8-2 Vectors in the Coordinate Plane

Component Vector → breaking a vector into its x-component & y-component.

$\vec{v} = \langle x_2 - x_1, y_2 - y_1 \rangle$ initial point (x_1, y_1) terminal point (x_2, y_2)

order matters!
angle brackets!

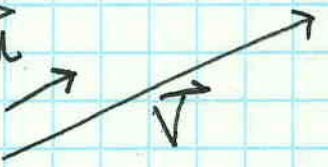
Magnitude → length of the vector
scalar value

$|\vec{v}| = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$ init / term. points

$|\langle a, b \rangle| = \sqrt{a^2+b^2}$ component vector

Unit Vector → direction vector

"mini" vector - magnitude of 1



$$\vec{u} = \frac{\vec{v}}{|\vec{v}|} = \frac{1}{|\vec{v}|}\vec{v}$$

$= 1$

Operations with Vectors $\vec{a} = \langle a_1, a_2 \rangle$ $\vec{b} = \langle b_1, b_2 \rangle$

$\vec{a} + \vec{b} = \langle a_1 + b_1, a_2 + b_2 \rangle$ addition

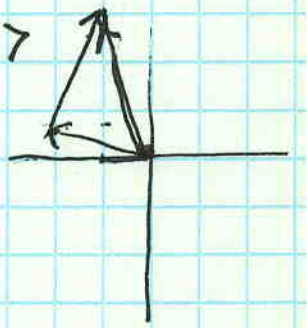
$\vec{a} - \vec{b} = \langle a_1 - b_1, a_2 - b_2 \rangle$ subtraction

$K\vec{a} = \langle Ka_1, Ka_2 \rangle$ scalar multiplication.

you <u>cannot</u> multiply vectors directly.
(vectors use a dot-product)

Ex 3: Operations

$\vec{w} = \langle -4, 1 \rangle \quad \vec{y} = \langle 2, 5 \rangle \quad \vec{z} = \langle -3, 0 \rangle$



$\vec{w} + \vec{y} = \langle (-4+2), (1+5) \rangle = \langle -2, 6 \rangle$

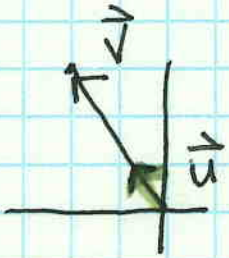
$2\vec{w} + 4\vec{y} - \vec{z} =$

$2\langle -4, 1 \rangle + 4\langle 2, 5 \rangle - \langle -3, 0 \rangle$

$\langle -8, 2 \rangle + \langle 8, 20 \rangle + \langle 3, 0 \rangle = \langle 3, 22 \rangle$

Ex: 4 Unit Vector

Find $\vec{u}$ for $\vec{v} = \langle -2, 3 \rangle$



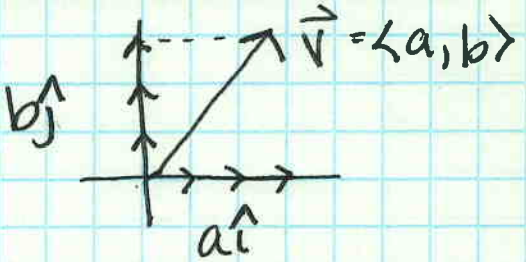
$\vec{u} = \frac{1}{|\vec{v}|}\vec{v} = \frac{1}{|\langle -2, 3 \rangle|}\langle -2, 3 \rangle$

$\frac{1}{\sqrt{-2^2+3^2}}\langle -2, 3 \rangle = \frac{1}{\sqrt{13}}\langle -2, 3 \rangle = \langle -\frac{2}{\sqrt{13}}, \frac{3}{\sqrt{13}} \rangle$

$\vec{u} = \langle -\frac{2\sqrt{13}}{13}, \frac{3\sqrt{13}}{13} \rangle$

Standard Unit Vectors and Linear Combination

$\hat{i} = \langle 1, 0 \rangle \quad \hat{j} = \langle 0, 1 \rangle$



Linear Combination

$\vec{v} = a\hat{i} + b\hat{j}$

$\vec{v} = \langle a, b \rangle$

$\vec{v} = \langle a, 0 \rangle + \langle 0, b \rangle$ (sum of components)

$\vec{v} = a\langle 1, 0 \rangle + b\langle 0, 1 \rangle$ (factor out scalar)

$\vec{v} = a\hat{i} + b\hat{j}$

$\langle a, b \rangle \rightarrow a\hat{i} + b\hat{j}$