

$$\vec{v} (2,0,3) \quad , \quad \vec{u} (2,0,-3) \quad (1)$$

$$\begin{aligned} \vec{u} \wedge \vec{v} &= \begin{vmatrix} 0 & 0 \\ -3 & 3 \end{vmatrix} \vec{i} - \begin{vmatrix} 2 & 3 \\ 3 & 0 \end{vmatrix} \vec{j} + \begin{vmatrix} 2 & 2 \\ 0 & 0 \end{vmatrix} \vec{k} \\ &= -12 \vec{j} \end{aligned}$$

$$\vec{v} (1,-1,1) \quad , \quad \vec{u} (1,1,1) \quad (2)$$

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

$$\vec{v} (2,5,3) \quad , \quad \vec{u} (2,-2,1) \quad (3)$$

$$\begin{aligned} \vec{u} \wedge \vec{v} &= \begin{vmatrix} -2 & 5 \\ 1 & 3 \end{vmatrix} \vec{i} - \begin{vmatrix} 2 & 2 \\ 1 & 3 \end{vmatrix} \vec{j} + \begin{vmatrix} 2 & 2 \\ -2 & 5 \end{vmatrix} \vec{k} \\ &= -11 \vec{i} - 4 \vec{j} + 14 \vec{k} \end{aligned}$$

إعداد الأستاذ : عبد العزيز فرحاني