Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1799737130

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **October/November 2023**

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 **(a)** Write $19-12x-3x^2$ in the form $a(x+b)^2+c$ where a, b and c are integers. [4]

(b) Hence find the maximum value of $19-12x-3x^2$ and the value of x at which this maximum occurs. [2]

(c) Use your answer to **part (a)** to solve the equation $19-12\sqrt{u}-3u=0$. [3]

2 Solve the following simultaneous equations.

$$5x - 3\ln y = 2$$
$$x + \ln y = 1$$

[4]

3 **(a)** Find $\int\left(4x+5-\frac{1}{2x+3}\right)\mathrm{d}x$. [3]

(b) Hence find the exact value of $\int_1^3\left(4x+5-\frac{1}{2x+3}\right)\mathrm{d}x$, simplifying your answer. [3]

4 In this question a and b are integers.

Three terms in the expansion of $(2+ax)^5(1+bx)$ are $32+112x-240x^2$. Find the values of a and b. [7]

5 In this question p and q are constants.

The normal to the curve $y = \frac{p}{x^2} + 5x - 2$, at the point where $x = 1$, has equation $y = -x + q$.

Find the values of p and q. [6]

6 Find the value of the constant a for which the line $y = (2a+1)x - 10$ is a tangent to the curve $y = ax^2 - 5x + 2$. [6]

7 A particle moves in a straight line. At time t seconds after passing through a fixed point O, its velocity, $v\,\mathrm{m\,s^{-1}}$, is given by $v = 10\sin 2t - 6\cos 2t$.

(a) Find an expression for the acceleration of the particle. [2]

(b) Find the acceleration when $t = \frac{\pi}{4}$. [1]

(c) Find the first time at which the acceleration is zero. [3]

(d) Find the displacement of the particle between $t = \frac{\pi}{4}$ and $t = \frac{\pi}{2}$. [4]

8 DO NOT USE A CALCULATOR IN THIS QUESTION.

Solve the equation $(2-\sqrt{10})x^2 + x + (2+\sqrt{10}) = 0$, giving your answers in the form $a + b\sqrt{10}$, where a and b are rational. [7]

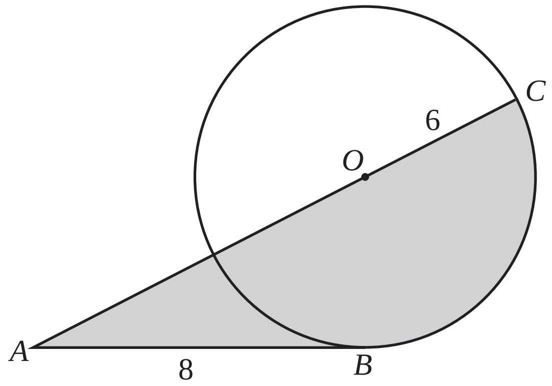
9 The functions f and g are defined as follows, for all real values of x.

$$f(x) = 2x^2 - 1$$
$$g(x) = e^x + 1$$

(a) Solve the equation $fg(x) = 8$. [3]

(b) For each of the functions f and g, either explain why the inverse function does not exist or find the inverse function, stating its domain. [4]

10 In this question all lengths are in centimetres.



The diagram shows a circle centre O with radius 6. The line AB is a tangent to the circle at the point B. The point C lies on the circle such that AOC is a straight line. $AB = 8$.

(a) Find the perimeter of the shaded region. [6]

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

11 **(a)** Show that $\dfrac{1}{\sec x - \operatorname{cosec} x} + \dfrac{1}{\sec x + \operatorname{cosec} x} = \dfrac{2\cos x}{1 - \cot^2 x}$. [5]

(b) Solve the equation $3\tan^2\left(y+\frac{\pi}{4}\right)=1$ for $-2\pi < y < 0$. [4]

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