2.9 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:

- dimension of a space
- rank of a matrix (dimension of column space)
- nullity of a matrix (dimension of null space)
- rank nullity theorem (Theorem 14)
- what makes a matrix invertible continued: adding rank and nullity to Theorem 8 when the matrix is square

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. Re-examine the 2.8 handwrite by going to your personalized feedback as well as the solutions that are now open in the re-engage 2.8 handwrite activity so that you can extend it, where $A = \begin{bmatrix} 1 & 2 & 3 & 3 \\ 2 & 4 & 9 & 3 \\ 2 & 4 & 6 & 6 \end{bmatrix}$.

   a) Using the re-engage 2.8 activity, fill in the 2 blanks:

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

   b) Interpreting this, what is the rank?

   c) Using the re-engage 2.8 activity, fill in the 2 blanks:

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

   d) Interpreting this, what is the nullity?

   e) Apply the rank-nullity theorem and show this. It will look something like 1+ 2 = 3, but the relevant numbers for this matrix and the rank as the first number in the sum.

3. Examine $A = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$

a) What is the *entire* column space of A? Show reasoning.

b) What is the rank?

c) What is a basis for the null space using our standard mathematical notation, if it exists? Show by-hand work and reasoning.

d) What is the nullity?

e) What is $\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$?

f) How does $\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$ relate to the entire column space? Circle one: same different

g) How do the solutions of $A\vec{x} = \vec{0}$ relate to the entire nullspace? Circle one: same different

h) Are the columns of A linearly independent?

i) What is the determinant of A?

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.