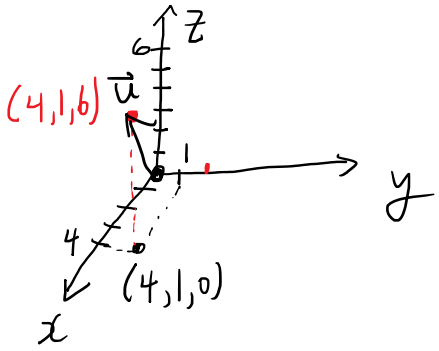
Ex: Draw $\vec{u} = [4,1,6]$ in $\mathbb{R}^3$



Ex: Let $\vec{u}$ in $\mathbb{R}^3$
Show that $\vec{u} + \vec{0} = \vec{u}$

Let $\vec{u} = [u_1, u_2, u_3]$

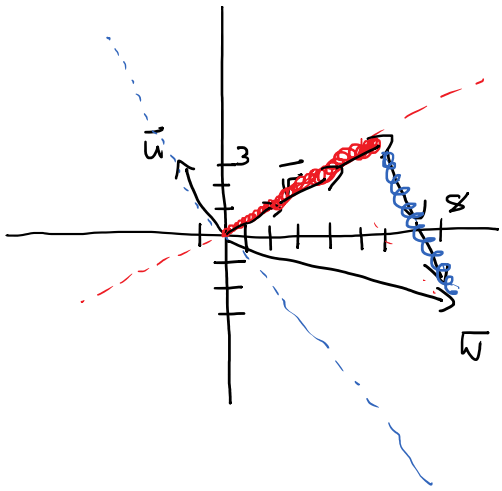
Start with more complicated side

$$\vec{u} + \vec{0} = [u_1, u_2, u_3] + [0, 0, 0]$$
$$= [u_1, u_2, u_3]$$
$$= \vec{u}$$

Ex: Write $\vec{w} = \begin{bmatrix} 8 \\ -3 \end{bmatrix}$ as a linear combination of $\vec{u} = \begin{bmatrix} -1 \\ 3 \end{bmatrix}$ and $\vec{v} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$ by graphing.

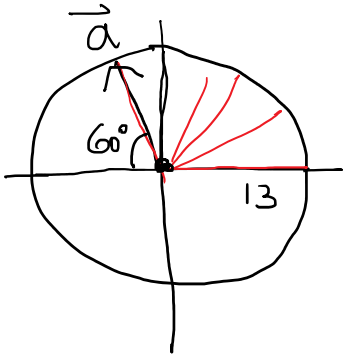
$$\vec{w} = c_1\vec{u} + c_2\vec{v}$$

$\vec{w} = \underbrace{c_1\vec{u} + c_2\vec{v}}_{\text{lin. com.}}$

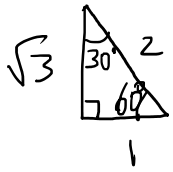


$\vec{w} = 3\vec{v} - 2\vec{u}$

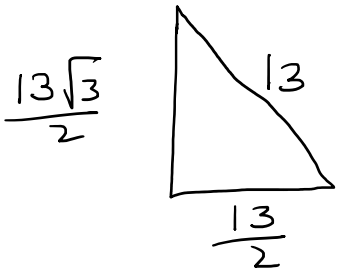
Ex:



Find $\vec{a}$



Multiply by $\frac{13}{2}$ (so hypotenuse = 13)



$\vec{d} = \left[\frac{-13}{2}, \frac{13\sqrt{3}}{2} \right]$

watch signs

Section 1.2

Ex: $\vec{a} = [1, 2, 3, 4]$ $\vec{b} = [-7, 6, 5, 1]$

Calculate:

a) $\vec{a} \cdot \vec{b} = -7 + 12 + 15 + 4$

$= 24$

b) $\vec{b} \cdot \vec{a}$

$= \vec{a} \cdot \vec{b}$

$= 24$

$\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a}$ for all vectors $\vec{a}, \vec{b}$

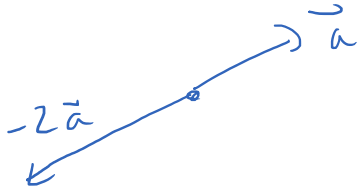
c) $\|\vec{a}\|$

$= \sqrt{1^2 + 2^2 + 3^2 + 4^2}$

$= \sqrt{30}$

d) $\|k\vec{a}\|$

$= |k|\sqrt{30}$



$\vec{a} = [1,2,3,4]$

$\vec{b} = [-7,6,5,1]$

e) $\|\vec{b}\|^2$

$= (-7)^2 + 6^2 + 5^2 + 1^2$

$= 111$

f) $\vec{b} \cdot \vec{b}$

$= 111$

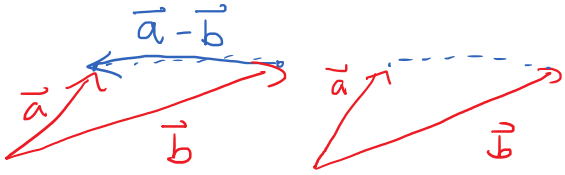
$\vec{b} \cdot \vec{b} = \|\vec{b}\|^2$ for every $\vec{b}$

$\vec{a} = [1,2,3,4]$

$\vec{b} = [-7,6,5,1]$

g) $d(\vec{a}, \vec{b})$

$= \|\vec{a} - \vec{b}\|$



$= \|[8,-4,-2,3]\|$

$= \| \langle 8, -4, -2, 3 \rangle \|$

$= \sqrt{64 + 16 + 4 + 9}$

$= \sqrt{93}$

h) $\vec{a} \cdot (\vec{b} \cdot \vec{a})$

vector · (#)

undefined

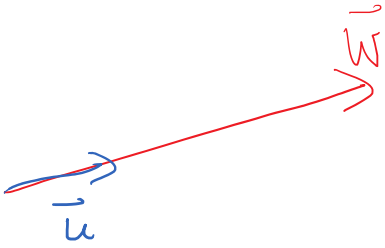
$\vec{u} \cdot \vec{v}$ is only defined when $\vec{u}, \vec{v}$ have the same # of components

$c\vec{v}$ is defined

$c \cdot \vec{v}$ is undefined

Ex: $\vec{w} = [-2, 3, 7]$ Normalize $\vec{w}$

(Find a ~~unit vector~~ in the same direction as $\vec{w}$)



$\| \vec{w} \| = \sqrt{4 + 9 + 49}$

$= \sqrt{62}$

$$\bar{u} = \frac{1}{\sqrt{62}}\bar{w} \quad \text{or} \quad \frac{1}{\sqrt{62}}[-2, 3, 7]$$