Answer on Question #52039 — Physics - Quantum Mechanics

Find angle between two vectors with coordinates:

$a_x=3.2, a_y=1.6, b_x=0.5, b_y=4.5$

Solution:

We have two vectors $\bar{a}, \bar{b}$ with components:

$$\bar{a} = (3.2, 1.6,)$$
$$\bar{b} = (0.5, 4.5)$$

Acording to definition of dot product :

$\bar{a}\cdot\bar{b}=a_x b_x+a_y b_y=|\bar{a}||\bar{b}|\cos(\phi)$,where

a_x, a_y -components of vector $\bar{a}$, b_x, b_y -components of vector $\bar{b}$,

$|\bar{a}|$ module of vector overline $\bar{a}$, $|\bar{b}|$ module of vector $\bar{b}$.

ϕ is angle between $\bar{a}$ and $\bar{b}$.

We can find angle between two vectors by next formula:

$$\cos(\phi)=\frac{\bar{a}\cdot\bar{b}}{|\bar{a}||\bar{b}|} \quad ,$$

$$\bar{a}\cdot\bar{b}=a_x b_x+a_y b_y=3.2\cdot0.5+1.6\cdot4.5=1.6+7.2=8.8$$

$$|\bar{a}|=\sqrt{a_x^2+a_y^2}=\sqrt{3.2^2+1.6^2}=\sqrt{10.24+2.56}=\sqrt{12.8}=3.57$$

$$|\bar{b}|=\sqrt{b_x^2+b_y^2}=\sqrt{0.5^2+4.5^2}=\sqrt{0.25+20.25}=\sqrt{20.5}=4.52$$

$$\cos(\phi)=\frac{\bar{a}\cdot\bar{b}}{|\bar{a}||\bar{b}|}=\frac{8.8}{3.57\cdot4.52}=0.545$$

$$\varphi=\arccos(0.545)=56.98^o$$

Answer: $\varphi=57^o$