Cambridge Assessment International Education

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CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

6277213431

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 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 [ ].

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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

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

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

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

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1 Find constants a, b and c such that $\dfrac{\sqrt{p}\,q^{\frac{2}{3}}r^{-3}}{\left(pq^{-1}\right)^{2}r^{-1}} = p^{a}q^{b}r^{c}$. [3]

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2 A particle moves in a straight line such that its displacement, s metres, from a fixed point, at time t seconds, $t \geqslant 0$, is given by $s = (1+3t)^{-\frac{1}{2}}$.

(a) Find the exact speed of the particle when $t = 1$. [3]

(b) Show that the acceleration of the particle will never be zero. [2]

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3 A function f is such that $\mathrm{f}(x) = \ln(2x+1)$, for $x > -\frac{1}{2}$.

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

A function g is such that $\mathrm{g}(x) = 5x - 7$, for $x \in \mathbb{R}$.

(b) Find the exact solution of the equation $\mathrm{gf}(x) = 13$. [3]

(c) Find the solution of the equation $\mathrm{f}'(x) = \mathrm{g}^{-1}(x)$. [6]

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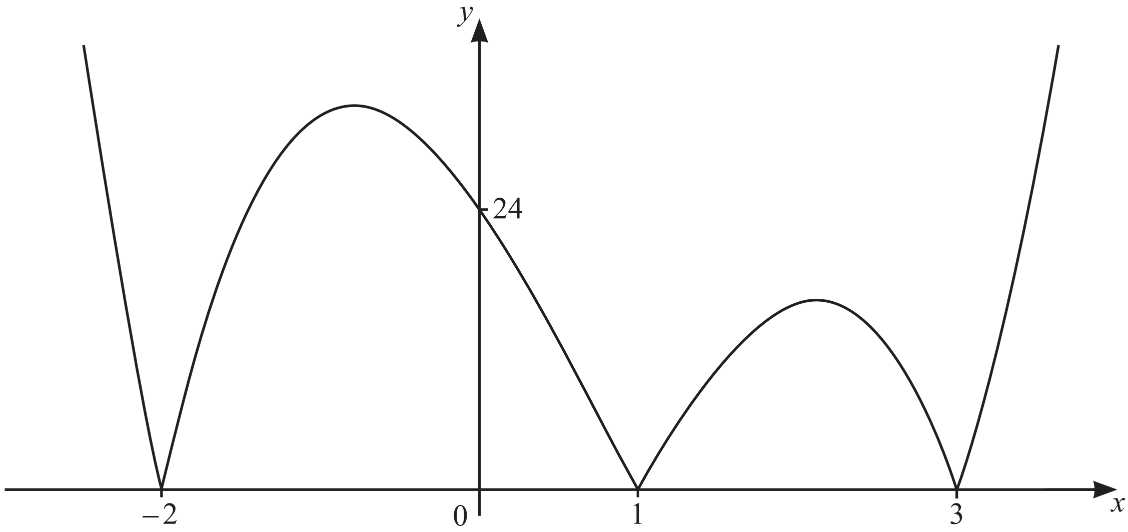
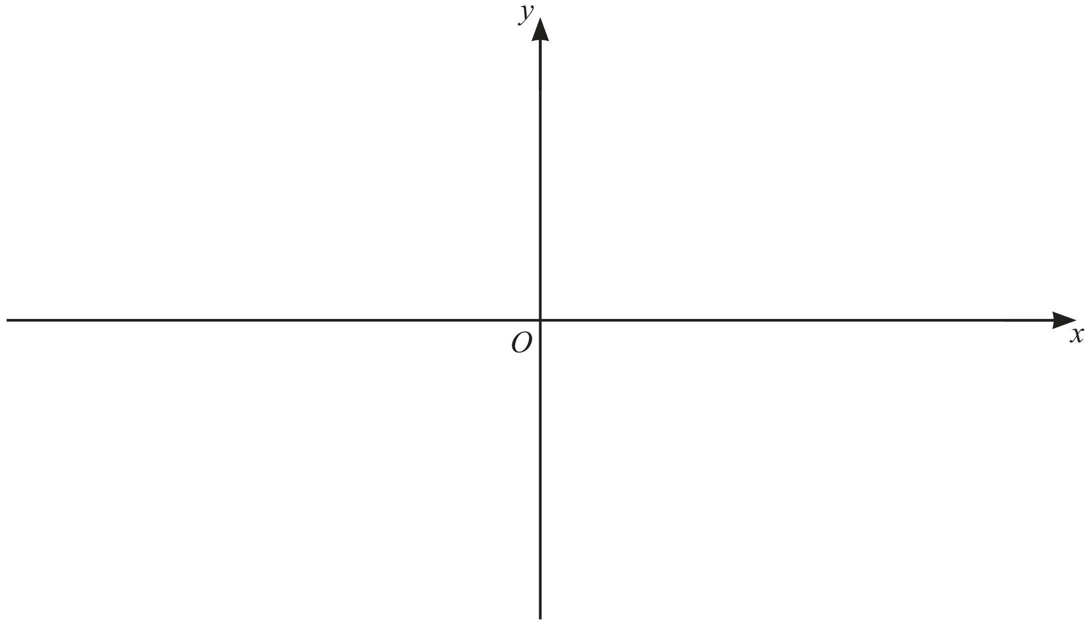
4 **(a)**



The diagram shows the graph of $y = |f(x)|$, where $f(x)$ is a cubic. Find the possible expressions for $f(x)$. [3]

(b) **(i)** On the axes below, sketch the graph of $y = |2x + 1|$ and the graph of $y = |4(x - 1)|$, stating the coordinates of the points where the graphs meet the coordinate axes. [3]



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(ii) Find the exact solutions of the equation $|2x+1| = |4(x-1)|$. [4]

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5 **(a)** Find the vector which is in the opposite direction to $\begin{pmatrix} 15 \\ -8 \end{pmatrix}$ and has a magnitude of 8.5. [2]

(b) Find the values of a and b such that $5\begin{pmatrix} 3a \\ b \end{pmatrix} + \begin{pmatrix} 2a+1 \\ 2 \end{pmatrix} = 6\begin{pmatrix} b+a \\ 2 \end{pmatrix}$. [3]

6 **(a)** Write down the values of k for which the line $y = k$ is a tangent to the curve $y = 4\sin\left(x + \frac{\pi}{4}\right) + 10$. [2]

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(b) **(i)** Show that $\dfrac{1+\tan\theta}{1-\cos\theta}+\dfrac{1-\tan\theta}{1+\cos\theta}=\dfrac{2(1+\sin\theta)}{\sin^2\theta}$. [4]

(ii) Hence solve the equation $\dfrac{1+\tan\theta}{1-\cos\theta}+\dfrac{1-\tan\theta}{1+\cos\theta}=3$, for $0° \leqslant \theta \leqslant 360°$. [4]

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7 **(a)** The first three terms of an arithmetic progression are $\lg 3,\ 3\lg 3,\ 5\lg 3$. Given that the sum to n terms of this progression can be written as $256\lg 81$, find the value of n. [5]

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(b) DO NOT USE A CALCULATOR IN THIS PART OF THE QUESTION.

The first three terms of a geometric progression are $\ln 256,\ \ln 16,\ \ln 4$. Find the sum to infinity of this progression, giving your answer in the form $p \ln 2$. [4]

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8 DO NOT USE A CALCULATOR IN THIS QUESTION.

(a) Find the exact coordinates of the points of intersection of the curve $y = x^2 + 2\sqrt{5}x - 20$ and the line $y = 3\sqrt{5}x + 10$. [4]

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(b) It is given that $\tan\theta = \dfrac{\sqrt{3}-1}{2+\sqrt{3}}$, for $0 < \theta < \dfrac{\pi}{2}$. Find $\operatorname{cosec}^2\theta$ in the form $a + b\sqrt{3}$, where a and b are constants. [5]

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9 A circle, centre O and radius r cm, has a sector OAB of fixed area $10\,\text{cm}^2$. Angle AOB is θ radians and the perimeter of the sector is P cm.

(a) Find an expression for P in terms of r. [3]

(b) Find the value of r for which P has a stationary value. [3]

(c) Determine the nature of this stationary value. [2]

(d) Find the value of θ at this stationary value. [1]

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10 The normal to the curve $y = \tan\left(3x + \frac{\pi}{2}\right)$ at the point P with coordinates $(p, -1)$, where $0 < p \leqslant \frac{\pi}{6}$, meets the x-axis at the point A and the y-axis at the point B. Find the exact coordinates of the mid-point of AB. [10]

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