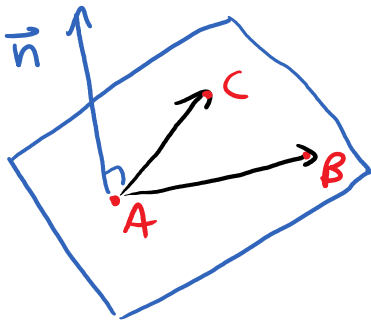


Office Hours Fri 7:45 - 8:30
CBA 151

Bring music / earplugs

Test Review

Ex: Normal form of plane through
 $A = (1, 2, 3)$, $B = (6, 5, 4)$ and $C = (3, -3, -3)$?



$$\vec{AB} = [5, 3, 1] \text{ Think } B-A$$

$$\vec{AC} = [2, -5, -6]$$

$$\vec{n} = \vec{AB} \times \vec{AC} \\ = [-13, 32, -31]$$

$$\begin{array}{cccccc} 5 & 3 & 1 & 5 & 3 & \\ & \times & \times & \times & & \\ 2 & -5 & -6 & 2 & -5 & \end{array}$$

Normal Form $\vec{n} \cdot \vec{x} = \vec{n} \cdot \vec{p}$

$$\begin{bmatrix} -13 \\ 32 \\ -31 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -13 \\ 32 \\ -31 \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

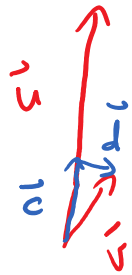
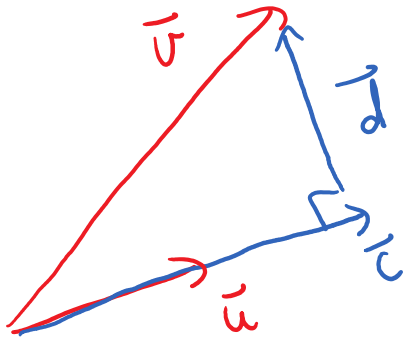
Ex: Let $\vec{u} = [1, -1, 2]$ and $\vec{v} = [3, 0, 4]$

Find \vec{c} and \vec{d} so that:

\vec{c} is parallel to \vec{u} ,

\vec{d} is perpendicular to \vec{u} , and

$$\vec{v} = \vec{c} + \vec{d}$$



$$\begin{aligned}\vec{c} &= \text{proj}_{\vec{u}} \vec{v} \\ &= \frac{\vec{u} \cdot \vec{v}}{\|\vec{u}\|^2} \vec{u} \\ &= \frac{11}{6} [1, -1, 2]\end{aligned}$$

$$\vec{v} = \vec{c} + \vec{d}$$

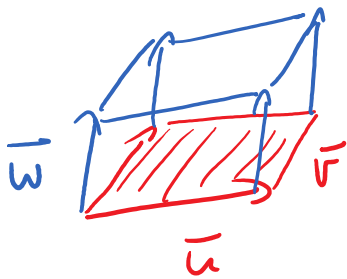
$$\vec{d} = \vec{v} - \vec{c}$$

$$= [3, 0, 4] - \frac{11}{6} [1, -1, 2]$$

$$= \frac{1}{6} [18, 0, 24] - \frac{1}{6} [11, -11, 22]$$

$$= \frac{1}{6} [7, 11, 2]$$

Ex: Volume of parallelepiped
formed by $\vec{u} = [-4, 2, 3]$,
 $\vec{v} = [2, 1, 2]$ and $\vec{w} = [3, -3, 6]$?



$V =$ absolute value of $\begin{vmatrix} -4 & 2 & 3 \\ 2 & 1 & 2 \\ 3 & -3 & 6 \end{vmatrix}$

$$= 1 - 4 \begin{vmatrix} 1 & 2 \\ -3 & 6 \end{vmatrix} - 2 \begin{vmatrix} 2 & 2 \\ 3 & 6 \end{vmatrix} + 3 \begin{vmatrix} 2 & 1 \\ 3 & -3 \end{vmatrix} \quad \begin{bmatrix} + & - & + \\ - & + & - \end{bmatrix}$$

$$= 1 - 4(12) - 2(6) + 3(-9)$$

$$= 1 - 87$$

$$= 87$$

Ex: Solve

$$\begin{bmatrix} 2 & -4 & 6 & | & 12 \\ 3 & 5 & 1 & | & 7 \\ 10 & 2 & 14 & | & 38 \end{bmatrix}$$

$$\frac{R_1}{2} \begin{bmatrix} 1 & -2 & 3 & | & 6 \\ 3 & 5 & 1 & | & 7 \\ 10 & 2 & 14 & | & 38 \end{bmatrix}$$

$$\begin{array}{l} R_2 - 3R_1 \\ R_3 - 10R_1 \end{array} \begin{bmatrix} 1 & -2 & 3 & | & 6 \\ 0 & 11 & -8 & | & -11 \\ 0 & 22 & -16 & | & -22 \end{bmatrix}$$

$$\frac{R_2}{11} \begin{bmatrix} 1 & -2 & 3 & | & 6 \\ 0 & 1 & -\frac{8}{11} & | & -1 \\ 0 & 22 & -16 & | & -22 \end{bmatrix}$$

$$\begin{array}{l} R_1 + 2R_2 \\ R_3 - 22R_2 \end{array} \begin{array}{c} x \quad y \quad z \\ \begin{bmatrix} 1 & 0 & \frac{17}{11} & | & 4 \\ 0 & 1 & -\frac{8}{11} & | & -1 \\ 0 & 0 & 0 & | & 0 \end{bmatrix} \end{array}$$

$$3 - \frac{16}{11} = \frac{33}{11} - \frac{16}{11}$$

RREF

$$z = t$$

$$x = 4 - \frac{17}{11}t$$

$$y = -1 + \frac{8}{11}t$$

$$x + \frac{17}{11}z = 4$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ -1 \\ 0 \end{bmatrix} + \begin{bmatrix} -\frac{17}{11} \\ \frac{8}{11} \\ 1 \end{bmatrix} t$$