Quiz 7

$$\vec{u} = \begin{bmatrix} 2 \\ 1 \\ -2 \end{bmatrix} \qquad \vec{v} = \begin{bmatrix} 3 \\ -4 \\ 1 \end{bmatrix}$$

① $2\vec{u} = \begin{bmatrix} 4 \\ 2 \\ -4 \end{bmatrix}$, $\|2\vec{u}\| = \sqrt{(4)^2 + (2)^2 + (-4)^2} = \sqrt{16+4+16} = \sqrt{36} = \underline{6}$

$-\vec{v} = \begin{bmatrix} -3 \\ 4 \\ -1 \end{bmatrix}$, $\|-\vec{v}\| = \sqrt{(-3)^2 + (4)^2 + (-1)^2} = \sqrt{9+16+1} = \underline{\sqrt{26}}$

② $\vec{u} - \vec{v} = \begin{bmatrix} -1 \\ 5 \\ -3 \end{bmatrix}$, $\|\vec{u} - \vec{v}\| = \sqrt{(-1)^2 + (5)^2 + (-3)^2} = \sqrt{1+25+9} = \underline{\sqrt{35}}$

③ $\vec{u}^T\vec{v} = \vec{u}\cdot\vec{v} = (2\cdot3) + (1\cdot -4) + (-2\cdot1) = 6 - 4 - 2 = \underline{0}.$

Since $\underline{\vec{u}\cdot\vec{v} = 0}$ they are <u>orthogonal</u> to each other

④ $\vec{u} + \vec{v} = \begin{bmatrix} 5 \\ -3 \\ -1 \end{bmatrix}$, $\|\vec{u} + \vec{v}\| = \sqrt{(5)^2 + (-3)^2 + (-1)^2} = \sqrt{25+9+1} = \sqrt{35}$

Let $\vec{w} = \frac{1}{\|\vec{u}+\vec{v}\|} \vec{u}+\vec{v} = \frac{1}{\sqrt{35}} \begin{bmatrix} 5 \\ -3 \\ -1 \end{bmatrix} = \underline{\begin{bmatrix} 5/\sqrt{35} \\ -3/\sqrt{35} \\ -1/\sqrt{35} \end{bmatrix}}$