MA 232 Linear Algebra **HW 4** **Due: Friday Oct 14 by 5:00 pm**

Name (Printed): ______________________________

Pledge and Sign: ______________________________

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Upload solutions to Gradescope by the due date. Assign solution pages to corresponding problems. You need to pledge and sign on the cover page of your solutions. You may use this page as the cover page.

Legibility, organization of the solution, and clearly stated reasoning where appropriate are all important. Points will be deducted for sloppy work or insufficient explanations.

1. Consider the vectors $\mathbf{v}_1 = \begin{bmatrix} 2 \\ 1 \\ 1 \\ -1 \end{bmatrix}$, $\mathbf{v}_2 = \begin{bmatrix} 0 \\ 3 \\ 0 \\ 1 \end{bmatrix}$, $\mathbf{v}_3 = \begin{bmatrix} -1 \\ 0 \\ 2 \\ 0 \end{bmatrix}$, and $\mathbf{v}_4 = \begin{bmatrix} 7 \\ 9 \\ 1 \\ -1 \end{bmatrix}$. Check whether $\mathbf{v}_1$, $\mathbf{v}_2$, $\mathbf{v}_3$ and $\mathbf{v}_4$ are independent. If they are not, find a basis for the subspace of $\mathbb{R}^4$ spanned by these vectors.

2. Let V be the subspace spanned by $(1,1,1)$ and $(2,1,0)$.

(a) [3 pts.] Find a matrix A that has V as its row space.

(b) [4 pts.] Find a matrix B that has V as its nullspace.

(c) [3 pts.] Find AB (to make the dimensions match for multiplication, remember that adding a row of zeros to a matrix will not change its nullspace). What is the rank of AB?

3. [10 pts.] Find bases for all the four fundamental subspaces of

$$A = \begin{bmatrix} 1 & 2 & -3 & -2 \\ 2 & 5 & -8 & -1 \\ 1 & 4 & -7 & 5 \end{bmatrix}.$$