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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5029941878

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 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.

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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

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

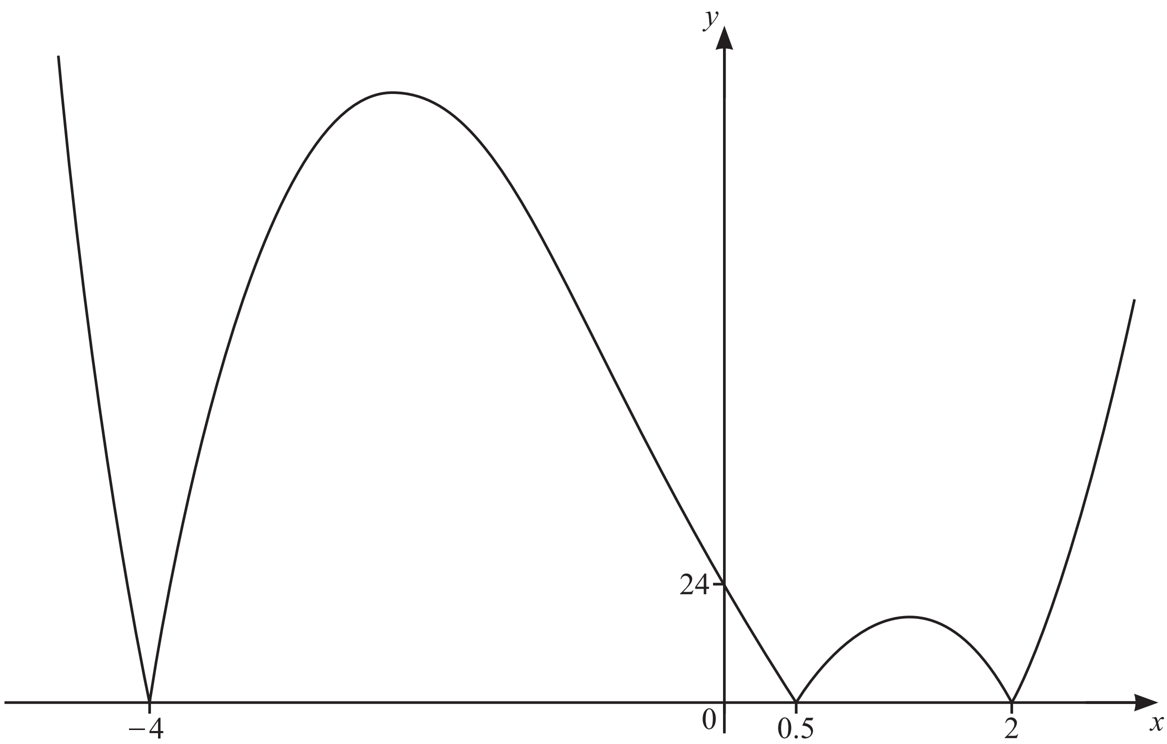
Formulae for ΔABC

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

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

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

1



The diagram shows the graph of $y = |f(x)|$, where $f(x)$ is a cubic polynomial. Find the two possible expressions for $f(x)$ in terms of linear factors with integer coefficients. [3]

2 **(a)** Given that $256^{x+y} \times 16^{-2x} = 8^{-x+3y}$, show that $y = 3x$. [2]

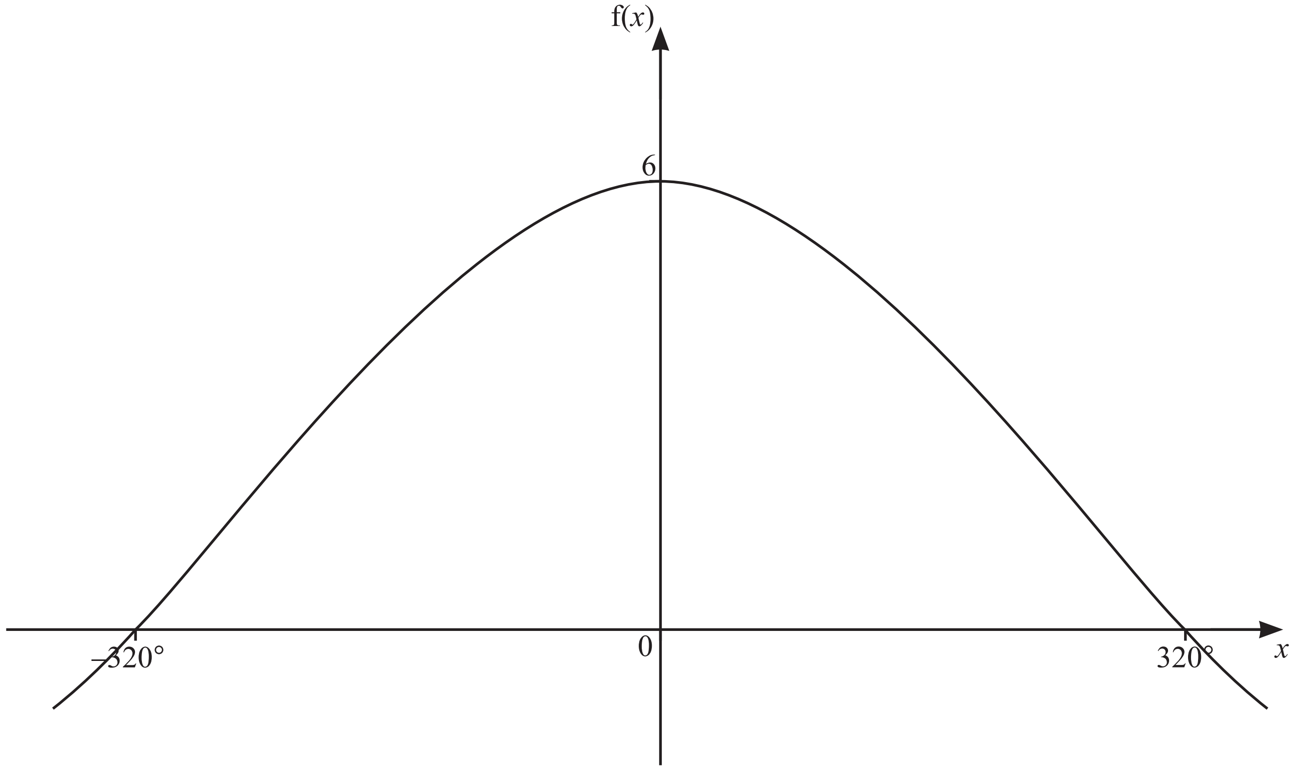
(b) Hence find the exact solutions of the following simultaneous equations.

$$256^{x+y} \times 16^{-2x} = 8^{-x+3y}$$

$$x^2 + 3y^2 = 56$$

[3]

3



The diagram shows part of the graph of $f(x) = a\cos bx + c$, where a, b and c are constants. Given that $f(x)$ has a period of 960°, find the values of a, b and c. [4]

4 Given that $\int_0^{2a+1} \frac{8}{4x+3}\,\mathrm{d}x = \ln 16$, find the exact value of the constant a. [5]

5 **(a)** In the expansion of $(1+kx)^{15}$, where k is a constant, the coefficient of x^3 is $-29\,120$. Find the value of k. [2]

(b) Find the term independent of y in the expansion of $\left(8y^2 - \frac{1}{2y}\right)^{12}$. [2]

6 The polynomial p is such that $p(x) = ax^3 + 11x^2 + bx + c$, where a, b and c are integers.
It is given that $p'(0) = 12$.
It is also given that $x+3$ is a factor of p.
When p is divided by $x-1$ the remainder is 16.

Find the values of a, b and c. [6]

7 When e^{5y} is plotted against x^3, a straight line passing through the points $(-2.56, 4.38)$ and $(6.54, 9.84)$ is obtained.

(a) Find y in terms of x. [5]

(b) Find the values of x for which y can exist. [3]

8 Given that $f''(x) = (3x+5)^{-\frac{2}{3}}$, $f'(1) = 6$, and $f(1) = 20$, find an expression for $f(x)$. [8]

9 The equation of a curve is $y = \dfrac{e^{-3x+2}}{x+1}$ where $x < -1$.

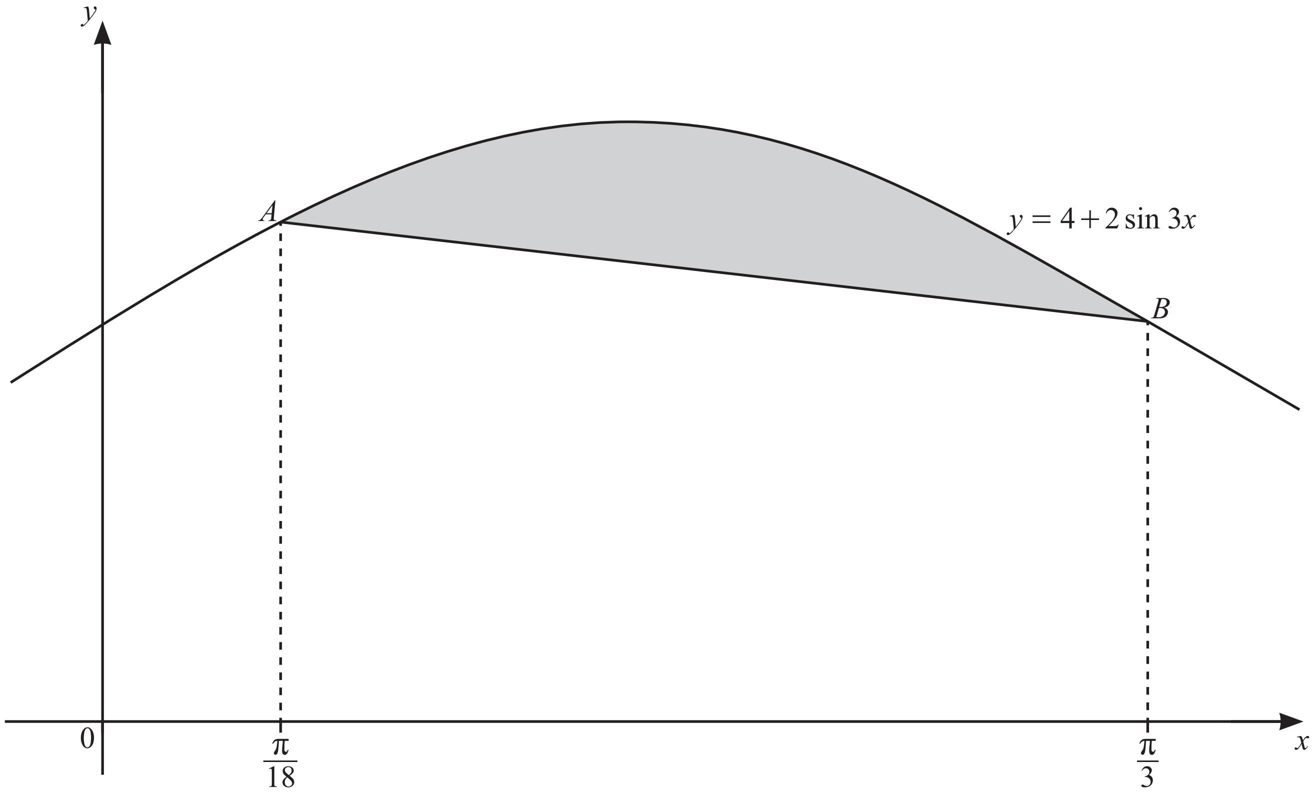
(a) Show that $\dfrac{dy}{dx} = \dfrac{e^{-3x+2}}{(x+1)^2}(Ax+B)$ where A and B are integers to be found. [5]

(b) Hence show that there is only one stationary point on the curve and find its exact coordinates. [3]

10 **(a)** The 3rd and 8th terms of a geometric progression are 6 and 1458 respectively. Find the common ratio and the first term of this progression. [4]

(b) The first 3 terms of a second geometric progression are $\cos\theta$, $2\cos^2\theta$, $4\cos^3\theta$, where $-90° < \theta < 90°$. Find the values of θ for which this geometric progression has a sum to infinity. [4]

11



The diagram shows part of the curve $y = 4 + 2\sin 3x$ and the straight line AB. The points A and B lie on the curve. The x-coordinate of A is $\frac{\pi}{18}$ and the x-coordinate of B is $\frac{\pi}{3}$. Find the area of the shaded region, giving your answer in exact form. [9]

Continuation of working space for Question 11.

12 **(a)** Solve the equation $2\operatorname{cosec}^2\theta - 5 = 5\cot\theta$ for $-180^\circ \leqslant \theta \leqslant 180^\circ$. [7]

(b) Solve the equation $3\sin(2\phi + 1.5) = 2$ for $0 < \phi < 5$, where ϕ is in radians. [5]

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