MA 574. Pre Class Assignment 14 26/10/2023

Q1. A) To check if the vectors are orthogonal, the dot product of both vectors should be 0.

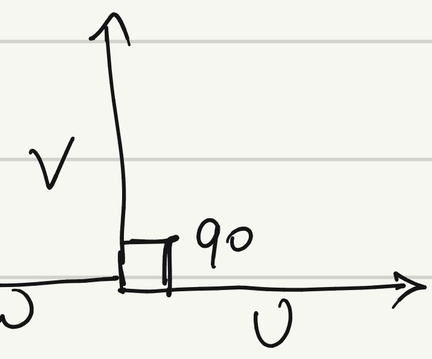
$$\begin{pmatrix} 2 \\ -3 \\ 1 \end{pmatrix} \cdot \begin{pmatrix} -4 \\ 0 \\ 8 \end{pmatrix} = 0.$$

$$2(-4) + (-3)(0) + 1(8) = 0.$$
$$-8 + 0 + 8 = 0.$$
$$0 = 0.$$

Hence both vectors are orthogonal.

B) $U \cdot V = 0$

$V \cdot W = 0$



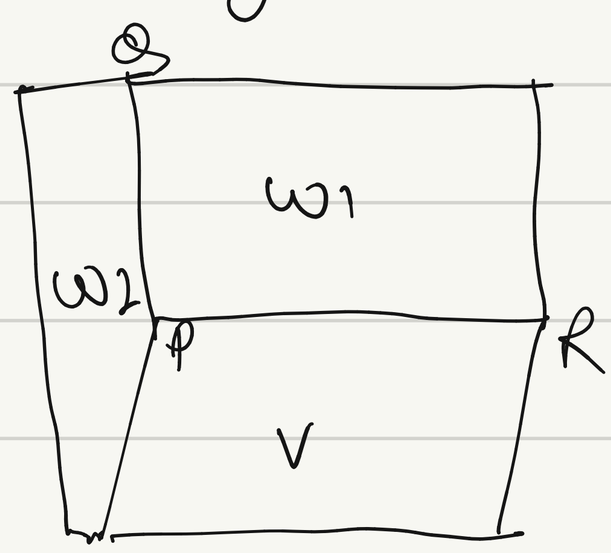
comparing both eq^n

$U \cdot V = V \cdot W.$

$U = W.$

U cannot be orthogonal to W since they lie on the same plane.

C) Yes the floor & the wall are orthogonal subspaces



Since V & W1 are perpendicular to each other, we say that vectors are orthogonal.

Q2. (A) Z axis means only third vector has to be nonzero.

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}_{3\times 3}$$

(B) x-y plane means, 1st & 2nd vector has to be non zero.

$$\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}_{3\times 3}$$

Q3. Vector projection of u onto v

$$\text{proj}_v u = \left(\frac{u \cdot v}{\|v\|^2}\right) \cdot v$$

$$u \cdot v = \begin{pmatrix} 1 \\ 2 \\ 2 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \Rightarrow 1 + 2 + 2 \Rightarrow \underline{5}.$$

$$\|v\| = \sqrt{x_1^2 + y_1^2 + z_1^2} = \sqrt{3}$$

$$= \left(\frac{5}{(\sqrt{3})^2}\right) \cdot \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

$$\text{proj}_V U = \left(\frac{5}{3}\right)\begin{pmatrix}1\\1\\1\end{pmatrix}$$

$$= \begin{pmatrix}5/3\\5/3\\5/3\end{pmatrix}$$

$$e = u - p$$

$$e = \begin{pmatrix}1\\2\\2\end{pmatrix} - \begin{pmatrix}5/3\\5/3\\5/3\end{pmatrix}$$

$$e = \begin{pmatrix}-2/3\\1/3\\1/3\end{pmatrix}$$

$$e.V = 0 \quad = \begin{pmatrix}-2/3\\1/3\\1/3\end{pmatrix}\begin{pmatrix}1\\1\\1\end{pmatrix} = 0$$

$$= \frac{-2}{3} + \frac{1}{3} + \frac{1}{3} = 0.$$

$$= 0$$

e & p are orthogonal.