

# Vector Algebra

## 1 12<sup>th</sup> Maths - Exercise 10.3.13

1. If  $\vec{a}, \vec{b}, \vec{c}$  are unit vectors such that  $\vec{a} + \vec{b} + \vec{c} = 0$ , find the value of  $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$ .

## 2 Solution

The given vectors  $\vec{a}, \vec{b}$  and  $\vec{c}$  are unit vectors

The magnitudes vectors  $\vec{a}, \vec{b}, \vec{c}$  are

$$\|\vec{a}\| = \sqrt{1^2} = 1 \quad (1)$$

$$\|\vec{b}\| = \sqrt{1^2} = 1 \quad (2)$$

$$\|\vec{c}\| = \sqrt{1^2} = 1 \quad (3)$$

The Given equation is  $\vec{a} + \vec{b} + \vec{c} = 0$

$$\|\vec{a} + \vec{b} + \vec{c}\|^2 = 0^2 \quad (4)$$

$$\|\vec{a}\|^2 + \|\vec{b}\|^2 + \|\vec{c}\|^2 + 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}) = 0 \quad (5)$$

$$1^2 + 1^2 + 1^2 + 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}) = 0 \quad (6)$$

$$3 + 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}) = 0 \quad (7)$$

$$\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a} = \frac{-3}{2} \quad (8)$$