

$$\#1 \quad \vec{v} = (3, 2, 1), \quad \vec{w} = (0, -1, 1)$$

$$a) \quad \vec{v} + \vec{w} = \boxed{(3, 1, 2)}$$

$$b) \quad 5\vec{v} - 4\vec{w} = 5(3, 2, 1) - 4(0, -1, 1) \\ = (15, 10, 5) + (0, 4, -4) = \boxed{(15, 14, 1)}$$

$$c) \quad \langle \vec{v}, \vec{w} \rangle = 3 \cdot 0 + 2 \cdot (-1) + 1 \cdot 1 = -2 + 1 = \boxed{-1}$$

$$d) \quad \langle \vec{v} + 2\vec{w}, \vec{v} - 3\vec{w} \rangle = \langle \vec{v}, \vec{v} \rangle - 3\langle \vec{v}, \vec{w} \rangle \\ + 2\langle \vec{w}, \vec{v} \rangle - 6\langle \vec{w}, \vec{w} \rangle \\ = \langle \vec{v}, \vec{v} \rangle - \langle \vec{v}, \vec{w} \rangle - 6\langle \vec{w}, \vec{w} \rangle \\ = (9 + 4 + 1) + 1 - 6(1 + 1) \\ = 14 + 1 - 12 = \boxed{3}$$

$$\#2 \quad \vec{v} \times \vec{w} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 2 & 1 \\ 0 & -1 & 1 \end{vmatrix} = (3, -3, -3)$$

$$\|\vec{v} \times \vec{w}\|^2 = 9 + 9 + 9 = 27 \Rightarrow \|\vec{v} \times \vec{w}\| = 3\sqrt{3}$$

$$\text{Answ: } \vec{u} = \frac{\vec{v} \times \vec{w}}{\|\vec{v} \times \vec{w}\|} = \frac{(3, -3, -3)}{3\sqrt{3}} = \left(\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}} \right)$$