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# Math 215: Linear Algebra

PROBLEM SET 8 : DUE NOVEMBER 19

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(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  $y = 3x$ .  
(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.