CROSS PRODUCT - ANSWERS

Find the cross product $\vec{u} \times \vec{v}$

1. $\vec{u} = 2\hat{i} + 3\hat{j} - 2\hat{k}$
   $\vec{v} = -4\hat{i} + 4\hat{j} + 3\hat{k}$

$$\vec{u} \times \vec{v} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & -2 \\ -4 & 4 & 3 \end{vmatrix} = \begin{vmatrix} 3 & -2 \\ 4 & 3 \end{vmatrix}\hat{i} - \begin{vmatrix} 2 & -2 \\ -4 & 3 \end{vmatrix}\hat{j} + \begin{vmatrix} 2 & 3 \\ -4 & 4 \end{vmatrix}\hat{k} = 17\hat{i} + 2\hat{j} + 20\hat{k}$$

2. $\vec{u} = 2\hat{i} + 3\hat{j} - 2\hat{k}$
   $\vec{v} = 2\hat{i} + 3\hat{j} - 2\hat{k}$

$$\vec{u} \times \vec{v} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & -2 \\ 2 & 3 & -2 \end{vmatrix} = \begin{vmatrix} 3 & -2 \\ 3 & -2 \end{vmatrix}\hat{i} - \begin{vmatrix} 2 & -2 \\ 2 & -2 \end{vmatrix}\hat{j} + \begin{vmatrix} 2 & 3 \\ 2 & 3 \end{vmatrix}\hat{k} = 0\hat{i} + 0\hat{j} + 0\hat{k} = \vec{0}$$

3. $\vec{u} = 2\hat{i} + 3\hat{j}$
   $\vec{v} = -4\hat{i} + 4\hat{j}$

$$\vec{u} \times \vec{v} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 0 \\ -4 & 4 & 0 \end{vmatrix} = \begin{vmatrix} 3 & 0 \\ 4 & 0 \end{vmatrix}\hat{i} - \begin{vmatrix} 2 & 0 \\ -4 & 0 \end{vmatrix}\hat{j} + \begin{vmatrix} 2 & 3 \\ -4 & 4 \end{vmatrix}\hat{k} = 0\hat{i} + 0\hat{j} + 20\hat{k} = 20\hat{k}$$

4. $\vec{u} = \hat{i}$
   $\vec{v} = \hat{j}$

   $\vec{u} \times \vec{v} = \hat{k}$

5. $\vec{u} = \hat{j}$
   $\vec{v} = \hat{i}$

   $\vec{u} \times \vec{v} = -\hat{k}$