2.9.7

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Question :

$$\mathbf{a} = 2\hat{i} + \hat{j} + 3\hat{k},\ \mathbf{b} = -\hat{i} + 2\hat{j} + \hat{k},\ \mathbf{c} = 3\hat{i} + \hat{j} + 2\hat{k}$$

then find $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c})$

Symbol	Value	Description
a	$\begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix}$	vector
b	$\begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix}$	vector
c	$\begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix}$	vector

Table : vectors

Solution :

$$\mathbf{b} \times \mathbf{c} = \begin{pmatrix} |\mathbf{B_{23}} & \mathbf{C_{23}}| \\ |\mathbf{B_{31}} & \mathbf{C_{31}}| \\ |\mathbf{B_{12}} & \mathbf{C_{12}}| \end{pmatrix}$$

$$\begin{vmatrix} \mathbf{B_{23}} & \mathbf{C_{23}} \end{vmatrix} = \begin{vmatrix} 2 & 1 \\ 1 & 2 \end{vmatrix} = 3$$

$$\begin{vmatrix} \mathbf{B_{31}} & \mathbf{C_{31}} \end{vmatrix} = \begin{vmatrix} 1 & 2 \\ -1 & 3 \end{vmatrix} = 5$$

$$\begin{vmatrix} \mathbf{B_{12}} & \mathbf{C_{12}} \end{vmatrix} = \begin{vmatrix} -1 & 3 \\ 2 & 1 \end{vmatrix} = -7$$

$$\mathbf{b} \times \mathbf{c} = \begin{pmatrix} 3 \\ 5 \\ -7 \end{pmatrix}$$

the value of $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c}) = \mathbf{a}^{\top}(\mathbf{b} \times \mathbf{c}) = \begin{pmatrix} 2 & 1 & 3 \end{pmatrix} \begin{pmatrix} 3 \\ 5 \\ -7 \end{pmatrix}$

= (2)(3) + (1)(5) + (3)(-7) = 6 + 5 - 21

= -10

Final Answer : $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c})$ = -10

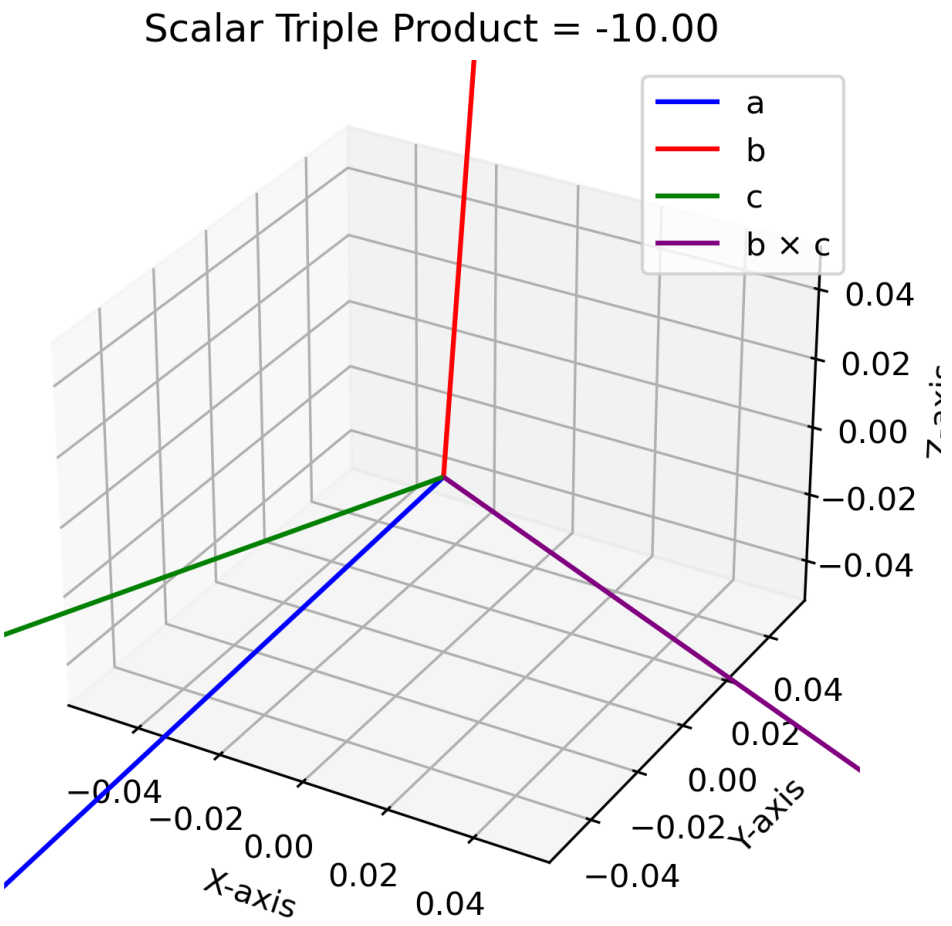
Scalar Triple Product = -10.00
a
b
c
b × c
0.04
0.02
0.00
−0.02
−0.04
Z-axis
−0.04
−0.02
0.00
0.02
0.04
X-axis
0.04
0.02
0.00
−0.02
−0.04
Y-axis

Fig : Vectors