12.4, number 1: **Find the length and direction of $\vec{u} \times \vec{v}$ and $\vec{v} \times \vec{u}$ for $\vec{u} = 2\vec{i} - 2\vec{j} - \vec{k}$ and $\vec{v} = \vec{i} - \vec{k}$.**

Answer:

$$\begin{aligned}\vec{u} \times \vec{v} &= \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 2 & -2 & -1 \\ 1 & 0 & -1 \end{vmatrix} = \begin{vmatrix} -2 & -1 \\ 0 & -1 \end{vmatrix} \vec{i} - \begin{vmatrix} 2 & -1 \\ 1 & -1 \end{vmatrix} \vec{j} + \begin{vmatrix} 2 & -2 \\ 1 & 0 \end{vmatrix} \vec{k} \\ &= 2\vec{i} + \vec{j} + 2\vec{k}.\end{aligned}$$

The the length of $\vec{u} \times \vec{v}$ is $\sqrt{2^2 + 1^2 + 2^2} = \boxed{3}$ and the unit vector that has the same direction as $\vec{u} \times \vec{v}$ is $\boxed{\frac{1}{3}(2\vec{i} + \vec{j} + 2\vec{k})}$. It follows that the length of $\vec{v} \times \vec{u}$ is also $\boxed{3}$ and a unit vector that points in the same direction as $\vec{v} \times \vec{u}$ is $\boxed{\frac{-1}{3}(2\vec{i} + \vec{j} + 2\vec{k})}$.

You can compute the second half of the answer or just state the second half of the answer, which ever feels better to you.