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Daffodil International University

Faculty of Science & Information Technology
Department of Computing and Information System
Final Examination, Summer-2025
Course Code: MAT101, Course Title: Mathematics I
Level: 1 Term: 2

Exam Duration: 2 Hours **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)	An aerospace company is evaluating the daily operating cost of a prototype jet engine as a function of its thrust setting. Let x be the thrust level in units of 10,000 lbf (pounds-force). Based on fuel burn, thermal stress on components, and maintenance scheduling, the daily cost C(x) (in thousands of dollars) of running the engine at thrust x is modeled by $$C(x) = x^6 - 12x^5 + 36x^4 + 4$$ i. Construct $C'(x)$ and find all the critical points. ii. Find the maximum and minimum daily cost of running the jet engine.	[5]	CLO3 L-1,5
2.	a)	Simplify $\frac{7x-25}{(x-3)(x-4)}$ into partial fraction.	[4]	CLO4 L-3,4
	b)	Apply the concept of partial fraction to evaluate $\int \frac{dx}{x^3+1}$	[6]	
3.		Solve the following integrations: i. $\int \frac{4x\ dx}{\sqrt{2x^2+1}}$ ii. $\int x^2 e^{3x}\ dx$ iii. $\int \frac{e^x - 1}{e^x + 1}\ dx$	[3] + [3] + [4]	CLO4 L-3
4.	a)	Evaluate the integration the function $sec^3\theta$ within the interval 0 to $\frac{\pi}{4}$	[5]	CLO4 L-1,4
	b)	Find the area of the largest region bounded by the circle $x^2 + y^2 = 16$ and the straight line $x - 2 = 0$.	[5]	
5.		A warehouse worker uses a hand truck to move a heavy crate along the floor. The combined displacement of the crate can be described by the vector $$\vec{r} = 3\hat{\imath} + 2\hat{\jmath} - 5\hat{k}\ \text{(In meters)}$$ During this move, the worker applies a steady force $$\vec{F} = 2\hat{\imath} - \hat{\jmath} - \hat{k}\ \text{(In newtons)}$$ Demonstrate the work done (in joules) by the worker in moving the crate along the given displacement.	[5]	CLO4 L-2