

Dr Oliver Mathematics
Applied Mathematics: Mechanics or Statistics
Section B
2011 Paper
1 hour

The total number of marks available is 32.

You must write down all the stages in your working.

1. Differentiate the following, simplifying where possible.

(a) $f(x) = \frac{1 + \sin x}{1 + 2 \sin x}$, $0 \leq x \leq \pi$, (3)

(b) $g(x) = \ln(1 + e^{2x})$. (2)

2. (a) Given (2)

$$\mathbf{A} = \begin{pmatrix} 1 & -2 \\ 3 & 0 \end{pmatrix},$$

obtain \mathbf{A}^{-1} .

- (b) Given (3)

$$\mathbf{AB} = \begin{pmatrix} -4 & -3 \\ 6 & -3 \end{pmatrix},$$

find the matrix \mathbf{B} .

3. A curve is defined by the equations (4)

$$x = 5 \cos t \text{ and } y = 3 \sin t, 0 \leq t < 2\pi.$$

Find the gradient of the curve when $t = \frac{1}{6}\pi$.

4. (a) Find the value of N for which (3)

$$\sum_{r=1}^N r = 210.$$

- (b) Evaluate (2)

$$\sum_{r=1}^N r^2$$

for this value of N .

5. Use the substitution $u = \ln x$ to obtain (4)

$$\int \frac{2}{x \ln x} dx,$$

where $x > 1$.

6. At any point (x, y) on a curve C , where $x \neq 0$, the gradient of the tangent is (9)

$$4 - \frac{3y}{x}.$$

Given that the point $(1, 3)$ lies on C , obtain an equation for C in the form $y = f(x)$.

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