Math 122-002 201730
Practice Assignment # 9

Please remember that the assignment consists of only a sample of the kind of questions you are supposed to be able to do. It is **not** *a safe practice to just do the assignment, and that is why there is a list of "suggested practice problems".*

1. Consider the vectors $\vec{u} = \begin{bmatrix} -1 \\ 2 \end{bmatrix}$, $\vec{v} = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$, $\vec{w} = \begin{bmatrix} 2 \\ 0 \end{bmatrix}$ in $\mathbb{R}^2$. Draw the vectors
   (a) $\vec{u} + \vec{v}$;
   (b) $2\vec{u}$ and $(-1/2)\vec{w}$;
   (c) $2(\vec{u} + \vec{w})$;
   (d) $\vec{v} + \vec{u} - \vec{w}$.

2. Consider the following vectors:

$$\vec{r} = \begin{bmatrix} -1/\sqrt{2} \\ 1/\sqrt{2} \end{bmatrix}, \quad \vec{s} = \begin{bmatrix} 1.5 \\ 0 \end{bmatrix} \quad \text{in } \mathbb{R}^2;$$

$$\vec{u} = \begin{bmatrix} 3 \\ 2 \\ -1 \end{bmatrix}, \quad \vec{v} = \begin{bmatrix} 3 \\ -4 \\ 5 \end{bmatrix}, \quad \vec{w} = \begin{bmatrix} 0 \\ 0 \\ 3 \end{bmatrix} \quad \text{in } \mathbb{R}^3;$$

$$\vec{x} = \begin{bmatrix} 1 \\ 2 \\ 0 \\ 6 \end{bmatrix}, \quad \vec{y} = \begin{bmatrix} -1 \\ 0 \\ 2 \\ 3 \end{bmatrix} \quad \text{in } \mathbb{R}^4.$$

   (a) Find $\vec{u} + \vec{v} - \vec{w}$ and $\vec{x} - \vec{y}$.
   (b) Find $\sqrt{2}\,\vec{s} - 2\vec{r}$, $3\vec{u}$, $-\vec{r}$, and $0\vec{x} + 1\vec{y}$.
   (c) Find $\|\vec{u}\|$, $\|\vec{v}\|$, $\|\vec{u} + \vec{v}\|$.
   (d) Find $\|\vec{s}\|$, $\|\vec{r}\|$, $\|\vec{x}\|$, $\|\vec{y}\|$.
   (e) Find $\vec{s} \cdot \vec{r}$, $\vec{u} \cdot \vec{v}$, $\vec{x} \cdot \vec{y}$.
   (f) Decide if $\vec{x}$ and $\vec{y}$ are orthogonal.
   (g) Find $\vec{u} \times \vec{v}$.

3. Calculate $\vec{u} + \vec{v}$, $\vec{u} - \vec{v}$, $\|\vec{u}\|$, $\|\vec{v}\|$, $5\vec{v}$, $-\sqrt{2}\vec{u}$.
   (a) $\vec{u} = 2\check{\mathbf{i}} - 3\check{\mathbf{j}} + 5\check{\mathbf{k}}$, $\vec{v} = \sqrt{2}\check{\mathbf{i}} + 6\check{\mathbf{j}} - 5\check{\mathbf{k}}$
   (b) $\vec{u} = 2\check{\mathbf{i}} - 5\check{\mathbf{j}}$, $\vec{v} = \check{\mathbf{i}} + 5\check{\mathbf{j}} - \check{\mathbf{k}}$
   (c) $\vec{u} = \check{\mathbf{i}} + \check{\mathbf{j}} + \check{\mathbf{k}}$, $\vec{v} = 2\check{\mathbf{i}} - 2\check{\mathbf{j}} + 3\check{\mathbf{k}}$.

4. Compute the dot product of the two vectors. Determine the cosine of the angle between them, and answer whether they are orthogonal or not

(a) $\check{\mathbf{i}}$, $2\check{\mathbf{i}} - 3\check{\mathbf{j}} + \check{\mathbf{k}}$

(b) $-4\check{\mathbf{i}} - 3\check{\mathbf{j}} + 4\check{\mathbf{k}}$, $-8\check{\mathbf{i}} - 5\check{\mathbf{j}} + \check{\mathbf{k}}$

(c) $\check{\mathbf{i}} - 3\check{\mathbf{k}}$, $2\check{\mathbf{j}} + 6\check{\mathbf{k}}$

5. What can you say about the vector $\vec{v}$ if

(a) $\vec{v} \cdot \vec{v} = 0$?

(b) $\vec{v} \cdot \check{\mathbf{i}} = 0$, $\vec{v} \cdot \check{\mathbf{j}} = 0$, $\vec{v} \cdot \check{\mathbf{k}} = 0$?