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 **[3 marks]**

In a process of optimization task, two parameter matrices are provided as follows

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & -1 \end{pmatrix} \text{ and } B = \begin{pmatrix} -2 & 3 \\ 0 & 4 \\ 7 & -1 \end{pmatrix}$$

a. Determine $2A + B^T$. (1.5 marks)

b. Determine $3A \times 2B$ (1.5 marks)

Question 2 **[5 marks]**

As a deck officer, you are using a matrix to correct the ship's position based on three different navigation systems. The correction data is given in this matrix:

$$H = \begin{pmatrix} 9 & 6 & -9 \\ 7 & 3 & 1 \\ -6 & 4 & 8 \end{pmatrix}$$

To reverse these corrections and check the original readings, you need to find the inverse of matrix H. Determine the inverse of this matrix?

Question 3 **[7 marks]**

In a navigation system analysis, three monitoring sensors provide readings influenced by three unknown factors: compass deviation (x), ocean current effect (y), and rudder misalignment (z). Based on calibration data, the relationships between the sensor readings and these factors are given by the following system of equations:

$$\begin{aligned} 2x + y - 3z &= 5 \\ -x + 4y + 2z &= 6 \\ 3x - 2y + z &= 4 \end{aligned}$$

Determine the values of x, y, and z using **Cramer's Rule**.

Question 4 **[5 marks]**

In a two-dimensional coordinate system, the positions of two points are given as:

$$A(2,-1) \text{ and } B(8,5).$$

To study the displacement and direction between these points, answer the following:

a. State the position vectors of A and B. (1 mark)

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

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

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

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

Question 5 **[4 marks]**

You are analyzing two directional forces acting on a vessel during navigation. One force represents the effect of wind on the ship, while the other represents the influence of ocean currents. These forces can be modeled as vectors:

$$\boldsymbol{a} = 8i - 2j \text{ and } \boldsymbol{b} = 9i + 4j.$$

To better understand how these forces interact and affect the ship's movement, determine the angle between the two vectors using the scalar (dot) product.

Question 6 **[4 marks]**

Apply De Moivre's theorem to determine the three cube roots of the complex number given below.

$$-3 + j$$

Express all roots in rectangular form $a + bj$.

Question 7 **[3 marks]**

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

$$\frac{2}{8+2j}+\frac{1}{2j}$$

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

Question 8 **[9 marks]**

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

$$\lim_{x \to 3} \frac{x - 3}{x^2 - 5x + 6}$$

b. Evaluate the following limits given below:

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

ii. $\lim_{h\to 0}\frac{\sqrt{h^2+16}-4-\frac{h^2}{8}}{h^4}$ (3 marks)

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
   $$H^{-1} = \frac{1}{|H|} \times \text{adjoint}\ (H).$$

MLO & Bloom's Level of Complexity

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

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.