Worksheet - Lecture 3

Matrix Arithmetic

1. On a coordinate plane, draw the vectors $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$ and then draw $\mathbf{c} = \mathbf{a} + \mathbf{b}$. Make dotted lines which illustrate how the point/vector $\mathbf{c}$ can be reached by connecting the vectors a and b "tail-to-head".

2. Use the following vectors to answer the questions:

$$\mathbf{v} = \begin{pmatrix} 6 \\ -1 \end{pmatrix} \quad \mathbf{u} = \begin{pmatrix} -2 \\ 1 \end{pmatrix} \quad \mathbf{x} = \begin{pmatrix} 4 \\ 2 \\ 1 \end{pmatrix} \quad \mathbf{y} = \begin{pmatrix} -1 \\ -2 \\ -3 \end{pmatrix} \quad \mathbf{e} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

   a. Compute the following linear combinations, if possible:

   $2\mathbf{u} + 3\mathbf{v} =$ $\mathbf{u} + \mathbf{e} =$

   $\mathbf{x} - 2\mathbf{y} + \mathbf{e} =$

   $-2\mathbf{u} - \mathbf{v} + \mathbf{e} =$

   b. Compute the following inner products, if possible:

   $\mathbf{u}^T\mathbf{v} =$ $\mathbf{x}^T\mathbf{u} =$ $\mathbf{v}^T\mathbf{x} =$

   $\mathbf{x}^T\mathbf{x} =$ $\mathbf{x}^T\mathbf{e} =$ $\mathbf{e}^T\mathbf{v} =$

   $\mathbf{e}^T\mathbf{y} =$ $\mathbf{y}^T\mathbf{e} =$

   c. What happens when you multiply a vector by $\mathbf{e}$?

   d. What happens when you take the inner product of a vector with itself (as in $\mathbf{x}^T\mathbf{x}$)?