Is $(\lambda\vec{v}) \times (\alpha\vec{w}) = \lambda\alpha(\vec{v}\times\vec{w})$? YES

$\vec{v} = \langle v_1, v_2, v_3\rangle$, $\vec{w} = \langle w_1, w_2, w_3\rangle$.

$\lambda\vec{v} = \langle \lambda v_1, \lambda v_2, \lambda v_3\rangle$, $\alpha\vec{w} = \langle \alpha w_1, \alpha w_2, \alpha w_3\rangle$

$$\lambda\vec{v} \times \alpha\vec{w} = \langle \lambda v_1, \lambda v_2, \lambda v_3\rangle \times \langle \alpha w_1, \alpha w_2, \alpha w_3\rangle$$

$$= \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ \lambda v_1 & \lambda v_2 & \lambda v_3 \\ \alpha w_1 & \alpha w_2 & \alpha w_3 \end{vmatrix} = (\lambda v_2 \alpha w_3 - \lambda v_3 \alpha w_2)\vec{i} - (\lambda v_1 \alpha w_3 - \lambda v_3 \alpha w_1)\vec{j} + (\lambda v_1 \alpha w_2 - \lambda v_2 \alpha w_1)\vec{k}$$

$$= \lambda\alpha\left[(v_2 w_3 - v_3 w_2)\vec{i} - (v_1 w_3 - v_3 w_1)\vec{j} + (v_1 w_2 - v_2 w_1)\vec{k}\right]$$

$$= \lambda\alpha \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ v_1 & v_2 & v_3 \\ w_1 & w_2 & w_3 \end{vmatrix}$$

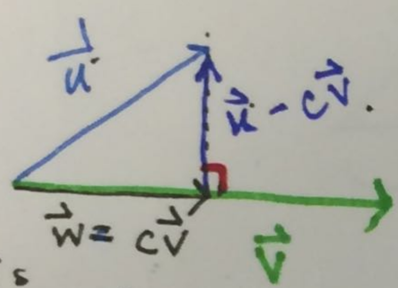
$$= \lambda\alpha(\vec{v}\times\vec{w}).$$

Theorem 3, p. 681: Projection $\vec{v} \neq \vec{0}$.

Projection of $\vec{u}$ along $\vec{v}$ is the vector

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

Proof: (sketch)



is $\text{proj}_{\vec{v}}\,\vec{u}$

$\vec{u} - c\vec{v} \perp \vec{v}$ so ...

$$(\vec{u} - c\vec{v})\cdot\vec{v} = 0$$

$$\vec{u}\cdot\vec{v} - c\vec{v}\cdot\vec{v} = 0$$

$$\vec{u}\cdot\vec{v} = c\vec{v}\cdot\vec{v}$$

$$\vec{v}\cdot\frac{\vec{u}\cdot\vec{v}}{\vec{v}\cdot\vec{v}} = c.(\vec{v})$$

$$\frac{\vec{u}\cdot\vec{v}}{\vec{v}\cdot\vec{v}}\,\vec{v} = c\vec{v}$$

$$c\vec{v} = \left(\frac{\vec{u}\cdot\vec{v}}{\vec{v}\cdot\vec{v}}\right)\vec{v}$$

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