

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

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Student Information	
Name:	<input type="text"/>
Signature:	<input type="text"/>
ID:	<input type="text"/>

Invigilator	
Initials:	<input type="text"/>
Time received:	<input type="text"/>
<input type="checkbox"/> Student ID checked	

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 $f(x) = x^2(x^3 + 7)$ (5 marks)

- b) Determine the work done if the force is given by $f(x) = \frac{60}{(x-3)(x-1)^2}$ (5 marks)

Question 2**[10 marks]**

Calculate the following.

a) Find $\frac{dy}{dx}$ given that $y = (\sin(5x))^9$ (2 marks)

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

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

$$y = \frac{1 + e^{2t}}{1 + \sin(t)}$$

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

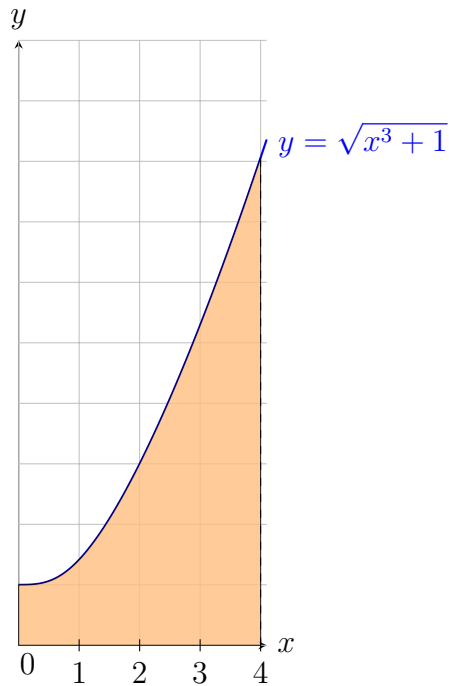
$$v = \frac{dy}{dt}.$$

(3 marks)

d) Find $\frac{d^{10}y}{dx^{10}}$ given that $y = x^{10}$ (2 marks)

Question 3**[10 marks]**

The plot in the figure represents the function $y = \sqrt{x^3 + 1}$.



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

- b) The area under the curve $y = \sqrt{xe^{2x}}$ from $x = 0$ to $x = 1$ 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 $y = \sqrt{x + 1}$ 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)

$$y = t^4 - 32t^2 + 19$$

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

$$\begin{array}{ll}
 \int x^n dx = \frac{1}{n+1}x^{n+1} + C, \quad n \neq -1 & \int \frac{1}{x+a} dx = \ln|x+a| + C \\
 \int e^x dx = e^x + C & \int a^x dx = \frac{1}{\ln a}a^x + C \\
 \int \sin x dx = -\cos x + C & \int \cos x dx = \sin x + C \\
 \int \tan x dx = \ln|\sec x| + C & \int \frac{1}{1+x^2} dx = \arctan(x) + C \\
 \int \sec^2 x dx = \tan x + C &
 \end{array}$$

Trapezoidal method of approximating integrals formula,

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

Simpson's method of approximating integrals formula,

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