QUIZ 4

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1 PROBLEM 1

1. Let the vectors $\mathbf{a}, \mathbf{b}, \mathbf{c}$ be given as $\begin{pmatrix} a1 \\ a2 \\ a3 \end{pmatrix}$, $\begin{pmatrix} b1 \\ b2 \\ b3 \end{pmatrix}$, $\begin{pmatrix} c1 \\ c2 \\ c3 \end{pmatrix}$. Then show that $\mathbf{a} \times (\mathbf{b} + \mathbf{c}) = \mathbf{a} \times \mathbf{b} + \mathbf{a} \times \mathbf{c})$

SOLUTION:

$$Let, \mathbf{a} = \begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix} \tag{1.0.1}$$

$$\mathbf{b} = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix} \tag{1.0.2}$$

$$\mathbf{c} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \tag{1.0.3}$$

$$LHS = \mathbf{a} \times (\mathbf{b} + \mathbf{c}) \tag{1.0.4}$$

$$= \begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix} \times \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \tag{1.0.5}$$

$$= \begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix} \times \begin{pmatrix} 2 \\ 3 \\ 2 \end{pmatrix} \tag{1.0.6}$$

$$= \begin{pmatrix} 3 \\ -2 \\ 0 \end{pmatrix} \tag{1.0.7}$$

$$RHS = (\mathbf{a} \times \mathbf{b}) + (\mathbf{a} \times \mathbf{c}) \tag{1.0.8}$$

$$= \begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix} \times \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix} \times \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \tag{1.0.9}$$

$$= \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix} \tag{1.0.10}$$

LHS = RHS
Hence, Proved.