Math 54 Homework 7 Solutions

6.1-1 $u \cdot u = 5$, $v \cdot u = 8$, $\frac{v \cdot u}{u \cdot u} = \frac{8}{5}$.

6.1-7 $\sqrt{3^2 + (-1)^2 + (-5)^2} = \sqrt{35}$

6.1-13 $x - y = (11, 2)$, $\|x - y\| = \sqrt{121 + 4} = 5\sqrt{5}$.

6.1-14 $u - z = (4, -4, -6)$, $\|u - z\| = \sqrt{4^2 + (-4)^2 + (-6)^2} = 2\sqrt{17}$

6.2-17 Orthogonal:

$$\begin{pmatrix} 1/3 \\ 1/3 \\ 1/3 \end{pmatrix} \cdot \begin{pmatrix} 1/2 \\ 0 \\ -1/2 \end{pmatrix} = 0$$

normalized:

$$\begin{pmatrix} 1/\sqrt{3} \\ 1/\sqrt{3} \\ 1/\sqrt{3} \end{pmatrix}, \begin{pmatrix} 1/\sqrt{2} \\ 0 \\ -1/\sqrt{2} \end{pmatrix}$$

6.2-18 Not orthogonal:

$$\begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \cdot \begin{pmatrix} 0 \\ -1 \\ 0 \end{pmatrix} = -1$$

6.2-19 Orthogonal:

$$\begin{pmatrix} -0.6 \\ 0.8 \end{pmatrix} \cdot \begin{pmatrix} 0.8 \\ 0.6 \end{pmatrix} = 0$$

these vectors are already normalized.

6.2-20 Orthogonal:

$$\begin{pmatrix} -2/3 \\ 1/3 \\ 2/3 \end{pmatrix} \cdot \begin{pmatrix} 1/3 \\ 2/3 \\ 0 \end{pmatrix} = 0$$

normalized:

$$\begin{pmatrix} -2/3 \\ 1/3 \\ 2/3 \end{pmatrix}, \begin{pmatrix} 1/\sqrt{5} \\ 2/\sqrt{5} \\ 0 \end{pmatrix}$$

6.4-7

$$v_1 = \begin{pmatrix} 2 \\ -5 \\ 1 \end{pmatrix}, \; v_2 = \begin{pmatrix} 4 \\ -1 \\ 2 \end{pmatrix}$$

$$u_1 = \frac{1}{\sqrt{4 + 25 + 1}} v_1 = \frac{1}{\sqrt{30}} \begin{pmatrix} 2 \\ -5 \\ 1 \end{pmatrix}$$

$$w_2 = v_2 - (v_2 \cdot u_1)u_1 = \begin{pmatrix} 4 \\ -1 \\ 2 \end{pmatrix} - \left(\begin{pmatrix} 4 \\ -1 \\ 2 \end{pmatrix} \cdot \frac{1}{\sqrt{30}} \begin{pmatrix} 2 \\ -5 \\ 1 \end{pmatrix} \right) \frac{1}{\sqrt{30}} \begin{pmatrix} 2 \\ -5 \\ 1 \end{pmatrix} = \begin{pmatrix} 3 \\ 3/2 \\ 3/2 \end{pmatrix}$$

$$u_2 = \frac{1}{\sqrt{6}} \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix}$$

The answer is (u_1, u_2).

6.4-8

$$v_1 = \begin{pmatrix} 3 \\ -4 \\ 5 \end{pmatrix}, \; v_2 = \begin{pmatrix} -3 \\ 14 \\ -7 \end{pmatrix}$$

$$u_1 = \frac{1}{5\sqrt{2}} \begin{pmatrix} 3 \\ -4 \\ 5 \end{pmatrix}$$

$$w_2 = v_2 - (v_2 \cdot u_1)u_1 = \begin{pmatrix} 3 \\ 6 \\ 3 \end{pmatrix}$$

$$u_2 = \frac{1}{\sqrt{6}} \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}$$

The answer is (u_1, u_2)