -\frac{1}{5}(x+2)(2x-1)(x+5)$, stating the intercepts with the axes. [3]



(b) Hence solve the inequality $-\frac{1}{5}(x+2)(2x-1)(x+5) \geqslant 0$. [2]

2 **DO NOT USE A CALCULATOR IN THIS QUESTION.**

The polynomial p is such that $\mathrm{p}(x) = 6x^3 - 35x^2 + 34x + 45$.

(a) Find $\mathrm{p}(x)$ in the form $(2x-5)\mathrm{q}(x) + r$, where $\mathrm{q}(x)$ is a polynomial and r is a constant. [3]

(b) Hence write the expression $\mathrm{p}(x) - 5$ as a product of linear factors. [2]

(c) Hence write down the solutions of the equation $\mathrm{p}(x) = 5$. [1]

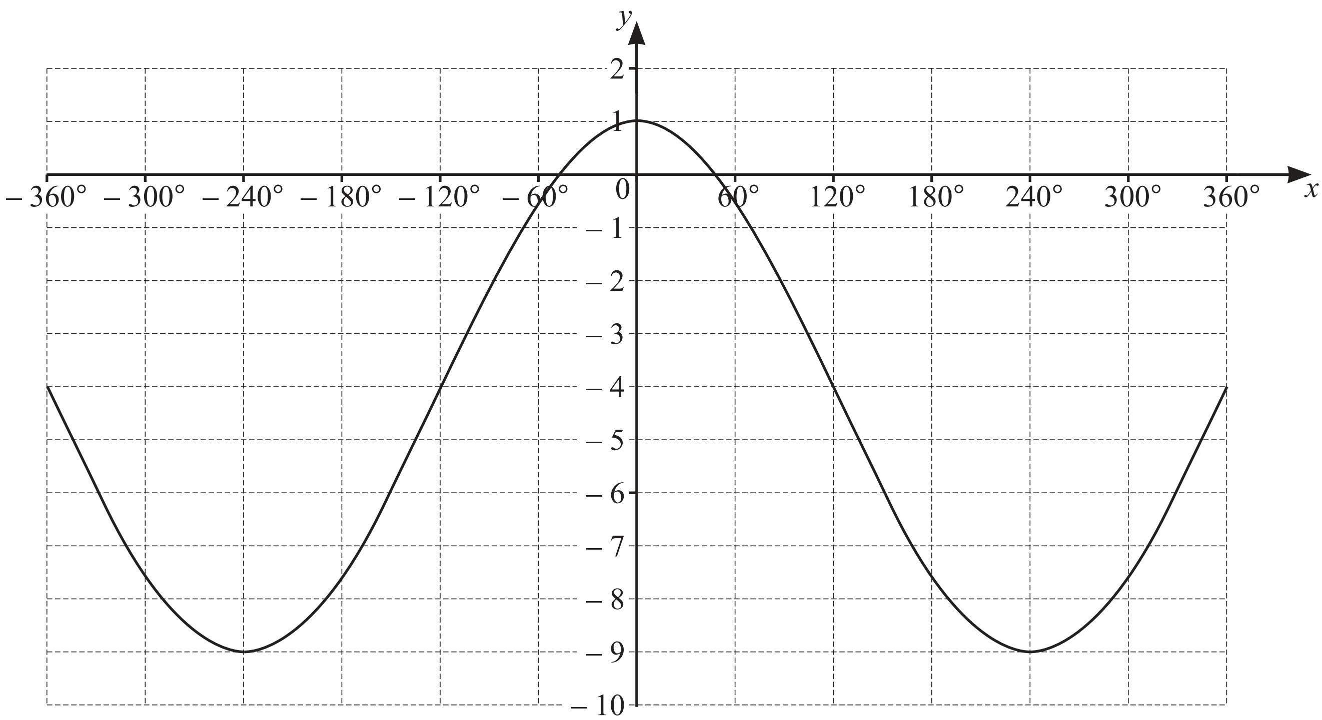
3 **(a)** Write $1+\lg(x^2-1)-2\lg(x-1)$, where $x>1$, as a single logarithm to base 10. Give your answer in its simplest form. [4]

(b) Solve the equation $4\log_5(x+1)=9\log_{(x+1)}5$, giving your answers in the form $a+b\sqrt{c}$, where a, b and c are constants. [5]

4 **(a)** The first three terms, in ascending powers of x, in the expansion of $(3+px)^n$ are $243+810x+qx^2$, where n, p and q are constants. Find the values of n, p and q. [5]

(b) Find the term independent of y in the expansion of $\left(2y-\frac{1}{3y^2}\right)^6$. Give your answer in exact form. [2]

5 **(a)** The diagram shows the graph of $y = a\cos bx + c$, for $-360° \leqslant x \leqslant 360°$, where a, b and c are constants. Find the values of a, b and c. [3]



(b) The line $y = p$ is a tangent to the curve $y = 3 - 2\sin 6\theta$. Write down the possible values of p. [2]

6 Find $\int_2^4 \left(\frac{2}{2x-3} - \frac{3}{(3x-5)^2}\right) dx$, giving your answer in exact form. [4]

7 Given that $2 + \cot\theta = 3x$ and $\sin\theta = \sqrt{y}$, find y in terms of x. [3]

8 Solve the equation $4\sin^2\left(2\alpha - \frac{\pi}{3}\right) = 1$ for $-\frac{\pi}{2} \leqslant \alpha \leqslant \frac{\pi}{2}$. Give your answers in terms of π. [5]

9 **(a)** Solve the following simultaneous equations.

$$e^{x+y} \times e^{3x-2y} = 1$$

$$x^2 y = 256$$

[5]

(b) Solve the equation $10e^{(2x-1)} - 11 = 6e^{(1-2x)}$, giving your answer in exact form. [4]

10 In this question, all distances are in metres and time, t, is in seconds.

A particle P is at a fixed point O at time $t = 0$.
The velocity, v, of P is given by $v = 3\sin 2t$ for $t \geqslant 0$.

(a) Find the exact value of t for which the velocity is zero for the first time after P leaves O. [2]

(b) Find an expression, in terms of t, for the displacement of P from O at time t. [4]

(c) Find the distance travelled by P for $0 \leqslant t \leqslant \pi$. [3]

11 The tangent to the curve $y = (3x - 1)^{\frac{1}{3}}$ at the point where $x = 3$ meets the coordinate axes at the points A and B. The point with coordinates (a, a) lies on the perpendicular bisector of the line AB. Find the exact value of a. [10]

Continuation of working space for Question 11.

Question 12 is printed on the next page.

12 **(a)** It is given that $y = \frac{\ln 3x}{x^2}$ for $x > 0$.

Find $\frac{dy}{dx}$. Give your answer in the form $\frac{A + B\ln 3x}{x^3}$, where A and B are integers. [4]

(b) Hence find $\int \frac{\ln 3x}{x^3}\,dx$. [4]