# FINAL EXAM
# MMATH-II: MATHEMATICS-2
# Spring – 2025

**Points of attention:**

- o For each question, the maximum earned points are specified in the question.
- o Write clearly! Answers that are not readable are not marked and don't earn marks!
- o All answers should be written in English using **blue or black pens** only.
- o Use the pencil only for diagrams and graphs.
- o Show all the calculation steps in the given space.
- o When finished, submit and sign the question paper to the invigilator.
- o 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 |

| | |
|---|---|
| | **40** |
| | **10** |

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**Student Information**

| Name: | | ID: | |
|---|---|---|---|
| Signature: | | | |

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**Invigilator**

| Initials: | | ☐ Student ID checked |
|---|---|---|
| Time received: | | |

**Question 1**                                                                    **[3 Marks]**

Find the direction angles of the vector given below, rounded to the nearest degree.

$$v = 2i + 3j - 6k$$

**Question 2**                                                                    **[4 Marks]**

A ship is sailing in a direction $N30°E$ at a speed of 500 km/h. Determine the north and east components of the velocity.

**Question 3**                                                                 **[5 Marks]**

Two vectors $u$ and $v$ are given below.

$u = \langle 1, 1, -1 \rangle$ and $v = \langle -1, 1, -1 \rangle$

**a.** Calculate a vector perpendicular to both $u$ and $v$.                    **(3 marks)**

**b.** Find a unit vector orthogonal (perpendicular) to both $u$ and $v$.       **(2 marks)**

**Question 4**                                                                                           **[3 Marks]**

For the function $f$ whose graph is given below, state the value of the given quantity if it exists. If it does not exist, explain why.

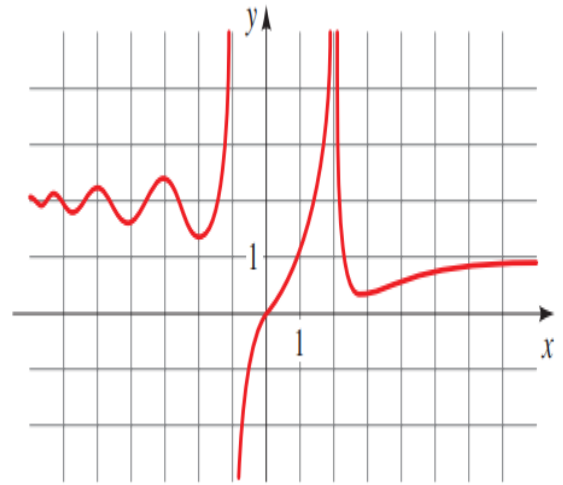**a.** $\lim\limits_{x \to 2^+} f(x)$



**b.** $\lim\limits_{x \to -3^-} f(x)$

**c.** $\lim\limits_{x \to -3^+} f(x)$

**d.** $\lim\limits_{x \to -3} f(x)$

**e.** $\lim\limits_{x \to 0} f(x)$

**f.** $\lim\limits_{x \to \infty} f(x)$

**Question 5**                                                                        **[10 Marks]**

Determine the limit, if it exists.

**a.** $\displaystyle\lim_{t\to 0}\frac{\sin 3t}{2t}$                                                                 **(3 marks)**

**b.** $\displaystyle\lim_{x\to\infty}\frac{3x^2-x-2}{5x^2+4x+1}$                                                          **(3 marks)**

**c.** $\lim\limits_{x \to 0} \dfrac{\sqrt{x+9}-3}{x}$         **(4 marks)**

**Question 6**                                                                                    **[5 Marks]**

Calculate the inverse of the matrix given below.

$$\begin{bmatrix} 2 & 4 & 1 \\ -1 & 1 & -1 \\ 1 & 4 & 0 \end{bmatrix}$$

**Question 7**                                                              **[10 Marks]**

A shipyard performs maintenance on propellers, engines, and hull repairs. The cost of maintaining a propeller is $800, an engine is $1500, and a hull repair is $2000. In one month, they serviced 30 components, earning $37,000. There were three times as many propellers serviced as hull repairs.

**a.** Formulate a system of equations.                                    **(2 marks)**

**b.** Use Gauss method or Cramer's rule to determine the number of each component serviced.

                                                                           **(8 marks)**

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

| Q # | MLO Addressed | Complexity Level | Mark | Remark |
|:---:|:---:|:---:|:---:|:---:|
| 1 | 1 & 2 | Understanding | 3 | Expect 100% to solve |
| 2 | 3 | Understanding | 4 | Expect 90% to solve |
| 3 | 2 & 4 | Application | 5 | 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 | 10 | Expect 70% to solve |

**Reference:** Washington, A. (2014) *Basic Technical Mathematics with Calculus*. 10th edn. Harlow: Pearson.