

Answer on Question #71180 – Math – Linear Algebra

Question

Can the magnitude of the resultant of the two vectors be greater than the sum of magnitude of individual vector?

Solution

Let $a = |\vec{a}|$, $b = |\vec{b}|$, then

$$|\vec{a} + \vec{b}| = \sqrt{|\vec{a}|^2 + |\vec{b}|^2 + 2|\vec{a}||\vec{b}|\cos\theta} = \sqrt{a^2 + b^2 + 2ab\cos\theta},$$

where θ is angle between \vec{a} and \vec{b} .

The maximum value of $|\vec{a} + \vec{b}|$ is reached when $\cos\theta = 1$:

$$|\vec{a} + \vec{b}|_{max} = \sqrt{a^2 + b^2 + 2ab} = a + b,$$

which is actually the sum of magnitudes of individual vectors.

Answer: no.