QUIZ 02

1) Find the vector projection of $(0,1,2)$ onto $(1,0,1)$

soln. Let $\vec{v} = (0,1,2)$, $\vec{w} = (1,0,1)$

$$\text{proj}_{\vec{w}}(\vec{v}) = \frac{\vec{v}\cdot\vec{w}}{|\vec{w}|}\,\frac{\vec{w}}{|\vec{w}|}$$

$$= \frac{2}{\sqrt{2}}\,\frac{(1,0,1)}{\sqrt{2}}$$

$$= (1,0,1).$$

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2) Find the scalar projection of $(21, 2.85e, \pi)$ onto $(0,0,1)$.

soln.
$$\frac{(21, 2.85e, \pi)\cdot(0,0,1)}{|(0,0,1)|} = \frac{\pi}{1} = \pi.$$

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3) Explain why two (nonzero) vectors are $\perp$ iff their dot product is zero.

soln: Suppose that ~~the~~ $\vec{a}$ & $\vec{b}$ are perpendicular,

$$\vec{a}\cdot\vec{b} = |\vec{a}||\vec{b}|\cos(90^\circ) = 0.$$

which shows that their dot product is zero.

Conversely, suppose that $\vec{a} \cdot \vec{b} = 0$.

$$0 = \vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}| \cos\theta$$

since $|\vec{a}| \neq 0$ & $|\vec{b}| \neq 0$ this means that ~~$\theta = 90^\circ$~~.

$\cos\theta = 0 \Rightarrow \theta = 90^\circ$. //