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

Final Exam
DMATH-III: MATH 3
Spring 2026

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:	12/05/2026
Program:	DO

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Student Information			
Name:		ID:	
Signature:			

Invigilator			
Initials:		☐ Student ID checked	
Time received:			

Question 1 **[5 marks]**

Applying Newton's method to determine the root of the following equation lying between 2 and 3;

$$x^4 - x^3 - 3x^2 - x - 4 = 0$$

Show all iterations clearly. Round each iteration's intermediate values to 6 decimal places and report the final approximated root to 4 decimal places.

Question 2 **[6 marks]**

A drift buoy is deployed by a naval vessel to measure surface currents in a shipping channel. The buoy follows a path described by the parametric equations:

$$x = 0.4t^2 \text{ and } y = -0.2t^3$$

where x and y are in feet and t is in minutes.

Determine the magnitudes and directions (rounded to 2 decimal places) of the:

a. Velocity of the drift buoy after $t = 2.0$ minutes. (3 marks)
b. Acceleration of the drift buoy after $t = 2.0$ minutes. (3 marks)

Question 3 **[5 marks]**

A conical fuel strainer aboard a ship is used to filter impurities from diesel fuel before it enters the engine. Fuel drains through the strainer into the fuel line at a constant rate of 18.0 cm^3/min. The strainer has a diameter of 15.0 cm and a depth of 15.0 cm.

Determine the rate at which the fuel level $\left(\frac{dh}{dt}\right)$ in the conical strainer is changing when the depth of the fuel is 10.0 cm.

Question 4 **[8 marks]**

Given the function $y = x^4 - 6x^2$:

a. Determine the values of x for which the function is concave up and concave down. (3 marks)

b. Determine the local extrema (local maximum and local minimum values). (3 marks)

c. Evaluate the points of inflection (if any). (2 marks)

Question 5 **[5 marks]**

A conveyor belt 8.00 m long moves at a constant speed of 0.25 m/s. A package is placed at the starting end of the belt.

a. Determine the displacement of the package from the starting end as a function of time t. (2 marks)
b. Determine the distance remaining from the package to the opposite end as a function of time t. (2 marks)
c. How long does it take for the package to reach the opposite end? (1 mark)

Question 6 **[5 marks]**

A sail on a racing yacht has a curved edge described by;

$$y = 4x - x^2,$$

where x and y are in meters.

Calculate the exact area of the sail between $x = 1$ and $x = 4$.

Question 7 **[6 marks]**

Evaluate the following, show all steps of the calculations.

a. Determine $\frac{dy}{dx}$ for the following equation at point $(1, 2)$; (3 marks)

$3x^3y^2 - 2y^3 = -4$

b. Find the second derivative of the function; (3 marks)

$f(x) = \frac{4.8\pi}{\sqrt{1+2x}}$

Formula list

Product Rule	$(uv)' = u'v + v'u$
Quotient Rule	$\left(\frac{u}{v}\right)' = \frac{u'v - v'u}{v^2}$
Power of a function	$([f(x)]^n)' = n.[f(x)]^{n-1}.f'(x)$
Equation of a line	$y - y_0 = m(x - x_0)$
Area of a circle	$A = \pi r^2$
Circumference of a circle	$C = 2\pi r$
Newton's Method Formula	$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$

MLO and Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	**2**	Apply	**5**	Newton's Method (marine context)
2	**3 and 4**	Analyze	**6**	Curvilinear motion (parametric)
3	**3 and 4**	Analyze	**5**	Related Rates (conical strainer)
4	**1**	Evaluate	**8**	Curve sketching concepts
5	**2**	Apply	**5**	Linear motion (cargo context)
6	**2**	Apply	**5**	Area under curve (sail shape)
7	**1**	Apply	**6**	Implicit differentiation and Higher derivatives

Reference:

Washington, Allyn J.(2014) Basic technical mathematics with calculus / Allyn J. Washington, Dutchess Community College. — Tenth edition