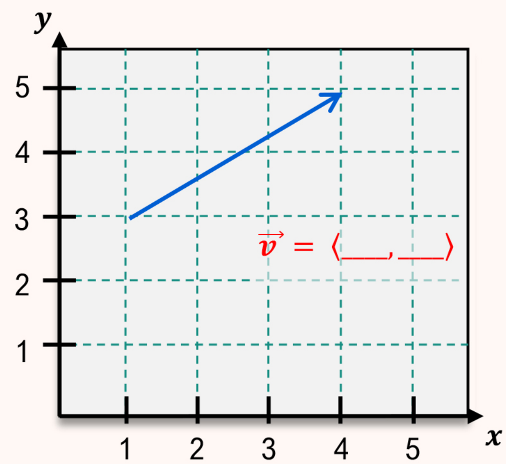
TOPIC: VECTORS IN COMPONENT FORM

Position Vectors & Component Form

◆ If a vector has its **[INITIAL | TERMINAL]** point drawn at the origin, it is a **position vector**.

- The **component form** $\langle v_x, v_y \rangle$ represents ____________ in the x & y directions.

New **Position Vectors**

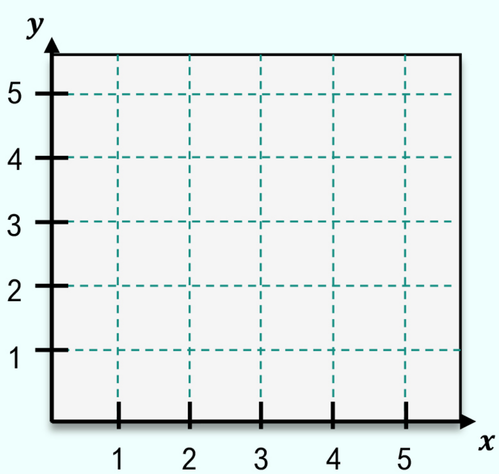


◆ Given initial pt (x_1, y_1) & terminal pt (x_2, y_2), subtract respective x & y coordinates to find component form.

New

$$\vec{v} = \langle v_x, v_y \rangle = \langle x_2 - x_1, y_2 - y_1 \rangle$$

EXAMPLE A vector has initial point $(2,3)$ and terminal point $(3,5)$. Without drawing, write the vector in component form.

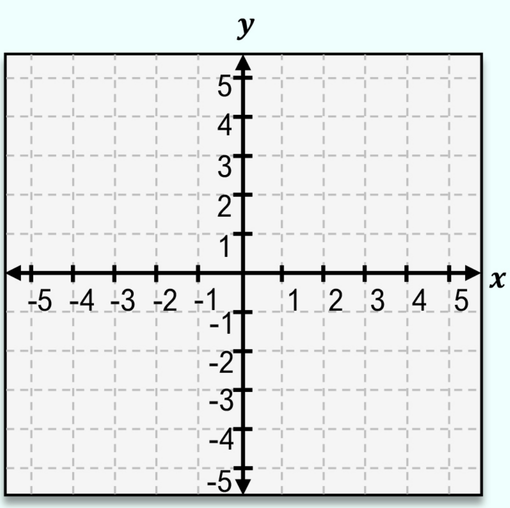


TOPIC: VECTORS IN COMPONENT FORM

PRACTICE True or false: If $\vec{a} = \langle 3, 2 \rangle$ and $\vec{b}$ has initial point $(3, -1)$ & terminal point $(6,1)$, then $\vec{a} = \vec{b}$.

PRACTICE True or false: If $\vec{a} = \langle 3, -2 \rangle$ and $\vec{b}$ has initial point $(-10, 5)$ & terminal point $(-7, 3)$, then $\vec{a} = \vec{b}$.

EXAMPLE If $\vec{v}$ has init. point $(4,3)$ & term. point $(1,2)$, write $\vec{v}$ in component form and sketch its position vector.

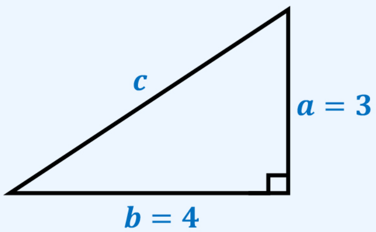


TOPIC: VECTORS IN COMPONENT FORM

Finding Magnitude of a Vector

- Recall: The **magnitude** (*how much*) of a vector represents the ___________.
  - Calculate by forming a right triangle with the vector's components & using the **Pythagorean Theorem**.

Recall — **Pythagorean Theorem**



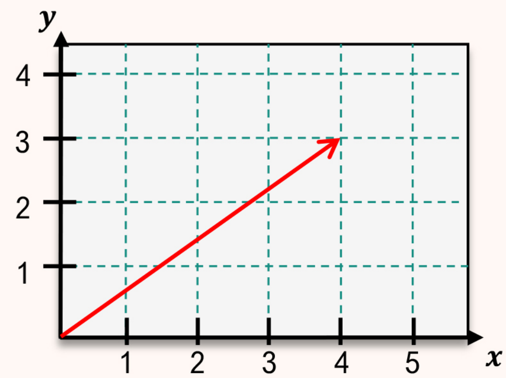
$$a^2 + b^2 = c^2$$
$$c = \sqrt{a^2 + b^2}$$

$$c = \sqrt{4^2 + 3^2}$$
$$c = \sqrt{16 + 9} = \sqrt{25} = 5$$

New — **Magnitude of a Vector**

$\vec{v} = \langle v_x, v_y \rangle = \langle \_\_, \_\_ \rangle$

$$|\vec{v}| = \sqrt{\_\_\_^2 + \_\_\_^2}$$



EXAMPLE Calculate the magnitude of $\overrightarrow{PQ}$ from $P = (1,2)$ to $Q = (5,3)$.

Recall

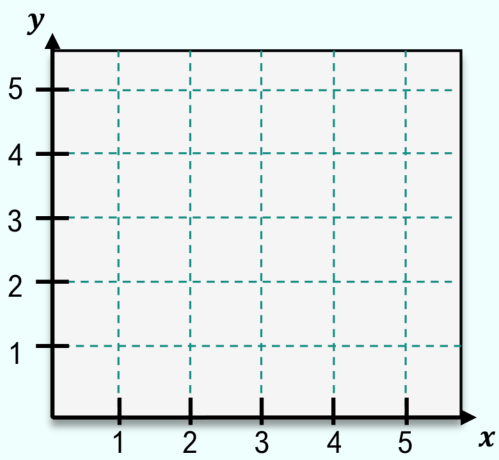
$$\vec{v} = \langle v_x, v_y \rangle = \langle x_2 - x_1, y_2 - y_1 \rangle$$

TOPIC: VECTORS IN COMPONENT FORM

PRACTICE If vector $\vec{v} = \langle -4, -10 \rangle$, calculate the magnitude $|\vec{v}|$.

PRACTICE If vector $\vec{v}$ has initial point $(-1,2)$ & terminal point $(9,5)$, calculate the magnitude $|\vec{v}|$.

EXAMPLE If $\vec{v}$ has init. point $(1,2)$ & term. point $(4,4)$ sketch $\vec{v}$ as a position vector and calculate $|\vec{v}|$.

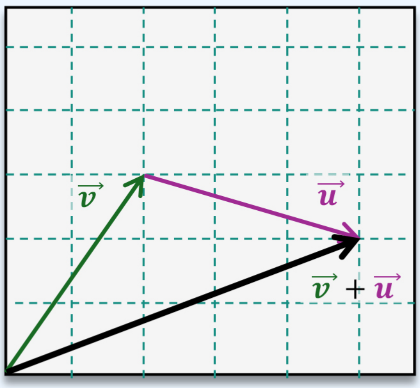


TOPIC: VECTORS IN COMPONENT FORM

Algebraic Operations on Vectors

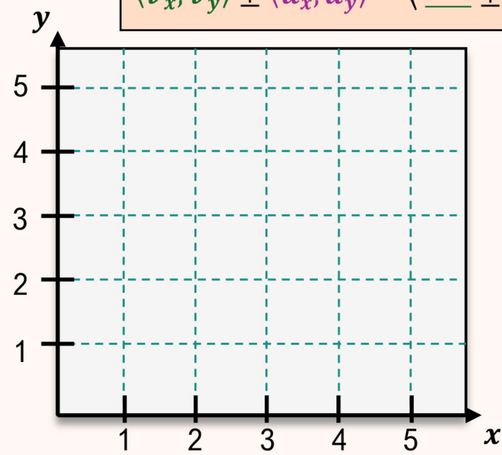
- To add or subtract vectors algebraically, add or subtract their x & y ________________, respectively.

Recall — **Add/Subtract Vectors Geometrically**



New — **Add/Subtract Vectors Algebraically**

$$\langle v_x, v_y \rangle \pm \langle u_x, u_y \rangle = \langle \_\_\_ \pm \_\_\_ , \_\_\_ \pm \_\_\_ \rangle$$



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

$\vec{v} + \vec{u} = \langle \_\_\_ + \_\_\_ , \_\_\_ + \_\_\_ \rangle$

$= \langle \_\_\_ , \_\_\_ \rangle$

- To multiply a vector by a scalar, ____________ the scalar to each x & y component.

New $k \cdot \langle v_x, v_y \rangle = \langle \_ \cdot v_x, \_ \cdot v_y \rangle$

EXAMPLE Given the vectors $\vec{v} = \langle 8,5 \rangle$ and $\vec{u} = \langle 2,4 \rangle$, find the vector $\vec{v} - 3\vec{u}$.

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PRACTICE If vectors $\vec{v} = \langle 2,1 \rangle$, $\vec{u} = \langle 3,4 \rangle$, and $\vec{w} = \langle -1,1 \rangle$, calculate $\vec{v} + \vec{u} - \vec{w}$.

PRACTICE If vectors $\vec{v} = \langle 4,1 \rangle$, $\vec{u} = \langle -8,3 \rangle$, and $\vec{w} = \langle -2,-1 \rangle$, calculate $\vec{w} - 3(\vec{v} + \vec{u})$.

EXAMPLE If vectors $\vec{a} = \langle 3,1 \rangle$, $\vec{b} = \langle -4,9 \rangle$ and $\vec{c} = 5\vec{a} - 2\vec{b}$, calculate the magnitude $|\vec{c}|$.