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Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science & Engineering
Midterm Examination, Fall 2026
Course Code: MAT101, Course Title: Mathematics I
Level: L1 Term: T1 Batch: 73

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 $x=1$ $f(x)=\begin{cases} x^2\sin\left(\frac{1}{x}\right); x<0 \\ x^3+x; 0\le x\le 1 \\ 3x^2-4x+3; x>1 \end{cases}$	**4**	**CO1**
	b)	If $a+b\sqrt{6}=\frac{75\sqrt{3}+48\sqrt{2}}{\sqrt{432}+\sqrt{162}}$ then demonstrate the value of (a,b).	**3**	
2.		Interpret the solution of the inequality $\frac{x-5}{x^3+24x^2+144x}\le 0$ using sign table.	**3**	**CO1**
3.		To determine the exact time complexity of the algorithm, the engineer derives the following characteristic polynomial equation: $4x^4-4x^3-61x^2+91x+60=0$ 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 $y=\sin 4x+\log_a x+\sec x+10^x+\sec^{-1}x+\log x$.	**3**	**CO3**
	b)	A motorcycle moves along a hill road. If the equation of the path is $y=\tan^{-1}\left(\frac{4\sqrt{x}}{1-4x}\right)+\left(x^x\right)^x$ then, inspect the slope of the path at $x=0.2$	**4**	
	c)	If $y=\ln\left(2\theta+\sqrt{\theta^2-2}\right)$ and $z=\ln\left(\theta e^{\theta}\left(\frac{1+\theta}{1-\theta}\right)^2\right)$ then, Inspect the rate of change of z with respect to y, or $\frac{dz}{dy}$.	**3**	