

Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science & Engineering

Midterm Examination, Summer 2026

Course Code: MAT101, Course Title: Mathematics I

Level: L1 Term: T1 Batch: 72

Time: 01:30 Hrs

Marks: 25

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	a)	Demonstrate the Continuity and Differentiability of the following function at the point $x = 0$ $f(x) = \begin{cases} e^x - 1; x < 0 \\ \sin x; 0 \leq x \leq \pi \\ x - \pi; x > \pi \end{cases}$	4	CO1
	b)	If $y = \sqrt{2 + \sqrt{2 + \sqrt{2 + \sqrt{2 + \dots}}}}$ then demonstrate the value of y .	3	
2.		Interpret the solution of the inequality $\frac{x^2 + x}{x^2 - 4x - 45} \leq 0$ using sign table.	3	CO1
3.		To determine the exact time complexity of the algorithm, the engineer derives the following characteristic polynomial equation: $x^4 - 3x^3 - 7x^2 - 13x - 10 = 0$ Where the largest real root x , represents the growth factor of the algorithm's execution time. Apply the Factor Theorem for Solving this equation to find the growth factor.	5	CO2
4.	a)	Inspect the rate of change of y with respect to x , or $\frac{dy}{dx}$ of the function $y = e^{-3x} + \log_a x + \sec^{-1} x + \cos ec 5x + a^x + \sec x$.	3	CO3
	b)	A motorcycle moves along a hill road. If the equation of the path is $y = \ln \sqrt{\frac{1 - \cos x}{1 + \cos x}} + (\ln e^x)^x$ then, inspect the slope of the path at $x = 0.5$	4	
	c)	If $y = \sin \left(\sin^{-1} \left(\cos \left(\sec \left(\sqrt{1 + x^2} \right) \right) \right) \right)$ and $z = 10^{\ln(\sin x + \sec x)}$ then, Inspect the rate of change of z with respect to y , or $\frac{dz}{dy}$.	3	