Linear Algebra
Module 11 Assignment

Due Sunday at 11:59 PM

1 Directions

Complete the following problems showing all your work. You may use a calculator to check your work, but should write out (or TeX up) all the steps of your solution. Unless otherwise specified, you may skip some steps of row reduction with a calculator, but state that you did so. Please upload your work as a single .pdf file to the course.

2 Problems

1. For complex vectors $\vec{x}, \vec{y} \in \mathbb{C}^n$, the dot product is defined as $\vec{x} \cdot \vec{y} = \sum_{i=1}^{n} x_i \overline{y_i}$, where $\overline{y_i}$ is the conjugate of each component of $\vec{y}$. When the vectors have only real components, this definition coincides with the definition from the text.

   Let $\vec{x} = \begin{bmatrix} 2 \\ 1+i \\ i \end{bmatrix}$ and $\vec{y} = \begin{bmatrix} 2-i \\ 2 \\ 1+2i \end{bmatrix}$, where $i^2 = -1$. Compute the following:

   (a) $\vec{x} \cdot \vec{y}$

   (b) $||\vec{x}||$

   (c) $||\vec{y}||$

   (d) $||\vec{x} - \vec{y}||$

   (e) $||\vec{x} + \vec{y}||$

   (f) The angle between $\vec{x}$ and $\vec{y}$.

   (g) The unit vector $\vec{u}$ in the direction of $\vec{x}$.

2. For the vectors $\vec{x}$ and $\vec{y}$ in the previous problem, state and verify the Cauchy-Schwartz inequality and the Triangle inequality. (See the bottom of pg 381 and top of pg 382 in the text.)