General Stuff

- Office Hours

  T: 12:30 - 1:30, Th: 10 - 11

- Midterm Thursday 2/4

  2 problems

  30 minutes to take exam

  5-10 minutes to upload to gradescope

  12:20 - 12:30 questions before midterms

  12:30 - 1:00 midterm

  1:00 - 1:10 uploading

- Lab 1 due tonight

  Hand in Exercises 1,3, and 6

  For problem 1, match all 6 functions to their plots, recreate each plot best you can, and only describe plot 4 in terms of its function

1. Let

$$A = \begin{pmatrix} 2 & -1 \\ 0 & 3 \\ 1 & 2 \end{pmatrix} \quad B = \begin{pmatrix} -6 & 1 \\ 4 & 0 \end{pmatrix} \quad v = \begin{pmatrix} -1 \\ 1 \\ 3 \end{pmatrix}.$$

Find which combinations of A, B, and v can be multiplied and evaluate them.

2. Project the vector $(2, 3, 1)$ onto the line $\ell(t) = t(-1, 1, 0)$ using the projection formula

$$p = \frac{x \cdot v}{||v||^2} v.$$

3. Find all matrices

$$M = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

which commute with

$$C = \begin{pmatrix} -1 & 1 \\ 0 & -1 \end{pmatrix}.$$

4. Find all matrices of the form $\begin{pmatrix} x & 0 \\ 0 & y \end{pmatrix}$ (called diagonal matrices), which commute with $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$. If there are none, explain why.

5. Let $v = (1, -1, 2, 3)$ and $w = (0, 0, 2, 2)$ be vectors in $\mathbb{R}^4$. Evaluate $|v \cdot w|$ and $\|v\| \, \|w\|$.

4. Find all matrices of the form $\begin{pmatrix} x & 0 \\ 0 & y \end{pmatrix}$ (called diagonal matrices), which commute with $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$. If there are none, explain why.

5. Let $v = (1, -1, 2, 3)$ and $w = (0, 0, 2, 2)$ be vectors in $\mathbb{R}^4$. Evaluate $|v \cdot w|$ and $\|v\| \, \|w\|$.

6. Consider the linear transformation $T : \mathbb{R}^3 \to \mathbb{R}^3$ given by

$$T(x, y, z) = \begin{pmatrix} -1 & 0 & 1 \\ 2 & 0 & -3 \\ -1 & 1 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}.$$

Determine whether this transformation compresses or expands space, and whether it preserves orientation or reverses orientation.

Derivatives in multi will be linear transformations. We can already see that a bit using the parametrization of a plane.