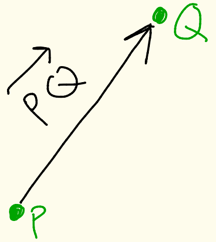
Math 2120

3-26-20

Thursday

11.1/11.2 continued...

Notation: $\overrightarrow{PQ}$



P initial point

Q terminal point

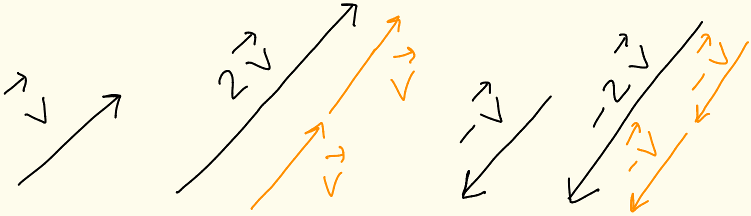
scalar (← number) multiplication of vectors

Let c be a scalar and $\vec{v}$ be a vector.

If $c > 0$, then $c\vec{v}$ is the vector pointing in the direction of $\vec{v}$ whose length is c times the length of $\vec{v}$.

If $c < 0$, then $c\vec{v}$ is the vector pointing in the opposite direction of $\vec{v}$ whose length is $|c|$ times the length of $\vec{v}$.

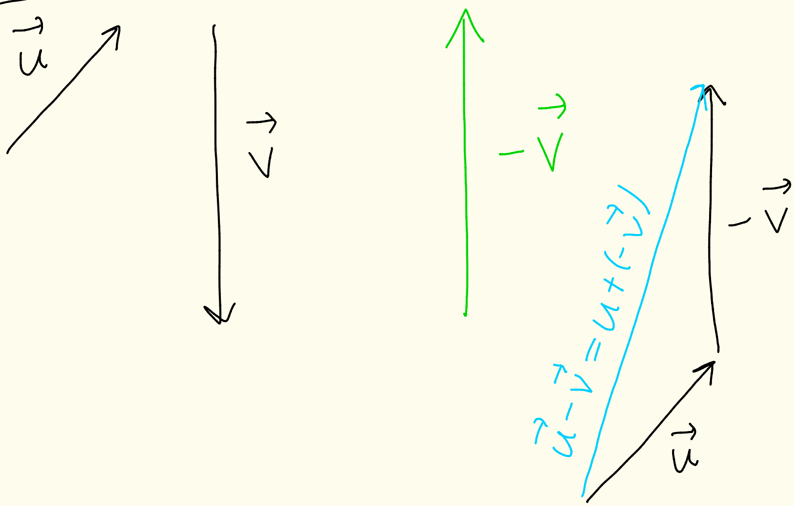
If $c = 0$, then $c\vec{v} = 0\vec{v} = \vec{0}$.



Subtracting vectors:

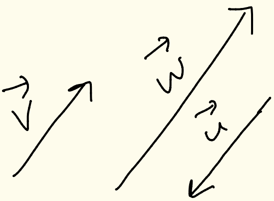
$\vec u - \vec v$ is defined as $\vec u + (-\vec v)$.

Ex:



Def: Two vectors are parallel if they are a scalar multiple of each other.

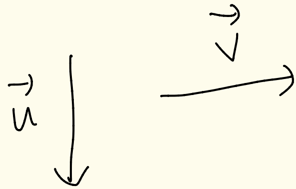
Ex:



$\vec{v}$ and $\vec{w}$ are parallel since $\vec{w} = 2\vec{v}$

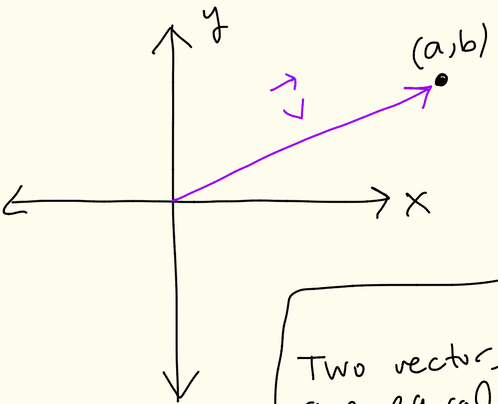
$\vec{v}$ and $\vec{u}$ are parallel since $\vec{u} = -\vec{v}$.

Ex:



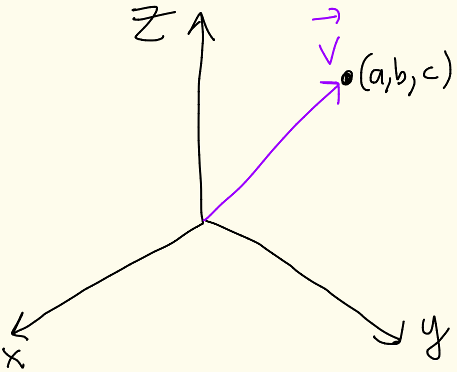
not parallel
not multiples of each other

In a coordinate system, we can place a vector so that its inital point is the origin. This is called the standard position of a vector.



If (a,b) is the terminal point of $\vec{v}$ in standard position then we write $\vec{v} = \langle a, b \rangle$.

Two vectors $\vec{w}_1 = \langle a_1, b_1 \rangle$ and $\vec{w}_2 = \langle a_2, b_2 \rangle$ are equal if and only if $a_1 = a_2$ and $b_1 = b_2$



If (a,b,c) is the terminal point of $\vec{v}$ then we write $\vec{v} = \langle a, b, c \rangle$

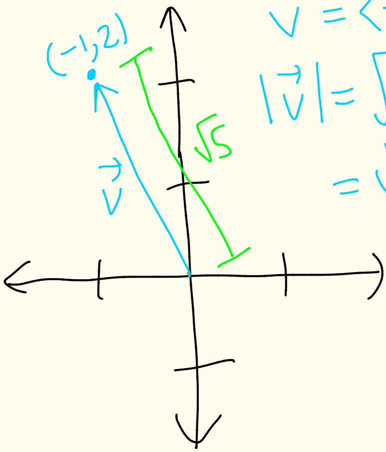
Two vectors $\vec{w}_1 = \langle a_1, b_1, c_1 \rangle$ and $\vec{w}_2 = \langle a_2, b_2, c_2 \rangle$ are equal if and only if $a_1 = a_2$, $b_1 = b_2$, $c_1 = c_2$.

Magnitude of vectors

In 2d, if $\vec{v} = \langle a, b \rangle$, then its magnitude, denoted by $|\vec{v}|$ or $\|\vec{v}\|$, is $|\vec{v}| = \sqrt{a^2 + b^2}$

In 3d, if $\vec{w} = \langle a, b, c \rangle$, then its magnitude, denoted by $|\vec{w}|$ or $\|\vec{w}\|$, is $|\vec{w}| = \sqrt{a^2 + b^2 + c^2}$

Ex:

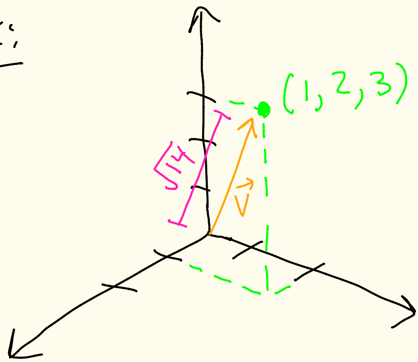


$\vec{v} = \langle -1, 2 \rangle$

$|\vec{v}| = \sqrt{(-1)^2 + 2^2}$

$= \sqrt{5}$

Ex:



$\vec{v} = \langle 1, 2, 3 \rangle$

$|\vec{v}| = \sqrt{1^2 + 2^2 + 3^2} = \sqrt{14}$

Adding, subtracting, scalar multiplication

pg 6

2d $\vec{v} = \langle a, b \rangle$, $\vec{w} = \langle e, f \rangle$, α is a scalar

$\vec{v} + \vec{w} = \langle a+e, b+f \rangle$

$\vec{v} - \vec{w} = \langle a-e, b-f \rangle$

$\alpha v = \langle \alpha a, \alpha b \rangle$

3d $\vec{v} = \langle a, b, c \rangle$, $\vec{w} = \langle e, f, g \rangle$

α is a scalar

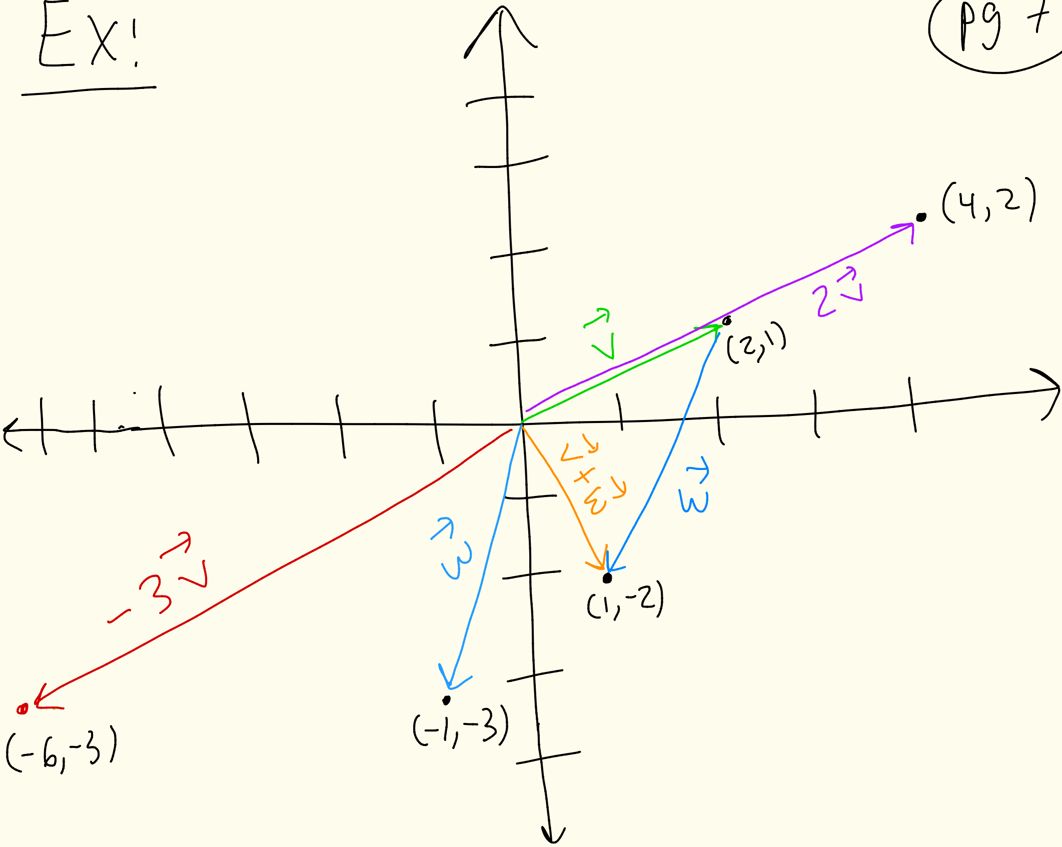
$\vec{v} + \vec{w} = \langle a+e, b+f, c+g \rangle$

$\vec{v} - \vec{w} = \langle a-e, b-f, c-g \rangle$

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

$\alpha \leftarrow$ alpha
greek letter

Ex!



$$\vec{v} = \langle 2, 1 \rangle$$

$$\vec{w} = \langle -1, -3 \rangle$$

$$\vec{v} + \vec{w} = \langle 2-1, 1-3 \rangle = \langle 1, -2 \rangle$$

$$2\vec{v} = \langle 2 \cdot 2, 2 \cdot 1 \rangle = \langle 4, 2 \rangle$$

$$-3\vec{v} = \langle -3 \cdot 2, -3 \cdot 1 \rangle = \langle -6, -3 \rangle$$