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

Final Exam
TMATH-I: TECHNICAL MATH I
Fall 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: 2.5 hours
Instructor's Name: Amer Alhabsi
Exam Date: 21/12/2025
Program: PE

	40
	10

Student Information			
Name:		ID:	
Signature:			

Invigilator		
Initials:		☐ Student ID checked
Time received:		

Question 1 **[10 marks]**

When a force, $f(x)$, is applied to move an object from position a to b, the work done (W) is given by

$$W = \int_a^b f(x)\,dx$$

a) Determine the work done in a chemical plant to move an object from $x = 4$ to $x = 10$ given that the force is $f(x) = \cos(x)(\sin(x) + 7) + 10$ (5 marks)

b) Determine the work done if the force is given by $f(x) = \dfrac{12}{(x+1)(x-4)^2}$ (5 marks)

Question 2 **[10 marks]**

Calculate the following.

a) Find $\frac{dy}{dx}$ given that $y = (\cos(2x))^7$ (2 marks)

b) Find $\frac{dy}{dx}$ given that $y \sin y = e^{3x}$ (3 marks)

c) The position of an object at time t along a straight line is given by

$$y = \frac{1 + e^{-3t}}{1 + \cos(t)}$$

Determine the velocity (v) of the object given that the velocity is

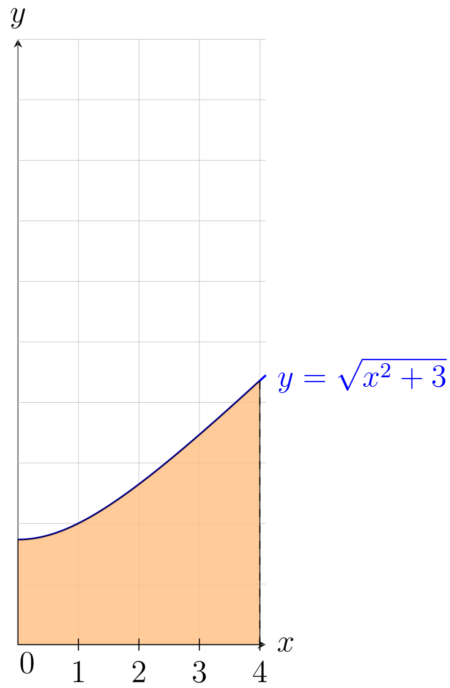
$$v(t) = \frac{dy}{dt}.$$

(3 marks)

d) Find $\frac{d^{40}y}{dx^{40}}$ given that $y = \sin x$ (2 marks)

Question 3 **[10 marks]**

The plot in the figure represents the function $y = \sqrt{x^2 + 3}$.



a) Estimate the area under the curve between $x = 0$ and $x = 4$ using the Trapezoidal method with 8 sub-intervals. Show your work with 3-decimal places. (5 marks)

b) The area under the curve $y = \sqrt{x \sin x}$ from $x = 0$ to $x = \pi$ is rotated around the x-axis to form a solid object. Calculate the volume of the object. (5 marks)

Question 4 **[10 marks]**

For the curve $y = 2x^3 + 5$

a) Determine the equation of the tangent at the point where $x = 8$. (3 marks)

b) Determine the equation of the normal at the point where $x = 15$. (2 marks)

c) The position of an object, y, at time t is given by (5 marks)

$$y = t^4 - 18t^2 + 5$$

Determine the local minima and maxima. Also, determine the intervals at which the position of the object increases and the intervals where it decreases.

Q #	MLO Addressed	Complexity Level	Mark	Comments
1	3, 4, 6	Analyze	10	
2	2	Apply	10	
3	1, 2	Analyze, apply	10	
4	1, 2	Analyze, apply	10	

Table of Integrals

$$\int x^n\,dx = \frac{1}{n+1}x^{n+1} + C,\ \ n \neq -1$$

$$\int e^x\,dx = e^x + C$$

$$\int \sin x\,dx = -\cos x + C$$

$$\int \tan x\,dx = \ln|\sec x| + C$$

$$\int \sec^2 x\,dx = \tan x + C$$

$$\int \frac{1}{x+a}\,dx = \ln|x+a| + C$$

$$\int a^x\,dx = \frac{1}{\ln a}a^x + C$$

$$\int \cos x\,dx = \sin x + C$$

$$\int \frac{1}{1+x^2}\,dx = \arctan(x) + C$$

Trapezoidal method of approximating integrals formula,

$$A \approx \frac{\Delta}{2}\left[f(x_0) + 2f(x_1) + 2f(x_2) + \cdots + 2f(x_{n-1}) + f(x_n)\right].$$

Simpson's method of approximating integrals formula,

$$A \approx \frac{\Delta}{3}\left[f(x_0) + 4f(x_1) + 2f(x_2) + \cdots + 4f(x_{n-1}) + f(x_n)\right].$$