# MA 1201 : Mathematics II

March 04, 2025 3 :00 - 4 :30 PM

## INSTRUCTIONS

- Start each problem on a new page.
- The maximum marks you can score is **20 points**.
- Answers without justification will receive **NO** credit.
- You may use any result/theorem proved in class (unless explicitly asked to prove it), BUT you must clearly state it while applying it.

---

**Problem 1.**
Prove that any subset of a countable set is atmost countable. [4 points]

**Problem 2.**
Prove or disprove :

(a) A $4 \times 4$ matrix with a row of zeros is not invertible.

(b) The set $\mathbb{R}^3$ with usual addition and new scalar multiplication defined by

$$\alpha(x_1, x_2, x_3) = (\alpha x_1, x_2, x_3)$$

is a vector space over $\mathbb{R}$. [$3 + 3 = 6$ points]

**Problem 3.**

(a) Find a basis of the nullspace of $A$, where

$$A = \begin{bmatrix} 1 & 3 & 1 & 2 \\ 2 & 6 & 2 & 5 \\ 3 & 9 & 3 & 7 \end{bmatrix}.$$

(b) Find condition on the vector $b = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$ such that $Ax = b$ admits a solution.

(c) Find the complete solution to $Ax = b$, where $b = \begin{bmatrix} 2 \\ 4 \\ 6 \end{bmatrix}$. [$5 + 3 + 3 = 11$ points]