6.1 #10

$\bar{x} = \begin{bmatrix} -6 \\ 4 \\ -3 \end{bmatrix} \Rightarrow \|x\| = \sqrt{(-6)^2 + (4)^2 + (-3)^2} = \sqrt{61}$

So a unit vector in the direction of $\bar{x}$ is $\begin{bmatrix} \frac{-6}{\sqrt{61}} \\ \frac{4}{\sqrt{61}} \\ \frac{-3}{\sqrt{61}} \end{bmatrix}$

6.1 #14

$\bar{u} = \begin{bmatrix} 0 \\ -5 \\ 2 \end{bmatrix}, \bar{z} = \begin{bmatrix} -4 \\ -1 \\ 8 \end{bmatrix}$

$dist(\bar{u},\bar{v}) = \|\bar{u} - \bar{z}\| = \left\| \begin{bmatrix} 4 \\ -4 \\ -6 \end{bmatrix} \right\| = \sqrt{(4)^2 + (-4)^2 + (-6)^2} = \sqrt{68}$

6.1 #16

$\bar{u} = \begin{bmatrix} 12 \\ 3 \\ -5 \end{bmatrix}, \bar{v} = \begin{bmatrix} 2 \\ -3 \\ 3 \end{bmatrix} \Rightarrow \bar{u} \cdot \bar{v} = 24 - 9 - 15 = 0$

$\Rightarrow \bar{u}$ and $\bar{v}$ are orthogonal.

6.1 18

$\bar{y} = \begin{bmatrix} -3 \\ 7 \\ 4 \\ 0 \end{bmatrix}, \bar{z} = \begin{bmatrix} 1 \\ -8 \\ 15 \\ -7 \end{bmatrix} \Rightarrow \bar{y} \cdot \bar{z} = 1$

$\Rightarrow \bar{y}$ and $\bar{z}$ are not orthogonal

6.1 #26

a) True , Thm 1a
b) False , c might be negative
c) True , p. 380
d) True, pythageorean theorem
e) True, thm 3

6.1 #28

Suppose $\bar{y}$ is orthogonal to $\bar{u}$ and $\bar{v}$.
Take $\bar{w} \in Span\{\bar{u}, \bar{v}\}$. $\bar{w} = c_1\bar{u} + c_2\bar{v}$ for some $c_1, c_2 \in \mathbb{R}$

$\bar{w} \cdot \bar{y} = (c_1\bar{u} + c_2\bar{v}) \cdot \bar{y} = \underbrace{c_1(\bar{u} \cdot y) + c_2(\bar{v} \cdot y)}_{=0}$ p. 376

So, $\bar{y}$ is orthogonal to any $\bar{w} \in Span\{\bar{u}, \bar{v}\}$