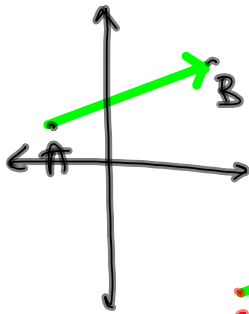


How do we operate with vectors?

$\vec{AB}$: from A to B.

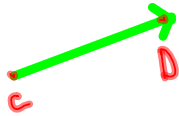
↪ direction
magnitude



$A(-2,1)$

$B(5,4)$

$\vec{AB} \langle 7, 3 \rangle$



$\vec{AB} \cong \vec{CD}$

Find $\vec{AB}$

1) $A(1,6)$

$B(-2,1)$

$\vec{AB} \langle -3, -5 \rangle$

$= -3i + -5j$

$= -3i - 5j$

2) $A(1,1,6)$

$B(2,0,5)$

$\vec{AB} \langle 1, -1, -1 \rangle$

$= i - j - k$

$i = \langle 1, 0, 0 \rangle$

$j = \langle 0, 1, 0 \rangle$

$k = \langle 0, 0, 1 \rangle$

operation ① scalar multiplication.

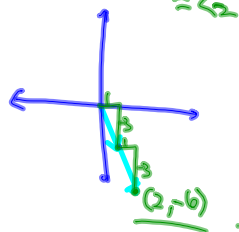
ex) $-3i = -3 \langle 1, 0 \rangle$ let $s \langle a, b, c \rangle$

$= \langle -3, 0 \rangle$

$= \langle sa, sb, sc \rangle$

ex) $2 \langle 1, -3 \rangle \rightarrow$ two of $\langle 1, -3 \rangle$

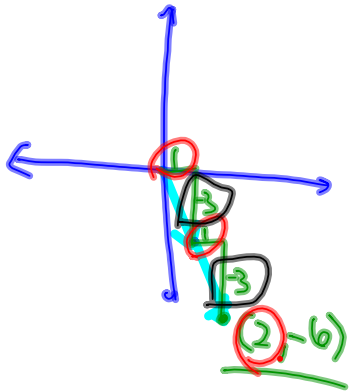
$= \langle 2, -6 \rangle$



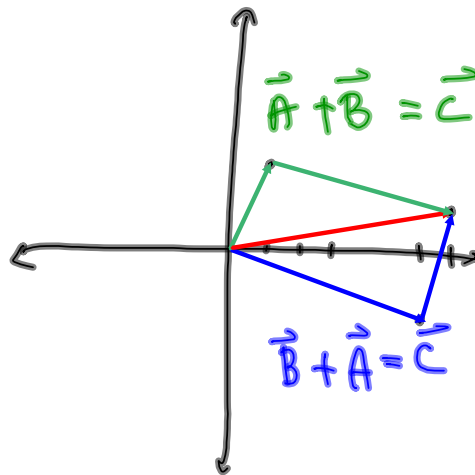
sum of vectors.

$$\vec{A} \quad \vec{B} \quad \vec{C}$$

$$\langle 1, 3 \rangle + \langle 6, -2 \rangle = \langle 7, 1 \rangle$$



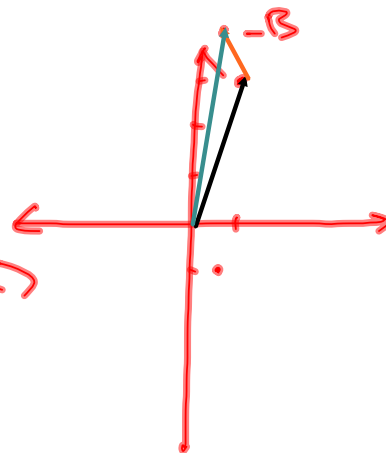
* commutative.



Let $\vec{A} = \langle 2, 6 \rangle$
 $\vec{B} = \langle 1, -2 \rangle$

What is $\vec{A} - \vec{B}$

$$\begin{aligned} \vec{A} + (-1)\vec{B} &= \langle 2, 6 \rangle + (-1)\langle 1, -2 \rangle \\ &= \langle 2, 6 \rangle + \langle -1, 2 \rangle \\ &= \langle 1, 8 \rangle \end{aligned}$$



magnitude.

 $\vec{AB}$ $A(2, 3)$ $B(-1, 5)$

1) Find $\vec{AB} \langle -3, 2 \rangle$ $|\langle a, b \rangle| = \sqrt{a^2 + b^2}$

2) Find $|\vec{AB}| = \sqrt{13}$

3) Let $A(2, 1, 6)$

$B(-1, 0, 4)$

 $|\vec{AB}|$

$$\sqrt{9+1+4} = \sqrt{14}$$

$$\vec{AB} \langle 1, 2 \rangle$$

$$\vec{CD} \langle 3, 6 \rangle$$

$$\frac{\vec{AB}}{|\vec{AB}|} = \frac{\langle 1, 2 \rangle}{\sqrt{5}}$$

$$= \left\langle \frac{1}{\sqrt{5}}, \frac{2}{\sqrt{5}} \right\rangle$$

$$\frac{\vec{CD}}{|\vec{CD}|} = \frac{\langle 3, 6 \rangle}{\sqrt{45}}$$

$$= \left\langle \frac{3}{\sqrt{45}}, \frac{6}{\sqrt{45}} \right\rangle$$

$$= \left\langle \frac{1}{\sqrt{5}}, \frac{2}{\sqrt{5}} \right\rangle$$