الجامعة الوطنية
National University
كلية عمان البحرية الدولية
International Maritime College Oman

Final Exam
DMATH-II: MATH 2
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: 2.5 hours
Instructor's Name: Dr. Taofeek Olanrewaju Alade
Exam Date: 10/05/2026
Program: DO

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Student Information			
Name:		ID:	
Signature:			

Invigilator			
Initials:		☐ Student ID checked	
Time received:			

Question 1 **[9 marks]**

a. Use a table of values to estimate the value of the following limit: (4 marks)

$$\lim_{x \to 2} \frac{x - 2}{x^3 - 8}$$

b. Evaluate the following limits given below:

i. $\lim_{x\to\infty}\left(\frac{6x^3-4x-1}{2x^3+5x^2+3}-\frac{4x^2+2x-3}{2x^2+3x-2}\right)$ (2 marks)

ii. $\lim_{t\to 0}\frac{\sqrt{t^2+25}-5-\frac{t^2}{10}}{t^4}$ (3 marks)

Question 2 **[4 marks]**

Express the given complex number $Z = \left(64\, e^{7.5j}\right)^{\frac{1}{2}}$ in polar and rectangular forms.

Question 3 **[4 marks]**

Determine all the cube roots of the complex number $\boldsymbol{z = 8 - 3j}$ using **De Moivre's theorem**, and express each root in rectangular form $(a + bj)$.

Question 4 **[3 marks]**

Two radar signal components are represented in complex form. The signal adjustments are given as:

$$\frac{2}{3+j}+\frac{1}{4j}$$

where j denotes the imaginary unit. Simplify the above expression and express your answer in the standard complex form $a+bj$.

Question 5 **[4 marks]**

You are studying two environmental forces acting on a vessel during its passage through coastal waters. One force represents the wind pressure acting on the ship's hull, while the other represents the ocean current influencing its drift. These forces are represented by the vectors:

$$\boldsymbol{a = 6i + 5j} \text{ and } \boldsymbol{b = -3i + 7j.}$$

To assess how these two forces interact and influence the vessel's resultant direction, determine the angle between the two vectors using the scalar (dot) product.

Question 6 **[5 marks]**

You are tracking the positions of three navigation points on a sea chart represented in a two-dimensional coordinate system. The points are:

$$\boldsymbol{X(5,2)}\ \textbf{and}\ \boldsymbol{Y(6,-3)}.$$

To analyze the vessel's movement and directional changes between waypoints, answer the following:

a. State the position vectors of points X and Y. (1 mark)

b. Determine the vector $\overrightarrow{XY}$. (1 mark)

c. Determine the magnitude of vector $\overrightarrow{XY}$. (1 mark)

d. State the direction ratios of $\overrightarrow{XY}$. (1 mark)

e. Determine the direction cosines of vector $\overrightarrow{XY}$. (1 mark)

Question 7 **[6 marks]**

You are analyzing data from three different navigational sensors. Each sensor provides a reading that depends on three unknown factors: wind influence (x), current drift (y), and steering error (z). The relationships are described by the following system of equations:

$$2x + y - z = 8$$

$$x - y + z = -5$$

$$3x + 2y = 9$$

To understand the individual effect of each factor, solve this system using **the inverse matrix method.**

Question 8 **[5 marks]**

You are undergoing training in validating cargo loading computations. A stability report describes the relationship between cargo masses stored in three different compartments as follows:

$$2W_1 + W_2 + 2W_3 = 8$$

$$W_1 - 3W_2 + 3W_3 = -4$$

$$4W_1 + 2W_2 - W_3 = 1$$

Using the **Gaussian elimination method**, determine the distribution of cargo weights (W_1, W_2, W_3) across the compartments.

Formula Sheet

1. De Moivre's theorem
   $[r(cos\ \theta + j\ sin\theta)]^n = [r^n(cos\ n\theta + j\ sin\ n\theta)]$

2. Scalar or Dot Product of vectors
   $$a \cdot b = |a||b|\ cos\ \theta$$
3. Inverse of a matrix
   $$A^{-1} = \frac{1}{|A|} \times \text{adjoint}\ (A)$$

MLO & Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	**4**	Application	**9**	
2	**4**	Application	**4**	
3	**4**	Analyzing	**4**	
4	**4**	Application	**3**	
5	**1,2, 3**	Application	**4**	
6	**1,2, 3**	Application	**5**	
7	**1,2, 3**	Application	**6**	
8	**1,2, 3**	Application	**5**	

References

1) Anthony Croft, R. D., 2008. Mathematics for Engineers. Fourth ed. Harlow: Pearson.

2) Washington, A. J., 2014. Basic Technical Mathematics. 10 ed. Harlow: Pearson.