

Section D (Mathematics 1)

Marks

Answer all the questions.

Answer these questions in a separate answer book, showing clearly the section chosen.

D1. Differentiate the following functions with respect to x :

(a) $y = \frac{\ln(1+x^2)}{(1+x^2)}$, 3

(b) $f(x) = e^{\sec x}$, $0 \leq x < \frac{\pi}{2}$. 2

D2. Solve the equation $\binom{n}{2} - \binom{n}{1} = 2$, where $n \geq 2$. 4

D3. Use the substitution $x = 1+t^2$ to find $\int \frac{x}{\sqrt{x-1}} dx$. 4

D4. Find the values of a and b which satisfy the system of equations

$$\begin{aligned} a + 0.99b &= 9.99 \\ 0.99a + 0.98b &= 9.89. \end{aligned}$$

By comparing these equations with

$$\begin{aligned} a + 0.99b &= 10 \\ 0.99a + 0.98b &= 9.89. \end{aligned}$$

decide whether or not the original equations are ill-conditioned.

State a reason for your answer. 4

D5. Express in partial fractions

$$\frac{2x^2 - 3x + 2}{x^2(x-1)}. \quad \text{5}$$

D6. The function f is defined by $f(x) = 3x + \frac{3}{x}$, $x > 0$.

(a) Write down an equation for each of the asymptotes of the graph of f . 2

(b) The graph of f has a stationary point when $x = a$.
Find the coordinates of this stationary point and justify its nature. 3

(c) Sketch the graph of f . 1

(d) Find the volume of the solid of revolution formed when the region between $y = f(x)$, $x = a$, $x = 3$ and $y = 0$ is rotated about the x -axis. 4

[END OF SECTION D]