Math 211 2018-10-23

$$\begin{pmatrix} u_1 \\ u_2 \\ u_3 \end{pmatrix} = u_1 \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} + u_2 \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} + u_3 \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}.$$

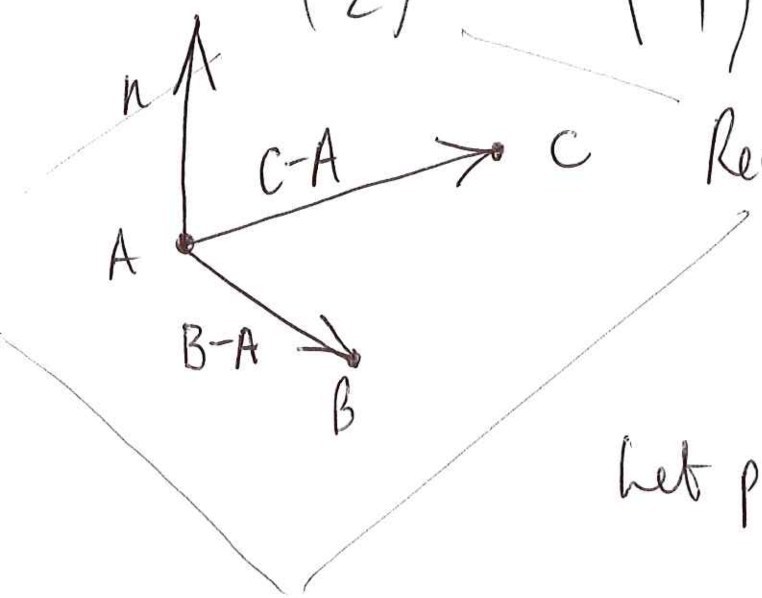
$$u = \begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix} \quad v = \begin{pmatrix} 3 \\ -2 \\ 1 \end{pmatrix}.$$

$$u \times v = \begin{pmatrix} -1+4 \\ 6-1 \\ -2+3 \end{pmatrix} = \begin{pmatrix} 3 \\ 5 \\ 1 \end{pmatrix}.$$

Find all vectors orthogonal to $u = \begin{pmatrix} 1 \\ -3 \\ 2 \end{pmatrix}$ and $v = \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix}$.

$$u \times v = \begin{pmatrix} -3-2 \\ 0-1 \\ 1-0 \end{pmatrix} = \begin{pmatrix} -5 \\ -1 \\ 1 \end{pmatrix};$$ So $k\begin{pmatrix} -5 \\ -1 \\ 1 \end{pmatrix}$ for $k \in \mathbb{R}$ are <u>all</u> vector $\perp$ to u and v.

Let $A = \begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix}$, $B = \begin{pmatrix} 2 \\ 0 \\ -1 \end{pmatrix}$, $C = \begin{pmatrix} 0 \\ -2 \\ 3 \end{pmatrix}$.



Recall $\underbrace{n}_{\perp \text{ to plane}} \cdot (x - \underbrace{p}_{\text{point on plane}}) = 0$

Let $p = A$.

Then $n = (C-A) \times (B-A) = \begin{pmatrix} -1 \\ -1 \\ 1 \end{pmatrix} \times \begin{pmatrix} 1 \\ 1 \\ -3 \end{pmatrix} = \begin{pmatrix} 3-1 \\ 1-3 \\ -1+1 \end{pmatrix} = \begin{pmatrix} 2 \\ -2 \\ 0 \end{pmatrix}$.

So $\begin{pmatrix} 2 \\ -2 \\ 0 \end{pmatrix} \cdot \left[\begin{pmatrix} x \\ y \\ z \end{pmatrix} - \begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix} \right] = 0$.