
Math 215: Linear Algebra

PROBLEM SET 8 : DUE SEPTEMBER 21

(17 points) Make sure you are familiar with the Academic Honesty policies for this class, as detailed on the syllabus. All work is due on the given day by 3 PM Grinnell Time, or 7 PM if you LaTeX the assignment

1. (4 points) Prove Prop 2.4.7 (3): *Let $T, S : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ be linear transformations. Then the function $T \circ S$ is a linear transformation.*
2. (3 points) Compute $\begin{pmatrix} -1 & 2 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} 4 \\ 7 \end{pmatrix}$ using the *matrix-vector product*. What does this product tell us in terms of the corresponding linear transformation T ?
3. (4 points) (a) Write the standard matrix for the transformation which represents projection onto the line $y = 2x$.
(b) Use (a) to compute where the vector $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ goes under this transformation (so $P_{\vec{w}}(\begin{pmatrix} -3 \\ 2 \end{pmatrix})$).
4. (6 points) Suppose we have a linear transformation $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ and we know $T\left(\begin{pmatrix} -1 \\ 1 \end{pmatrix}\right) = \begin{pmatrix} 5 \\ 1 \end{pmatrix}$ and $T\left(\begin{pmatrix} 2 \\ 1 \end{pmatrix}\right) = \begin{pmatrix} 0 \\ 3 \end{pmatrix}$. Use this information to compute $[T]$. Show all your work and reference any propositions or theorems you used.