Answer on Question #81409 – Math – Linear Algebra

Question

Check whether the vector $(2\sqrt{3}; 2)$ is equally inclined to the vectors $(2; 2\sqrt{3})$ and $(4; 0)$.

Solution

We have three vectors:

$\bar{a} = (2\sqrt{3}; 2)$

$\bar{b} = (2; 2\sqrt{3})$

$\bar{c} = (4; 0)$

We should check if angles $\widehat{a, b}$ and $\widehat{a, c}$ are equal.

Angles can be found by the following formulas (see Geometric definition from https://en.wikipedia.org/wiki/Dot_product):

$$\cos \widehat{a, b} = \frac{\bar{a} \cdot \bar{b}}{|\bar{a}| \cdot |\bar{b}|}$$

$$\cos \widehat{a, c} = \frac{\bar{a} \cdot \bar{c}}{|\bar{a}| \cdot |\bar{c}|}$$

where $\bar{a} \cdot \bar{b}$ and $\bar{a} \cdot \bar{c}$ are scalar (dot) products of vectors, $|\bar{a}|$, $|\bar{b}|$, $|\bar{c}|$ are lengths of vectors.

We have

$$\cos \widehat{a, b} = \frac{\bar{a} \cdot \bar{b}}{|\bar{a}| \cdot |\bar{b}|} = \frac{2\sqrt{3} \cdot 2 + 2 \cdot 2\sqrt{3}}{\sqrt{(2\sqrt{3})^2 + 2^2} \cdot \sqrt{2^2 + (2\sqrt{3})^2}} = \frac{8\sqrt{3}}{16} = \frac{\sqrt{3}}{2}$$

$$\cos \widehat{a, c} = \frac{\bar{a} \cdot \bar{c}}{|\bar{a}| \cdot |\bar{c}|} = \frac{2\sqrt{3} \cdot 4 + 2 \cdot 0}{\sqrt{(2\sqrt{3})^2 + 2^2} \cdot \sqrt{4^2 + 0^2}} = \frac{8\sqrt{3}}{16} = \frac{\sqrt{3}}{2}$$

As we can see, angles have equal cosines, so we can say that $\bar{a}$ is equally inclined to $\bar{b}$ and $\bar{c}$.

Answer: vector $(2\sqrt{3}; 2)$ is equally inclined to the vectors $(2; 2\sqrt{3})$ and $(4; 0)$.