$\boldsymbol{a} = \begin{pmatrix} 2 \\ 3 \\ -5 \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} 3 \\ -2 \\ 4 \end{pmatrix}$

Find $\mathbf{a} \times \mathbf{b}$

$$\mathbf{v} \times \mathbf{w} = \begin{pmatrix} \mathbf{v}_1 \\ \mathbf{v}_2 \\ \mathbf{v}_3 \end{pmatrix} \times \begin{pmatrix} \mathbf{w}_1 \\ \mathbf{w}_2 \\ \mathbf{w}_3 \end{pmatrix} = \begin{pmatrix} \mathbf{v}_2\mathbf{w}_3 - \mathbf{v}_3\mathbf{w}_2 \\ \mathbf{v}_3\mathbf{w}_1 - \mathbf{v}_1\mathbf{w}_3 \\ \mathbf{v}_1\mathbf{w}_2 - \mathbf{v}_2\mathbf{w}_1 \end{pmatrix}$$

$$\begin{pmatrix} 2 \\ 3 \\ -5 \end{pmatrix} \times \begin{pmatrix} 3 \\ -2 \\ 4 \end{pmatrix} = \begin{pmatrix} 3\times4 - (-5)\times(-2) \\ -(2\times4 - (-5)\times3) \\ 2\times(-2) - 3\times3 \end{pmatrix}$$

$$= \begin{pmatrix} 12 - 10 \\ -(8+15) \\ -4 - 9 \end{pmatrix}$$

$$= \begin{pmatrix} 2 \\ -23 \\ -13 \end{pmatrix}$$

Check $\underline{a} \times \underline{b}$ is perpendicular to $\underline{a}$ and $\underline{b}$

$$\begin{pmatrix} 2 \\ -23 \\ -13 \end{pmatrix} \cdot \begin{pmatrix} 2 \\ 3 \\ -5 \end{pmatrix} = 4 - 69 + 65 = 0 \quad \text{Yes!}$$

$$\begin{pmatrix} 2 \\ -23 \\ -13 \end{pmatrix} \cdot \begin{pmatrix} 3 \\ -2 \\ 4 \end{pmatrix} = 6 + 46 - 52 = 0 \quad \text{Yes!}$$