MATH 54-1, H/W 10

6.2 (2) Orthogonal (8) $\vec{u}_1 \cdot \vec{u}_2 = 3\cdot(-2)+1\cdot 6 = 0$; $\vec{x} = \text{proj}_{\{\vec{u}_1, \vec{u}_2\}} \vec{x} =$

$= \dfrac{\vec{x}\cdot\vec{u}_1}{\vec{u}_1\cdot\vec{u}_1}\vec{u}_1 + \dfrac{\vec{x}\cdot\vec{u}_2}{\vec{u}_2\cdot\vec{u}_2}\vec{u}_2 = -\frac{3}{2}\vec{u}_1 + \frac{3}{4}\vec{u}_2$

(14) $\vec{y} = \text{proj}_{\vec{u}}\vec{y} + (\vec{y} - \text{proj}_{\vec{u}}\vec{y})$;

$\text{proj}_{\vec{u}}\vec{y} = \dfrac{\vec{y}\cdot\vec{u}}{\vec{u}\cdot\vec{u}}\vec{u} = \frac{2}{5}\vec{u} = \begin{bmatrix} 14/5 \\ 2/5 \end{bmatrix} \rightarrow \vec{y} = \begin{bmatrix} 14/5 \\ 2/5 \end{bmatrix} + \begin{bmatrix} -4/5 \\ 28/5 \end{bmatrix}$;

$\begin{bmatrix} 14/5 \\ 2/5 \end{bmatrix} \in \text{Span}\{\vec{u}\}$, $\begin{bmatrix} -4/5 \\ 28/5 \end{bmatrix} \perp \vec{u}$.

(24) (a) True, as it can contain the zero vector. (See Th. 4)

(b) No; this is the definition of an orthogonal set

(c) True; see Theorem 7(a) (d) True, see the paragraph before Example 5 (or 6.2.31)

(e) True; see the paragraph before Example 7 (or, $U^{-1} = U^T$)

(29) $U^{-1} = U^T$, $V^{-1} = V^T \rightarrow$ UV is invertible, and $(UV)^{-1} = V^{-1}U^{-1} =$
$= V^T U^T = (UV)^T$. Therefore, UV is orthogonal.

6.3 (4) Answer: $\begin{bmatrix} 6 \\ 3 \\ 0 \end{bmatrix}$ (8) Answer: $\vec{y} = \hat{y} + \vec{z}$, $\hat{y} = \begin{bmatrix} 3/2 \\ 7/2 \\ 1 \end{bmatrix}$, $\vec{z} = \begin{bmatrix} -5/2 \\ 1/2 \\ 2 \end{bmatrix}$