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MAC 2313.8443
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Quiz 1
You must show all work to receive full credit!!

Problem 1. Let $\mathbf{u} = \langle 2, -3, 1\rangle$ and $\mathbf{v} = \langle -3, -2, 1\rangle$.
(a) (3 pts) Find a vector parametrization for the line passing through the point $(2, -5, 7)$ in the direction of the vector $\mathbf{u} - \mathbf{v}$.

$$\vec{u} - \vec{v} = \langle 2, -3, 1\rangle - \langle -3, -2, 1\rangle = \langle 2 + (+3), -3 + (+2), 1 - 1\rangle = \langle 5, -1, 0\rangle$$

Vector parametrization: $\vec{r}(t) = \langle x_0, y_0, z_0\rangle + t\langle a, b, c\rangle$

$$= \langle 2, -5, 7\rangle + t\langle 5, -1, 0\rangle$$

$$= \boxed{\langle 2 + 5t, -5 - t, 7\rangle}$$

(b) (4 pts) Find the projection of $\mathbf{u}$ along $\mathbf{v}$.

$$\text{proj}_{\vec{v}}\vec{u} = \left(\frac{\vec{u}\cdot\vec{v}}{\vec{v}\cdot\vec{v}}\right)\vec{v}$$

$$\vec{u}\cdot\vec{v} = \langle 2, -3, 1\rangle \cdot \langle -3, -2, 1\rangle = (2)(-3) + (-3)(-2) + (1)(1) = -6 + 6 + 1 = 1$$

$$\vec{v}\cdot\vec{v} = \|\vec{v}\|^2 = (-3)^2 + (-2)^2 + 1^2 = 9 + 4 + 1 = 14$$

Thus, $\text{proj}_{\vec{v}}\vec{u} = \frac{1}{14}\vec{v} = \frac{1}{14}\langle -3, -2, 1\rangle = \boxed{\left\langle \frac{-3}{14}, \frac{-2}{14}, \frac{1}{14}\right\rangle}$

(c) (3 pts) Find a vector that is orthogonal to both $\mathbf{u}$ and $\mathbf{v}$.

$$\vec{u}\times\vec{v} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -3 & 1 \\ -3 & -2 & 1 \end{vmatrix}$$

$$= \langle -3\cdot 1 - (-2\cdot 1), -3\cdot 1 - 2\cdot 1, 2(-2) - (-3)(-3)\rangle$$

$$= \langle -3 + (+2), -3 - 2, -4 - 9\rangle = \boxed{\langle -1, -5, -13\rangle}$$