

Final Exam  
**DMATH-III: MATH 3**  
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:** 2.5 hours  
**Instructor's Name:** Dr. Rokhsaneh Yousef Zehi  
**Exam Date:** 17/06/2025  
**Program:** DO

	<b>40</b>
	<b>10</b>

**Student Information**

Name:  ID:   
Signature:

**Invigilator**

Initials:  ☐ Student ID checked  
Time received:

**Question 1****[4 marks]**

After a power failure on a cargo ship, the engine room's cooling system shuts down, and the temperature inside the engine room starts rising. The temperature  $T$  (in °C) at time  $t$  (in hours) after the power failure is modeled by the equation:

$$T(t) = \frac{3t^2 + 4}{(2t + 3)^3}$$

Determine the rate of change of temperature with respect to time at  $t = 4$  hours.

**Question 2****[5 marks]**

Given the following implicit function

$$2x^2 + 3y^2 = xy^2 + 4$$

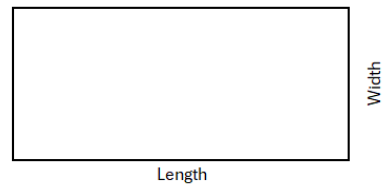
- (a) Determine the slope of the tangent line at the point (1,3). (3 marks)
- (b) Obtain the equation of the normal line to the curve at the point (1,3). (2 marks)

**Question 3****[5 marks]**

Two cruise ships depart from Sohar, Oman, at 03:00 PM. Ship A travels **north** toward Khasab at **20 km/h**, and Ship B travels **east** toward Sur at **35 km/h**. How fast are the two cargo ships moving apart at 07:00 PM?

**Question 4****[6 marks]**

A marine researcher encloses a rectangular corral with 900 ft of fencing. Find the maximum possible area of corral.



**Question 5****[5 marks]**

The Total electric charge  $Q$  (in  $C$ ) to pass a point in the circuit from time  $t_1$  to  $t_2$  is

$$Q = \int_{t_1}^{t_2} 3t \sqrt{t^2 + 1} dt$$

Determine the electric charge from  $t_1 = 0s$  to  $t_2 = 3s$ .

**Question 6****[5 marks]**

Approximate the value of the definite integral

$$\int_2^5 \frac{10}{1+x^2} dx$$

using the **Simpson's Rule** with  $n = 6$  subintervals. Write your answer correct to 3 decimal places.

**Question 7****[5 marks]**

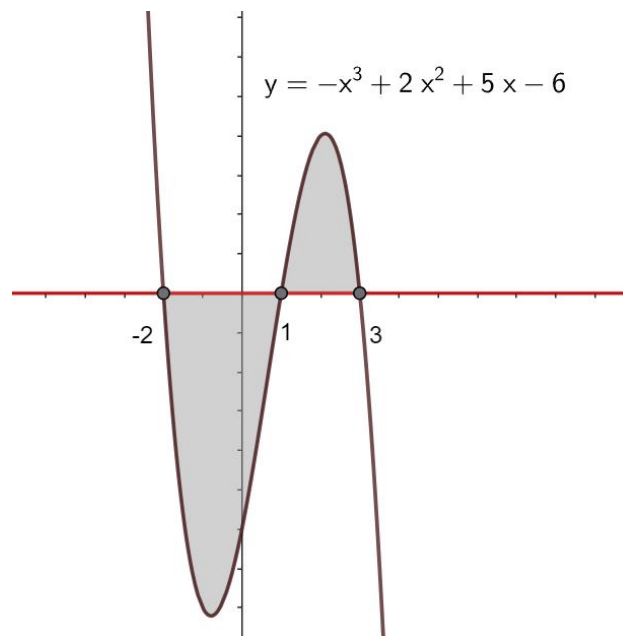
A ship's fuel tank is modeled by revolving the region bounded by the graph of

$$y = 3\sqrt{10 - x^2}$$

**about the  $x$ -axis**, where  $x$  and  $y$  are measured in meters. Find the volume of the fuel tank where  $x = 0$  to  $x = 3$ .

**Question 8****[5 marks]**

Determine the area enclosed by the curve  $y = -x^3 + 2x^2 + 5x - 6$  between  $x = -2$  to  $x = 3$ .



**This page is for rough work.**

**Formula sheet:**

Product Rule	$\frac{dy}{dx} = u'v + v'u$
Quotient Rule	$\frac{dy}{dx} = \frac{u'v - v'u}{v^2}$
Perimeter of rectangle	$P = 2(x + y)$
Area of rectangle	$A = xy$
Simpson's rule	$\int_a^b f(x)dx \approx \frac{h}{3}[y_0 + 4y_1 + 2y_2 + \cdots + 4y_{n-1} + y_n]$

**MLO and Bloom's Level of Complexity**

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	2,3	Application, Analysis	4	
2	1,2	Application	5	
3	3	Analysis	6	
4	2,3	Application, Analysis	5	
5	1,2	Application	5	
6	1	Application	5	
7	2,3	Application, Analysis	5	
8	1	Application	5	

**References:**

1. J. Washington, A., 2014. Basic Technical Mathematics with Calculus. 10 ed. Harlow: Pearson Education Limited.
2. Stewart, J., 2008. *Calculus: Early Transcendentals*. 6th ed. Boston: Brooks/Cole.