2.8 Handwrite

Welcoming Environment: Actively listen to others and encourage everyone to participate! Keep an open mind as you engage in our class activities, explore consensus and employ collective thinking across barriers. Maintain a professional tone, show respect and courtesy, and make your contributions matter.

Discuss and keep track of any questions your group has. Ask me questions during group work time as well as when I bring us back together. Try to help each other solidify and review the language of linear algebra, algebra, visualizations and intuition from this section, including those related to:

- subspace properties: closed under addition and scalar multiplication
- spaces associated to a matrix: column space and null space
- basis: linearly independent spanning set
- basis for column space as the pivot columns
- basis for null space as the vectors attached to free variables in parametric solutions to the homogeneous system $A\vec{x} = \vec{0}$

Take out your notes from the activities due today as well as the fill-in guide. Use them and each other to respond to the following by handwriting in the language of our class. Use only what we have covered so far in our readings, videos and quizzes.

1. **Building Community**: What are the preferred first names of those sitting near you? If you weren't able to be there, give reference to anyone you had help from or write N/A otherwise.

2. a) Given $A = \begin{bmatrix} 1 & 2 & 3 & 3 \\ 2 & 4 & 9 & 3 \\ 2 & 4 & 6 & 6 \end{bmatrix}$ show the elementary row operations (like $r_2' = -5r_1 + r_2$) to use the strict method of Gaussian elimination and provide the row echelon form of A (stop at ref and don't scale the rows but do use replacement!).

   b) Use part a) to find a basis for the column space using the pivot columns, using our standard mathematical notation.

   c) What is the geometry of the column space? Fill in the 2 blanks:

   The column space is a ____________________ inside of $\mathbb{R}$———

   d) Explain why that is the geometry of the column space.

e) Starting from ref of the augmented matrix in part a), show by-hand work to solve for the null space of A, the solutions to $A\vec{x} = \vec{0}$, leaving any variables without pivots free and showing back substitution. Show all work, but you can use that if we augment a matrix with $\vec{0}$ and reduce it the equal column will stay all 0. In addition, write a basis for the null space, using our standard mathematical notation.

f) What is the geometry of the null space? Fill in the 2 blanks:

The null space is a ____________________ inside of $\mathbb{R}$———

g) Explain why that is the geometry of the null space.

Next, as time allows before I bring us back together, work on the additional activities including any pollev activities and respond in your notes rather than here.

Help each other and PDF responses to ASULearn: If you are finished with the handwrite and additional activities before I bring us back together, first ensure that your entire group is finished too, and if not, help each other. Then submit your handwrite, continue reviewing and solidifying or discuss upcoming class work.

Collate your handwritten responses, preferably on this handout, into one full size multipage PDF for submission in the ASULearn assignment. I recommend you turn it in sometime today, but you have until the morning before the next class.