Homework #1

Math 2010
Due September 15

- The problems should be worked out showing all necessary steps required in obtaining the solution.

1. (1 point)
   (a) Determine the head of the vector $\mathbf{u} = [-2, 5]$ whose tail is at $(3, 2)$.
   (b) Sketch the vector from part (a) in both the original position and the standard position.
   (c) Find a unit vector in the direction of $\mathbf{u}$.
2. (1 point each)
   (a) Find all constants a such that $[a, 2]$ and $[a, -2]$ are orthogonal.
   (b) Find all constants a such that $[a, 4]$ and $[2, 5]$ are parallel.
3. (1 point) Find the angle between $[1, 0, 1]$ and $[0, 1, 1]$.
4. (1 point each) Let

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 0 \\ 2 & 1 \\ 3 & 2 \end{bmatrix}, \quad C = \begin{bmatrix} 3 & -1 & 3 \\ 4 & 1 & 5 \\ 2 & 1 & 3 \end{bmatrix},$$

$$D = \begin{bmatrix} 3 & -2 \\ 2 & 4 \end{bmatrix}, \quad E = \begin{bmatrix} 2 & -4 & 5 \\ 0 & 1 & 4 \\ 3 & 2 & 1 \end{bmatrix}, \quad F = \begin{bmatrix} -4 & 5 \\ 2 & 3 \end{bmatrix}$$

   and

$$O = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

   If possible, compute the following by hand.
   (a) $-3C + 5O$
   (b) $2ABD + F$
   (c) $tr(A^T B^T + E)$
   (d) $AF + D$
   (e) $2A^T + B$
5. (1 point) Use the definition of symmetric and properties of matrix addition and transposes to prove that $A + A^T$ is symmetric for every square matrix A. Make sure to show all steps and justify each step.