Math 3592H Honors Math I
Quiz 1, Thursday Sept. 22, 2016

Instructions:
15 minutes, closed book and notes, no electronic devices.
There are two problems, worth a total of 20 points.

1. (8 points total; 2 points each part)
Let A, B, C be matrices that represent linear transformations T_A, T_B, T_C (so $A = [T_A], B = [T_B], C = [T_C]$ in our book's notation), where

$$T_A : \mathbb{R}^2 \to \mathbb{R}^5,$$
$$T_B : \mathbb{R}^5 \to \mathbb{R}^3,$$
$$T_C : \mathbb{R}^3 \to \mathbb{R}^2.$$

What are the dimensions of these matrices?

(i) A

(ii) BA

(iii) $(CB)^\top$

(iv) $ACBA$

2. (12 points total; 4 points each part)
Which of these maps $T : \mathbb{R}^2 \to \mathbb{R}^2$ is a linear transformation? If it is

- linear, write down the matrix $A = [T]$ such that $T(\overline{v}) = A\overline{v}$,
- not linear, explain why not.

(i)

$$T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} 5y - 99x \\ 6x - y \end{bmatrix}.$$

(ii)

$$T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} x + 2 \\ y - 3 \end{bmatrix}.$$

(iii) $T =$ reflection in $\mathbb{R}^2$ through the y-axis as a line of symmetry.