

## Proficiency Exam 2 - Vector Spaces

You will have 30 minutes to complete the exam. You may use a calculator, but you must show all steps done to get full credit for completing the problem. This means that if you use your calculator for anything other than arithmetic, you must indicate on your test paper what you did on the calculator.

1. Consider the subset  $W = \{(x, y, z) \in \mathbb{R}^3 \mid x - y = 0 \text{ and } y - z = 0\}$ . Is  $W$  a subspace? Be sure to provide support for your answer.
2. Find a basis for the null space of the matrix

$$\begin{bmatrix} -3 & 1 & 0 & -2 \\ 3 & -1 & 1 & 4 \\ -6 & 2 & 3 & 2 \end{bmatrix}.$$

3. (TRUE or FALSE) Consider the statement and decide if it is true or false. If true, provide reasoning. If false, provide a counterexample.

“Any set of 3 or more vectors in  $\mathbb{R}^3$  spans the whole space.”

4. Is the following set a basis of  $\mathbb{R}^3$ ?

$$\left\{ \begin{bmatrix} 1 \\ 3 \\ 0 \end{bmatrix}, \begin{bmatrix} -2 \\ 0 \\ 2 \end{bmatrix}, \begin{bmatrix} 1 \\ -3 \\ -2 \end{bmatrix} \right\}$$