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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.





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

$$(a+b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \dots + \binom{n}{r} a^{n-r} b^r + \dots + b^n$$

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

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

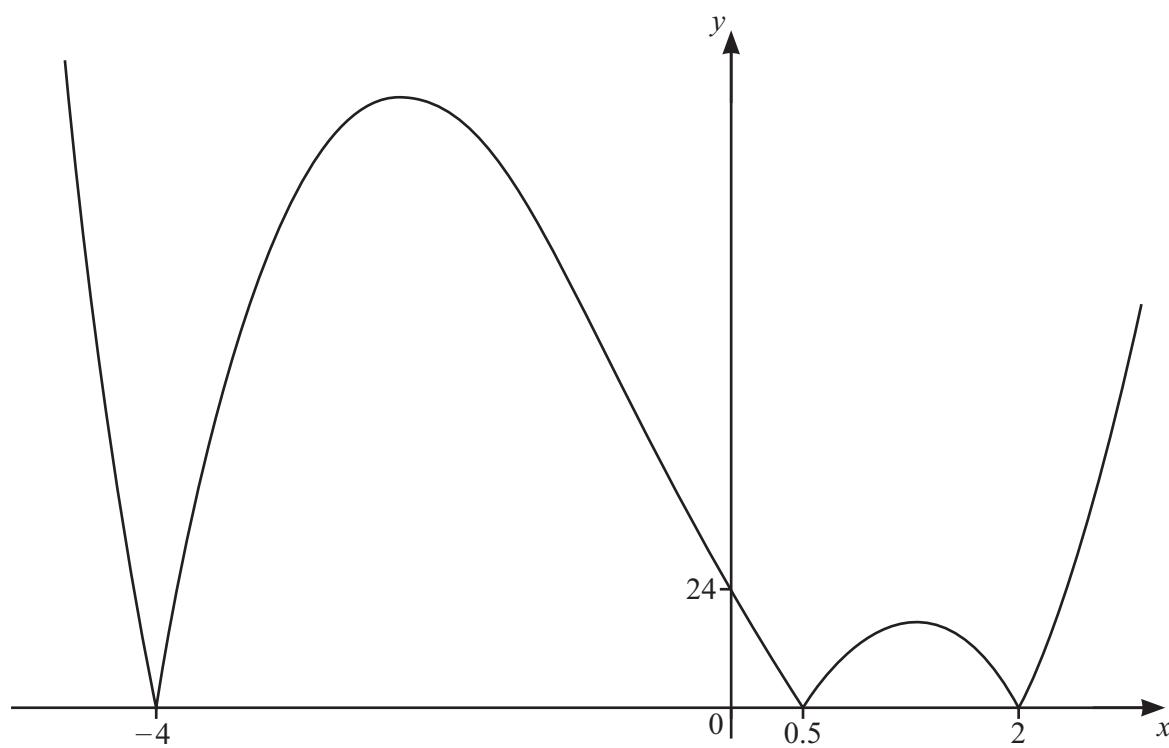
Formulae for ΔABC

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

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

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





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 $y = 3x$.

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

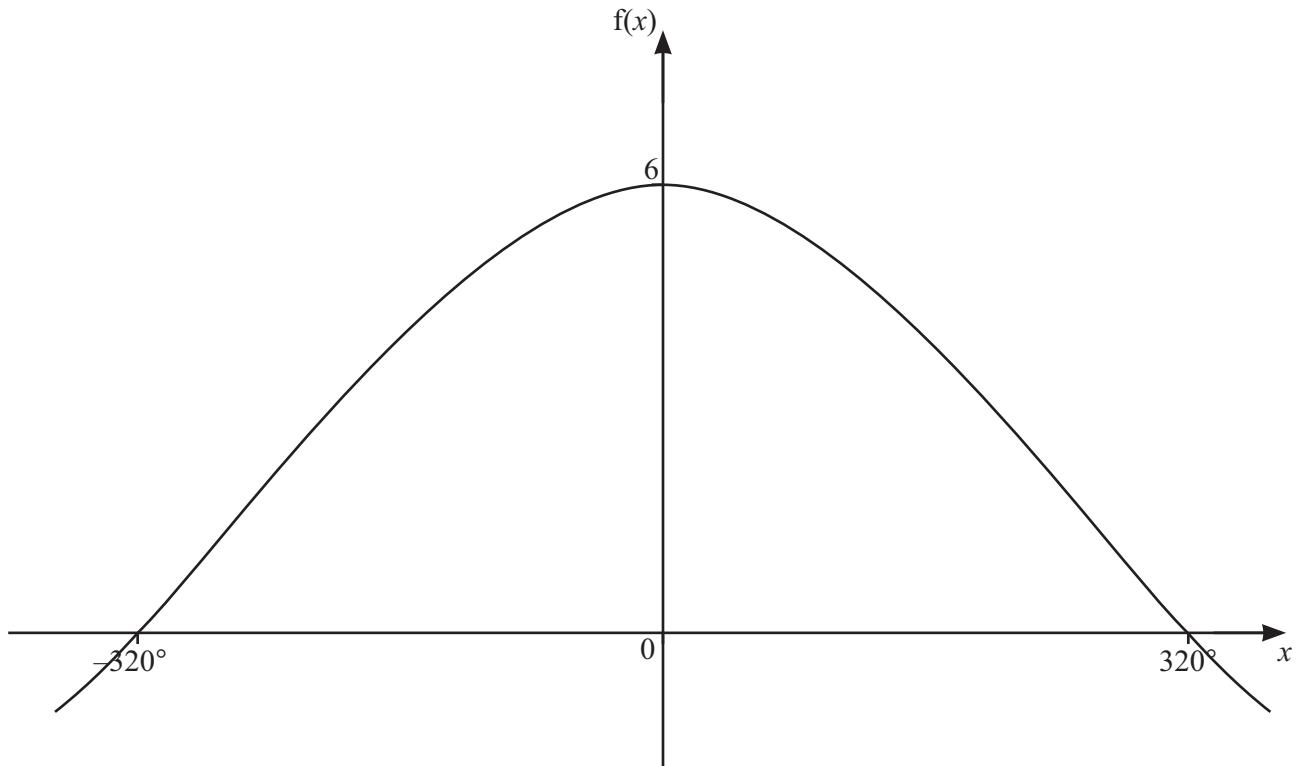
$$256^{x+y} \times 16^{-2x} = 8^{-x+3y}$$

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





3



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 $\int_0^{2a+1} \frac{8}{4x+3} dx = \ln 16$, find the exact value of the constant a .

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- 5 (a) In the expansion of $(1+kx)^{15}$, where k is a constant, the coefficient of x^3 is -29120 . 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]

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

(a) Show that $\frac{dy}{dx} = \frac{e^{-3x+2}}{(x+1)^2}(Ax+B)$ 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]





1

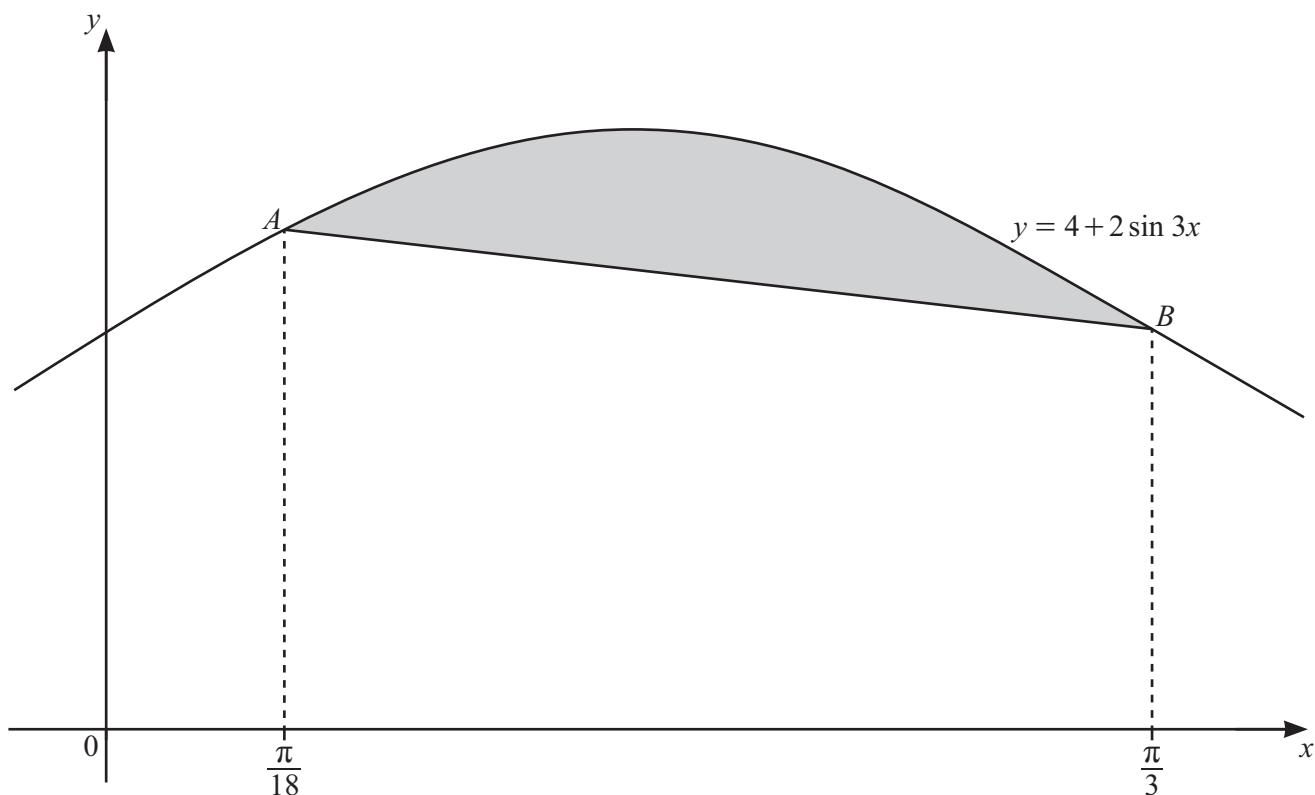
- 10 (a)** The 3rd and 8th terms of a geometric progression are 6 and 1458 respectively. Find the common ratio and the first term of this progression. [4]

- (b) The first 3 terms of a second geometric progression are $\cos \theta$, $2\cos^2 \theta$, $4\cos^3 \theta$, where $-90^\circ < \theta < 90^\circ$. 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.

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

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- (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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