

Quiz 1

January 18, 2017

Show all work and circle your final answer.

1. Find a vector in the *opposite* direction of the vector $\langle 2, -7, 1 \rangle$ of length 3. $|\langle 2, -7, 1 \rangle| = \sqrt{2^2 + (-7)^2 + 1^2} = \sqrt{54}$

A unit vector in the direction of $\langle 2, -7, 1 \rangle$: $\frac{1}{\sqrt{54}} \langle 2, -7, 1 \rangle$
" " in the opposite direction: $-\frac{1}{\sqrt{54}} \langle 2, -7, 1 \rangle$

A vector of length 3 in the opp. direction: $\boxed{-\frac{3}{\sqrt{54}} \langle 2, -7, 1 \rangle}$

2. If $|\vec{a}| = 3$, $|\vec{b}| = 2$, and $\vec{a} \cdot \vec{b} = 6$, are \vec{a} and \vec{b} parallel, orthogonal, or neither? Show your work.

$$\cos \theta = \frac{\vec{a} \cdot \vec{b}}{|\vec{a}| |\vec{b}|} = \frac{6}{3 \cdot 2} = 1$$

So $\theta = 0$, hence \vec{a} and \vec{b} are parallel

3. If $\vec{a} = \langle -3, 2, 1 \rangle$ and $\vec{b} = \langle -1, 1, -3 \rangle$, find:

(a) $\vec{a} - \vec{b} = \langle -3 - (-1), 2 - 1, 1 - (-3) \rangle$
 $= \boxed{\langle -2, 1, 4 \rangle}$

(b) $|3\vec{b} - 2\vec{a}| = |\langle 3(-1) - 2(-3), 3(1) - 2(2), 3(-3) - 2(1) \rangle|$
 $= |\langle +3, -1, -11 \rangle|$
 $= \sqrt{3^2 + 1^2 + 11^2} = \boxed{\sqrt{131}}$

4. Find $\text{proj}_{\vec{a}} \vec{b}$ if $\vec{a} = 3\mathbf{i} + 4\mathbf{k}$ and $\vec{b} = \mathbf{i} - \mathbf{j} - 2\mathbf{k}$.

$$\vec{a} = \langle 3, 0, 4 \rangle, \vec{b} = \langle 1, -1, -2 \rangle$$
$$\text{proj}_{\vec{a}} \vec{b} = \frac{\vec{a} \cdot \vec{b}}{|\vec{a}|^2} \vec{a} = \frac{-5}{5^2} \langle 3, 0, 4 \rangle = \boxed{-\frac{1}{5} \langle 3, 0, 4 \rangle}$$

$$\vec{a} \cdot \vec{b} = 3(1) + 0(-1) + 4(-2) = -5$$

$$|\vec{a}| = \sqrt{3^2 + 4^2} = 5$$