Question Q1.20

What does $\vec{A} \cdot \vec{A}$, the scalar product of a vector with itself, give? What about $\vec{A} \times \vec{A}$, the vector product of a vector with itself?

Solution

The dot product of two vectors, $\mathbf{A}$ and $\mathbf{B}$, is defined by

$$\mathbf{A} \cdot \mathbf{B} = AB \cos\theta,$$

so

$$\mathbf{A} \cdot \mathbf{A} = A^2 \cos 0 = A^2.$$

On the other hand, the magnitude of the cross product of two vectors, $\mathbf{A}$ and $\mathbf{B}$, is defined by

$$|\mathbf{A} \times \mathbf{B}| = AB \sin\theta,$$

so

$$|\mathbf{A} \times \mathbf{A}| = A^2 \sin 0 = 0,$$

which means $\mathbf{A} \times \mathbf{A} = \mathbf{0}$.