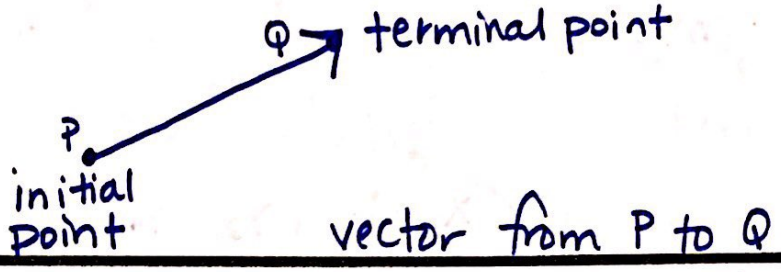
Intro to Vectors

A vector is a quantity that has both magnitude (size) and direction.

To represent them, we use directed line segments.

The segments have an initial point and a terminal point.

At the terminal point, we represent the direction of the vector with an arrow head.



Notations for Vectors

- using points: $\overrightarrow{PQ}$ *(use a half arrow over the points in order)*
- using vector name (typed): **v** *(bold lowercase letter)*
- using vector name (handwritten): $\vec{v}$ *(lowercase letter with half arrow)*

Notation for Magnitude $\|\overrightarrow{PQ}\|$ $\|\mathbf{v}\|$ $\|\vec{v}\|$

Vectors are equal if they have the same magnitude AND direction.

Location does not matter when determining if vectors are equal.

To show that two vectors are equal, show that their magnitude is the same and that they travel in exactly the same direction.

To find magnitude: use the distance formula: $d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

To show directions are equal, use the slope formula: $m = \dfrac{y_2-y_1}{x_2-x_1}$

Example: Determine if each of the following pairs of vectors are equal. If not, state why not.

	Initial Point	Terminal Point
1.	A(2, 2)	B(5, 7)
	R(4, 3)	S(7, 8)

$\|\overrightarrow{AB}\| = \sqrt{(5-2)^2+(7-2)^2}$

$= \sqrt{9+25}$

$= \sqrt{34}$ ✓

$m = \dfrac{7-2}{5-2} = \dfrac{5}{3}$ ✓

$\|\overrightarrow{RS}\| = \sqrt{(7-4)^2+(8-3)^2}$

$= \sqrt{9+25}$

$= \sqrt{34}$ ✓

$m = \dfrac{8-3}{7-4} = \dfrac{5}{3}$ ✓

So, $\overrightarrow{RS} = \overrightarrow{AB}$

Vectors are said to be in "Standard Position" if its initial point is (re-)located at the origin.

Most vectors can be thought of as position vectors because any vector can be re-positioned at the origin.

By initiating a vector at the origin, we can easily manipulate the horizontal and vertical components of the vector.

The Component form of a vector is written as the "end point" when the vector is in standard position (initial point at the origin).

The component form of the vector from P(a, b) to Q(c, d) can be found by subtracting the components of each point.

<c-a, d-b>

$\langle x_2 - x_1, y_2 - y_1 \rangle$

terminal point — initial point

This is also called the position vector.

Example: Find the component form and the magnitude of the vector.

Initial Point	Terminal Point
1. A(3, -2)	B(7, 3)

CF: $\langle 7-3, 3--2 \rangle$

$\boxed{\langle 4, 5 \rangle}$

$\|\overrightarrow{AB}\| = \sqrt{(7-3)^2 + (3--2)^2}$ OR $\sqrt{4^2+5^2}$

$= \sqrt{16+25}$ $= \sqrt{16+25}$

$= \sqrt{41}$ $= \sqrt{41}$