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Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science & Engineering
Final Examination, Fall 2025
Course Code: MAT101, Course Title: Mathematics I
Level: 1 Term: 1 Batch: 70

Time: 2:00 Hrs **Marks: 40**

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)***	Construct the following rational fraction into the partial fraction $\dfrac{x^2+5x+1}{x(x^2+3)(x^2+6)}$	**[6]**	**CO2**
	b)	Construct the following rational fraction into the partial fraction $\dfrac{x^2+4x}{x^2+3x-40}$	**[4]**	
2.		A temperature distribution along a thin metal rod is modeled by a continuous function $T(x)$, where x (in meters) represents the position along the rod. $T(x)=x^5-4x^4+6x^3-4x^2+x$ 1. List all critical points of the temperature function $T(x)$. 2. Examine using derivative tests to classify each critical point as a local maximum, local minimum, or point of inflection. 3. Interpret the results physically: i. At what positions is the rod hottest? ii. At what positions is the rod coldest?	**[5]**	**CO3**
3.	***a)***	Simplify the following integrals (i) $\int \dfrac{1}{\sqrt{(x^2-1)}\{9x+x(\sec^{-1}x)^2\}}dx$ (ii) $\int \dfrac{1}{1+\sin^2 x}dx$	**[5]** **[5]**	**CO4**
	b)	Consider the circle given by the equation $x^2+y^2=144$ and the vertical line $x=c$ where c is a real number and they intersect each other. If $c=6$ then examine the smallest area of the region bounded by the circle and the line.	**[5]**	

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	c)	Let the function $\int a^{2x} \sin 4x dx$ represent a rate of thermal exchange along a thin rod. Examine the total accumulated exchange from $x = 0$ to $x = \pi$	[5]	
4.		Assume the vector $\varphi = (2xy + z)i + (x^2 + 2yz)j + (y^2 + 3xz)k$, then examine that the vector is rotational (i.e. Curl $\overset{1}{\varphi} \neq 0$). Also simplify the Divergence of φ .	[5]	