# 12.10.3.13

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CLASS 12, CHAPTER 10, EXERCISE 3.13

13) If are **a**, **b**, **c** are unit vectors such that **a**+**b**+**c** = 0, find the value of $\mathbf{a} \cdot \mathbf{b} + \mathbf{b} \cdot \mathbf{c} + \mathbf{c} \cdot \mathbf{a}$.
**Solution:** The inner product of given unit vectors with sum of all unit vectors (Which is given to be 0) is zero

$$\mathbf{a}^\top(\mathbf{a} + \mathbf{b} + \mathbf{c}) = 0 \qquad (1)$$

$$\Rightarrow (\mathbf{a}^\top\mathbf{b} + \mathbf{a}^\top\mathbf{c}) = -1 \qquad (2)$$

$$\mathbf{b}^\top(\mathbf{a} + \mathbf{b} + \mathbf{c}) = 0 \qquad (3)$$

$$\Rightarrow (\mathbf{b}^\top\mathbf{c} + \mathbf{b}^\top\mathbf{a}) = -1 \qquad (4)$$

$$\mathbf{c}^\top(\mathbf{a} + \mathbf{b} + \mathbf{c}) = 0 \qquad (5)$$

$$\Rightarrow (\mathbf{c}^\top\mathbf{a} + \mathbf{c}^\top\mathbf{b}) = -1 \qquad (6)$$

$$\Rightarrow (\mathbf{a}^\top\mathbf{b} + \mathbf{b}^\top\mathbf{c} + \mathbf{c}^\top\mathbf{a}) = \frac{-3}{2} \qquad (7)$$

$$\Rightarrow \mathbf{a} \cdot \mathbf{b} + \mathbf{b} \cdot \mathbf{c} + \mathbf{c} \cdot \mathbf{a} = \frac{-3}{2} \qquad (8)$$