

Dr Oliver Mathematics
Mathematics: Advanced Higher
2026 Paper 1: Non-Calculator
1 hour

The total number of marks available is 35.

You must write down all the stages in your working.

1. Differentiate:

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

(b) $f(x) = \frac{e^{5x}}{2x + 1}.$ (3)

2. A system of equations is given by (4)

$$\begin{aligned}x + y - z &= 9 \\2x - y + z &= -2 \\3x + 2y - 2z &= 21.\end{aligned}$$

Use Gaussian elimination to solve this system of equations.

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 (5)

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

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

5. Matrix **A** is defined by

$$\mathbf{A} = \begin{pmatrix} 3 & 5 \\ -2 & x \end{pmatrix}.$$

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

Matrix **A** is multiplied by matrix **B** such that

$$\det(\mathbf{AB}) = 12x + 40.$$

- (b) State the determinant of $\mathbf{B}$. (1)

The inverse of matrix $\mathbf{B}$ is

$$\mathbf{B}^{-1} = \begin{pmatrix} 1 & -1 \\ -\frac{5}{4} & \frac{3}{2} \end{pmatrix}.$$

- (c) Find matrix $\mathbf{B}$. (2)

6. (a) Use the substitution (3)

$$u = x - 1$$

to find

$$\int x(x-1)^4 dx.$$

- (b) Hence find the exact volume of the solid formed by rotating the curve with equation (4)

$$y = 2\sqrt{x}(x-1)^2,$$

about the x -axis through 2π radians, from $x = 0$ to $x = 1$.

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)