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Daffodil International University

Faculty of Science & Information Technology
Department of Software Engineering
Final Examination, Spring 2026
Course Code: MAT101, Course Title: Mathematics I
Sections & Teachers: 46(A-Q) & HSA, DK, AHB, RAR, MSIM

Time: 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.	Briefly **explain** the following terms a. Condition for a maximum point of a function. b. Conditions for critical point(s) and inflection point(s).	1+1=2	CLO-1 L-2
2.	a. **Compute** the extremum value(s), by mentioning all the critical points of the polynomial function: $y = x^5 - 4x^4 + 4x^3$ b. Imagine you are writing a script to monitor a server's network usage. During an update, the download speed fluctuates according to the function $f(t) = 3 + 2t^2$ (in MB/s), where t is the time in seconds. **Interpret** this rate function using a definite integral to find the exact total data (in Megabytes) downloaded during the first 15 seconds.	6+2=8 5	
3.	**Evaluate** the following Integrals by applying appropriate Integration techniques: a. $\int \frac{\tan^{-1} x}{1+x^2}\, dx$ b. $\int x^2 \sin x\, dx$ c. $\int_0^{\frac{\pi}{2}} \cos^4 x \sin^8 x\, dx$ d. $\int_1^2 \int_{x^2}^{2x} (4y - 2x)\, dy\, dx$	3+3+4+5=15	CLO-2 L-3
4.	a. Assume you are programming a 2D space simulation. A planet is centered at the origin $(0, 0)$, and a satellite's elliptical orbit is defined by the equation $\frac{x^2}{9} + \frac{y^2}{4} = 1$. To define the simulation's rendering bounds, the engine must calculate the enclosed space. Using integration, **compute** the exact area bounded by tis orbit. b. **Calculate** the area of the enclosed by the curve $y = x^2$ and the x-axis evaluating the limit from $x = -3$ to $x = 3$ with proper justification.	6 4	CLO-3 L-4