# MAT1375, Classwork24, Fall2025

*Ch22. Vectors in the Plane*

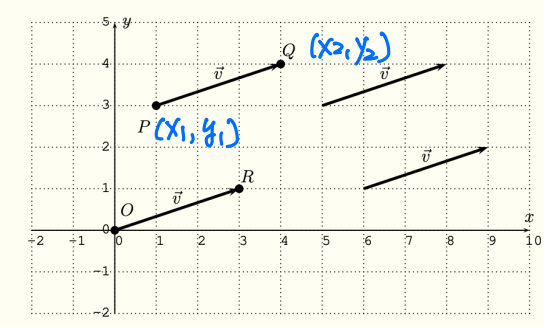
1. Definition of a geometric vector:

A geometric vector $\overrightarrow{PQ}$ is a directed line segment with a direction and a magnitude.

The magnitude of $\overrightarrow{PQ}$ is its length, denoted by $|\overrightarrow{PQ}|$ or $|PQ|$.

2. How to find and present a vector:

Given a vector $\vec{v} = \overrightarrow{PQ}$. We call $P$ the initial point and $Q$ the terminal point.




We find $\vec{v} = \overrightarrow{PQ}$ by $P(x_1, y_1)$ and $Q(x_2, y_2)$:

$$\vec{v} = (x_2 - x_1)\mathbf{i} + (y_2 - y_1)\mathbf{j} \text{ or } \langle x_2 - x_1, y_2 - y_1 \rangle,$$

where $\mathbf{i} = \langle 1, 0 \rangle$ and $\mathbf{j} = \langle 0, 1 \rangle$.

The magnitude of $\vec{v}$ is $\|\vec{v}\| =$ _____.

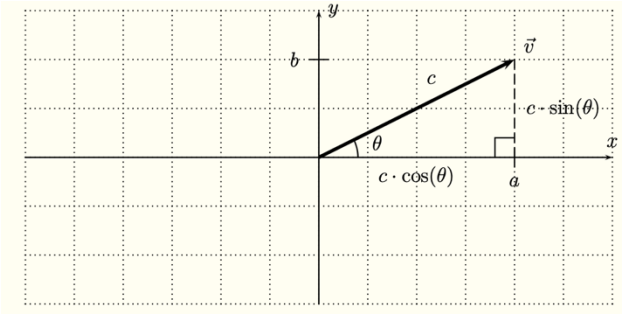
Any vectors with the same _____ and _____ are equivalent.

3. Direction angle:

Let $\vec{v} = \langle a, b \rangle = \overrightarrow{OR}$ be a vector with original point _____ as the initial point of $\vec{v}$ and $R(\quad, \quad)$ as the terminal point of $\vec{v}$.

The _____ of $\vec{v}$ is the angle $\theta$ determined by $\overrightarrow{OR}$:

$c =$ _____ is the _____ of $\vec{v}$ and we have $\sin(\theta) =$ , $\cos(\theta) =$ , and $\tan(\theta) =$ .

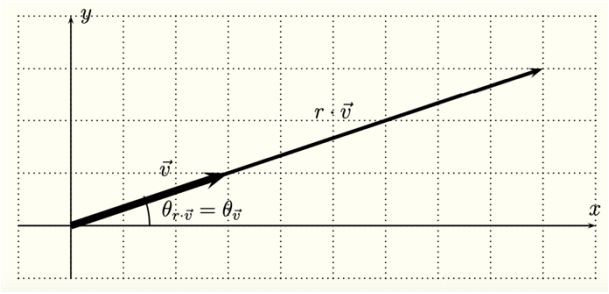



4. The vector $\vec{v}$ can be presented by its length _____ and direction angle _____:

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

5. Operations on vectors: Let $\vec{v} = \langle a, b \rangle$ and $\vec{w} = \langle c, d \rangle$

Scalar multiplication: $r\vec{v} = r \cdot \langle a, b \rangle = \langle \quad , \quad \rangle$

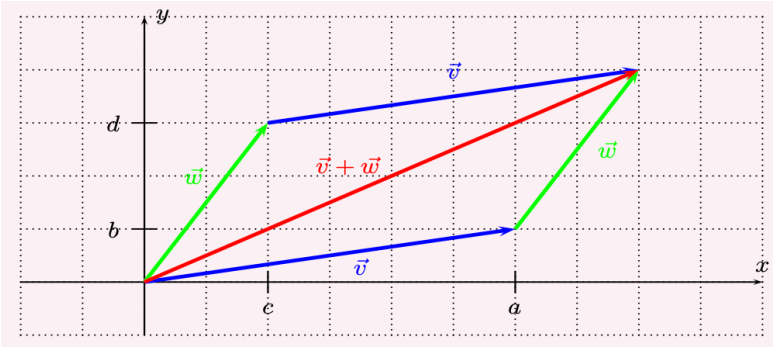



$\boldsymbol{r > 0}$:

$\boldsymbol{r < 0}$:

**Unit vector of $\vec{v}$**: $r\vec{v}$ where $r =$ and we have $r\vec{v} =$ .

Vector addition: $\vec{v} + \vec{w} = \langle a, b \rangle + \langle c, d \rangle = \langle \quad , \quad \rangle$




6. Let $\vec{v} = \langle 3, 4 \rangle$ and $\vec{w} = 4\mathbf{i} - 9\mathbf{j}$. Find (a) the directional angle of $\vec{v}$, (b) the unit vector of $\vec{v}$, (c) $\vec{v} + \vec{w}$, and (d) $2\vec{v} - 3\vec{w}$