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

FINAL EXAM
MMATH-II: MATHEMATICS-2
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 and sign the question paper to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

Exam Duration:	2 hours
Instructor's Name:	Muhammad Kazam
Exam Date:	18/06/2025
Program:	ME

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Student Information			
Name:		ID:	
Signature:			

Invigilator			
Initials:		☐ Student ID checked	
Time received:			

Question 1 **[4 Marks]**

Three vectors $\boldsymbol{u}$, $\boldsymbol{v}$, and $\boldsymbol{w}$ are given below.

$$\boldsymbol{u} = \boldsymbol{i} - \boldsymbol{j} + \boldsymbol{k}, \quad \boldsymbol{v} = -\boldsymbol{j} + \boldsymbol{k}, \quad \boldsymbol{w} = \boldsymbol{i} + \boldsymbol{j} + \boldsymbol{k}$$

a. Determine the scalar triple product $\boldsymbol{u}.(\boldsymbol{v} \times \boldsymbol{w})$. **(3 marks)**

b. State whether the vectors are coplanar or not. **(0.5 mark)**

c. If not, find the volume of the parallelepiped that they determine. **(0.5 mark)**

Question 2 **[3 Marks]**

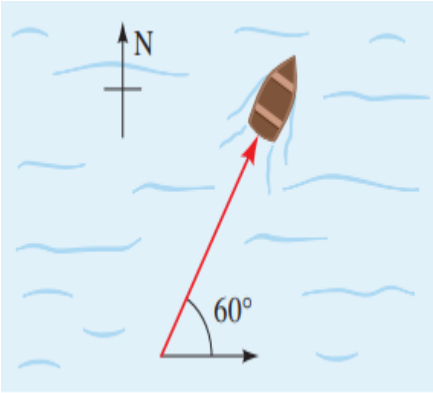
Find the area of ΔPQR whose vertices are given below.

$P(3, -2, 6), Q(-1, -4, -6), R(3, 4, 6)$

Question 3 **[8 Marks]**

A straight river flows east at a speed of $10\ km/h$. A boater starts at the south shore of the river and head in a direction $60°$ from the shore as shown in the figure. The motorboat has a speed of $20\ km/h$ relative to the water.

a. Express the velocity of the river as a vector in component form. **(2 marks)**



(Stewart, Redlin and Watson, 2017)

b. Express the velocity of the motorboat relative to the water as a vector in component form.

(2 marks)

c. Determine the true velocity of the motorboat. **(1 mark)**

d. Determine the true speed and direction of the motorboat. **(3 marks)**

Question 4 **[3 Marks]**

For the function given below, determine each limit, if it exists. If it does not exist, explain why.

$$f(x) = \begin{cases} 2 & if\ x < -1 \\ x^2 & if\ -1 \le x \le 2 \\ x + 2 & if\ x > 2 \end{cases}$$

a. $\lim_{x \to -1^1} f(x)$

b. $\lim_{x \to -1^+} f(x)$

c. $\lim_{x \to -1} f(x)$

d. $\lim_{x \to 2} f(x)$

e. $\lim_{x \to 0} f(x)$

f. $\lim_{x \to 3} [f(x)]^2$

Question 5 **[10 Marks]**

Determine the limit, if it exists.

a. $\lim_{x\to 0} \frac{1-\cos x}{\sin x}$ **(3 marks)**

b. $\lim_{x\to \infty} (\frac{1}{x} - \frac{2x}{x-1})$ **(3 marks)**

c. $\lim_{x\to -2} \frac{x^2-4}{x^2+x-2}$ **(4 marks)**

Question 6 **[5 Marks]**

Calculate the inverse of the matrix given below.

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 2 & 5 & 6 \end{bmatrix}$$

Question 7 **[7 Marks]**

Solve the following system of equations by Gauss method or Cramer's rule.

$$\begin{cases} 2x + 3z = 5 \\ x + y + 6z = 0 \\ 3x - y + z = 5 \end{cases}$$

MLO & Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	1 & 2	Understanding	4	Expect 100% to solve
2	3	Understanding	3	Expect 90% to solve
3	2 & 4	Application	8	Expect 100% to solve
4	5	Evaluating /Application	3	Expect 80% to solve
5	1, 2 & 5	Understanding / Application	10	Expect 90% to solve
6	4	Evaluating /Application	5	Expect 80% to solve
7	4 & 5	Application	7	Expect 70% to solve

Reference:

Stewart, J., Redlin, L. and Watson, S. (2017) *Precalculus Mathematics for Calculus*. 7th edn. Cengage.