

Question Q1.21

Let $\vec{\mathbf{A}}$ represent any nonzero vector. Why is $\vec{\mathbf{A}}/A$ a unit vector, and what is its direction? If θ is the angle that $\vec{\mathbf{A}}$ makes with the $+x$ -axis, explain why $(\vec{\mathbf{A}}/A) \cdot \hat{\mathbf{i}}$ is called the *direction cosine* for that axis.

Solution

\mathbf{A}/A is a unit vector because \mathbf{A} has a magnitude of A ; dividing it by A results in 1. This unit vector has the same direction as \mathbf{A} .

$(\mathbf{A}/A) \cdot \hat{\mathbf{i}}$ is called the direction cosine because it gives the cosine of the angle to the x -axis.

$$(\mathbf{A}/A) \cdot \hat{\mathbf{i}} = |\mathbf{A}/A| |\hat{\mathbf{i}}| \cos \theta_x = (1)(1) \cos \theta_x = \cos \theta_x$$

θ_x is the angle between $\hat{\mathbf{i}}$ (the x -axis) and \mathbf{A} .