National Qualifications 2026

X847/77/11

Mathematics
Paper 1 (Non-calculator)

THURSDAY, 7 MAY

9:00 AM – 10:00 AM

Total marks — 35

Attempt ALL questions.

You must NOT use a calculator.

To earn full marks you must show your working in your answers.

State the units for your answer where appropriate.

You will not earn marks for answers obtained by readings from scale drawings.

Write your answers clearly in the spaces provided in the answer booklet. The size of the space provided for an answer is not an indication of how much to write. You do not need to use all the space.

Additional space for answers is provided at the end of the answer booklet. If you use this space you must clearly identify the question number you are attempting.

Use **blue** or **black** ink.

You must leave your answer booklet on your desk; if you do not, you could lose all the marks for this paper.

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FORMULAE LIST

Standard derivatives	
$f(x)$	$f'(x)$
$\sin^{-1}x$	$\frac{1}{\sqrt{1-x^2}}$
$\cos^{-1}x$	$-\frac{1}{\sqrt{1-x^2}}$
$\tan^{-1}x$	$\frac{1}{1+x^2}$
$\tan x$	$\sec^2 x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\sec x$	$\sec x \tan x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$
$\ln x$	$\frac{1}{x}$
e^x	e^x

Standard integrals	
$f(x)$	$\int f(x)\,dx$
$\sec^2(ax)$	$\frac{1}{a}\tan(ax)+c$
$\frac{1}{\sqrt{a^2-x^2}}$	$\sin^{-1}\left(\frac{x}{a}\right)+c$
$\frac{1}{a^2+x^2}$	$\frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right)+c$
$\frac{1}{x}$	$\ln\lvert x\rvert+c$
e^{ax}	$\frac{1}{a}e^{ax}+c$

Summations

(Arithmetic series) $\quad S_n = \frac{1}{2}n\left[2a+(n-1)d\right]$

(Geometric series) $\quad S_n = \frac{a\left(1-r^n\right)}{1-r}, r \neq 1$

$$\sum_{r=1}^{n} r = \frac{n(n+1)}{2}, \quad \sum_{r=1}^{n} r^2 = \frac{n(n+1)(2n+1)}{6}, \quad \sum_{r=1}^{n} r^3 = \frac{n^2(n+1)^2}{4}$$

Binomial theorem

$$(a+b)^n = \sum_{r=0}^{n} \binom{n}{r} a^{n-r} b^r \text{ where } \binom{n}{r} = {}^nC_r = \frac{n!}{r!(n-r)!}$$

Maclaurin expansion

$$f(x) = f(0) + f'(0)x + \frac{f''(0)x^2}{2!} + \frac{f'''(0)x^3}{3!} + \frac{f^{iv}(0)x^4}{4!} + \ldots$$

De Moivre's theorem

$$[r(\cos\theta + i\sin\theta)]^n = r^n(\cos n\theta + i\sin n\theta)$$

Vector product

$$\mathbf{a}\times\mathbf{b} = |\mathbf{a}||\mathbf{b}|\sin\theta\,\hat{\mathbf{n}}$$

$$= \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} = \mathbf{i}\begin{vmatrix} a_2 & a_3 \\ b_2 & b_3 \end{vmatrix} - \mathbf{j}\begin{vmatrix} a_1 & a_3 \\ b_1 & b_3 \end{vmatrix} + \mathbf{k}\begin{vmatrix} a_1 & a_2 \\ b_1 & b_2 \end{vmatrix}$$

Matrix transformation

Anti-clockwise rotation through an angle, θ, about the origin, $\begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$

[Turn over

MARKS

Total marks — 35

Attempt ALL questions

1. Differentiate:

(a) $y = 3x^4 \sec 2x$ 2

(b) $f(x) = \dfrac{e^{5x}}{2x+1}$, simplifying your answer. 3

2. A system of equations is given by

$$x + y - z = 9$$
$$2x - y + 3z = -2$$
$$3x + 2y - 2z = 21$$

Use Gaussian elimination to solve this system of equations. 4

3. A complex number is defined by $z = \sqrt{3} + i$.

(a) Express z in polar form. 2

(b) Use de Moivre's theorem to show that z^3 is purely imaginary. 2

4. Find the particular solution of the differential equation

$$2\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + y = 0$$

given that $y = 2$ and $\dfrac{dy}{dx} = -1$ when $x = 0$. 5

MARKS

5. Matrix A is defined by $A = \begin{pmatrix} 3 & 5 \\ -2 & x \end{pmatrix}$.

(a) State an expression for the determinant of A in terms of x. 1

Matrix A is multiplied by matrix B such that det $AB = 12x + 40$.

(b) State the determinant of B. 1

The inverse of matrix B is $B^{-1} = \begin{pmatrix} 1 & -1 \\ -\frac{5}{4} & \frac{3}{2} \end{pmatrix}$.

(c) Find matrix B. 2

6. (a) Use the substitution $u = x - 1$ to find $\int x(x-1)^4 dx$. 3

(b) Hence find the exact volume of the solid formed by rotating the curve with equation $y = 2\sqrt{x}(x-1)^2$ about the x axis through 2π radians, from $x = 0$ to $x = 1$. 4

7. The complex number $z = 2 + i$ is a root of the polynomial equation $z^4 - 2z^3 - z^2 + 2z + 10 = 0$.

(a) State a second root of the equation. 1

(b) Find the remaining roots. 5

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