

Question Q1.19

If $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ are nonzero vectors, is it possible for $\vec{\mathbf{A}} \cdot \vec{\mathbf{B}}$ and $\vec{\mathbf{A}} \times \vec{\mathbf{B}}$ both to be zero? Explain.

Solution

The dot product and the magnitude of the cross product are defined by

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

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

In order for both $\mathbf{A} \cdot \mathbf{B} = 0$ and $|\mathbf{A} \times \mathbf{B}| = 0$,

$$\cos \theta = 0$$

$$\sin \theta = 0.$$

There's no value of θ that satisfies these two equations simultaneously, so it's not possible.