الجامعة الوطنية
National University
Science & Technology للعلوم والتكنولوجيا
كلية عمان البحرية الدولية
International Maritime College Oman

Final Exam
PMATH-I.II: Arithmetics II
Spring 2025

Points of attention:

- For each question, the maximum earned points are specified in the question.
- Write clearly! Answers that are not readable are not marked and don't earn marks!
- All answers should be written in English using **blue or black pens** only.
- Use the pencil only for diagrams and graphs.
- Show all the calculation steps in the given space.
- When finished, submit the question paper, together with the answer scripts and the signed cover page to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

Exam Duration:	2 hours
Instructor's Name:	Muhammad Javed
Exam Date:	19/06/2025
Program:	LTM

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Student Information			
Name:		ID:	
Signature:			

Invigilator			
Initials:		☐ Student ID checked	
Time received:			

Question 1 **[10 marks]**

Determine the derivative of the following function among the Product, Quotient and chain rules.

a. $h = \dfrac{3x^2 + 5x - 1}{x - 3}$ (5 marks)

b. $y = \sqrt[3]{(x^2 - 8)^2}$ (5 marks)

Question 2 **[5 marks]**

Using definition method, determine the derivative

$$f(x) = x^2 - x - 3$$

Question 3 **[5 marks]**

For the following cost function

$$c(q) = 3q - 3q^2 + q^3$$

Where q is the number of units?

a. Determine the relative rate of change of $f(x)$ when $q = 10$. (4 marks)

b. Calculate the percentage rate of change of $c(q)$ with respect to $q = 10$ up to 3 decimal places. (1 mark)

Question 4 **[7 marks]**

For the following function,

$$f(x) = 2x^3 - 9x^2 + 12x$$

Determine the following

a. The intervals on which the function is increasing and decreasing by using sign chart. (5 marks)
b. The x values on which the relative extrema fall. (1 mark)
c. The values of the relative extrema. (2 marks)

Question 5 **[6 marks]**

A delivery truck on a logistics route has its **acceleration** (in km/h^2) modeled by:

$$y'' = -5x^2 + 2x,$$

where x is time in hours. At $x = 1$ hour, the truck's **velocity** is zero $y' = 0$ km/hour, and its **initial position** at $x = 0$ is $y = 3$ km . Drive an expression for the truck's position

Question 6 **[7 marks]**

Evaluate the following integrals, showing all steps of the working process.

a. (4 marks)

$$\left(\int_1^2 xd\right)^2 - \int_1^2 x^2 dx$$

b. (3 marks)

$$\int_2^4 \frac{3}{(x-3)^2}\,dx$$

Rules

a. Derivative

1.	$\frac{d}{dx}(x^n) = nx^{n-1}$
2.	$(f.g)' = f'.g + f.g'$
3.	$\left(\frac{f}{g}\right)' = \frac{f'.g - f.g'}{g^2}$

b. Integration

1	$\int x^n \, dx = \frac{x^{n+1}}{n+1} + c$
2.	$\int \frac{1}{x} dx = \ln x + c$
3.	$\int [f(x)]^n f'(x) \, dx = \frac{[f(x)]^{n+1}}{n+1} + c$

MLO & Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	**3**	Understanding/Application	**10**	
2	**1**	Understanding	**5**	
3	**2**	Understanding /Application	**5**	
4	**4**	Application/Evaluating	**7**	
5	**4**	Evaluating	**6**	
6	**3**	Understanding /Application	**7**	