QUIZ 4

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1 PROBLEM 1

1. Let the vector

$$\mathbf{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}, \mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}, \mathbf{c} = \begin{pmatrix} c_1 \\ c_2 \\ c_3 \end{pmatrix} \qquad (1.0.1)$$

Then show that $\mathbf{a} \times (\mathbf{b} + \mathbf{c}) = \mathbf{a} \times \mathbf{b} + \mathbf{a} \times \mathbf{c}$

SOLUTION: Let,

$$\mathbf{a} = \begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix}, \mathbf{b} = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}, \mathbf{c} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \qquad (1.0.2)$$

$$LHS = \mathbf{a} \times (\mathbf{b} + \mathbf{c}) \qquad (1.0.3)$$

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

$$(1.0.4)$$

$$= \begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix} \times \begin{pmatrix} 2 \\ 3 \\ 2 \end{pmatrix} \qquad (1.0.5)$$

$$= \begin{pmatrix} 3 \\ -2 \\ 0 \end{pmatrix} \qquad (1.0.6)$$

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

$$(1.0.7)$$

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

$$(1.0.8)$$

$$= \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix} \qquad (1.0.9)$$

$$= \begin{pmatrix} 3 \\ -2 \\ 0 \end{pmatrix} \qquad (1.0.10)$$

LHS = RHS
Hence, Proved.