

A **unit vector** is a **vector** with magnitude of 1.

$$\mathbf{u} = \langle 1, 0 \rangle \quad \|\mathbf{u}\| = 1$$

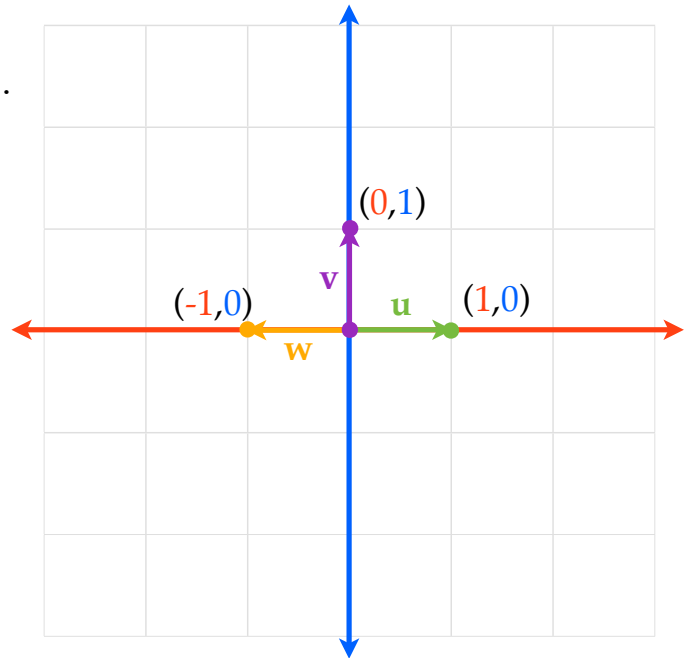
$\mathbf{u}$ is a unit vector

$$\mathbf{v} = \langle 0, 1 \rangle \quad \|\mathbf{v}\| = 1$$

$\mathbf{v}$ is a unit vector

$$\mathbf{w} = \langle -1, 0 \rangle \quad \|\mathbf{w}\| = 1$$

$\mathbf{w}$ is a unit vector



A **vector** can be expressed in component form

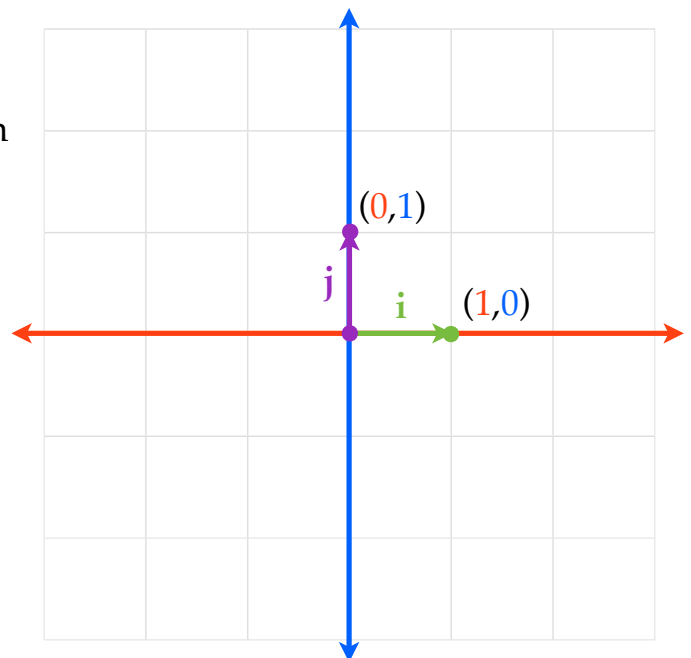
$$\mathbf{v} = \langle a, b \rangle$$

a is the **horizontal** component

b is the **vertical** component

Let $\mathbf{i} = \langle 1, 0 \rangle$ and $\mathbf{j} = \langle 0, 1 \rangle$, then
any **vector** $\mathbf{v} = \langle a, b \rangle$, can be expressed as

$$\mathbf{v} = a\langle 1, 0 \rangle + b\langle 0, 1 \rangle = a\mathbf{i} + b\mathbf{j}$$



$$\mathbf{v} = \langle a, b \rangle = a\langle 1, 0 \rangle + b\langle 0, 1 \rangle = a\mathbf{i} + b\mathbf{j}$$

$$\mathbf{v} = \langle 2, 3 \rangle$$

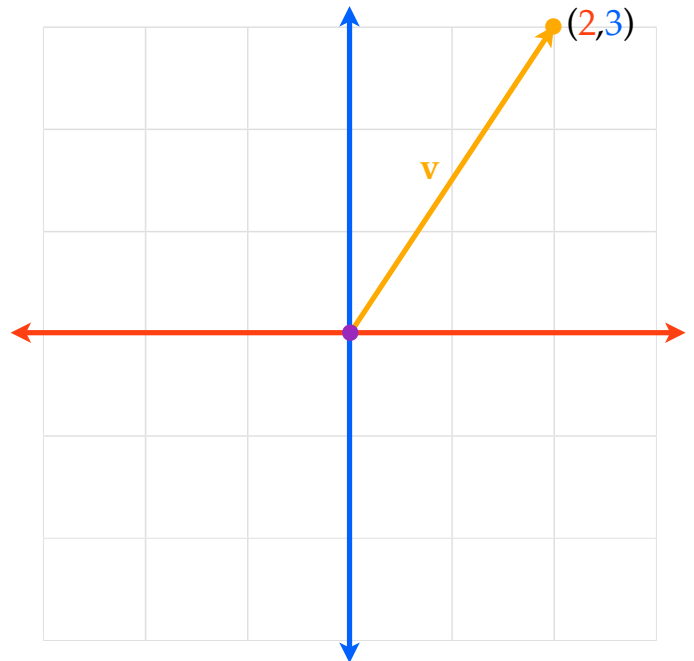
$a = 2$, horizontal component

$b = 3$, vertical component

$$\mathbf{v} = 2\langle 1, 0 \rangle + 3\langle 0, 1 \rangle$$

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

$$\mathbf{v} = 2\mathbf{i} + 3\mathbf{j}$$



$$\mathbf{v} = \langle a, b \rangle = a\langle 1, 0 \rangle + b\langle 0, 1 \rangle = a\mathbf{i} + b\mathbf{j}$$

$$\mathbf{v} = \langle -3, -2 \rangle$$

$a = -3$, horizontal component

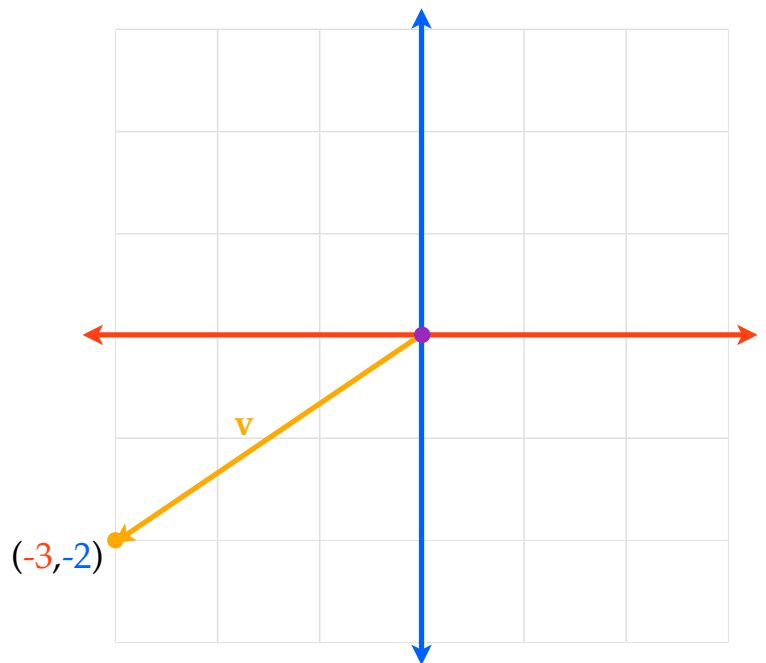
$b = -2$, vertical component

$$\mathbf{v} = -3\langle 1, 0 \rangle + -2\langle 0, 1 \rangle$$

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

$$\mathbf{v} = -3\mathbf{i} + -2\mathbf{j}$$

$$\mathbf{v} = -3\mathbf{i} - 2\mathbf{j}$$



$$\mathbf{v} = \langle a, b \rangle = a\langle 1, 0 \rangle + b\langle 0, 1 \rangle = a\mathbf{i} + b\mathbf{j}$$

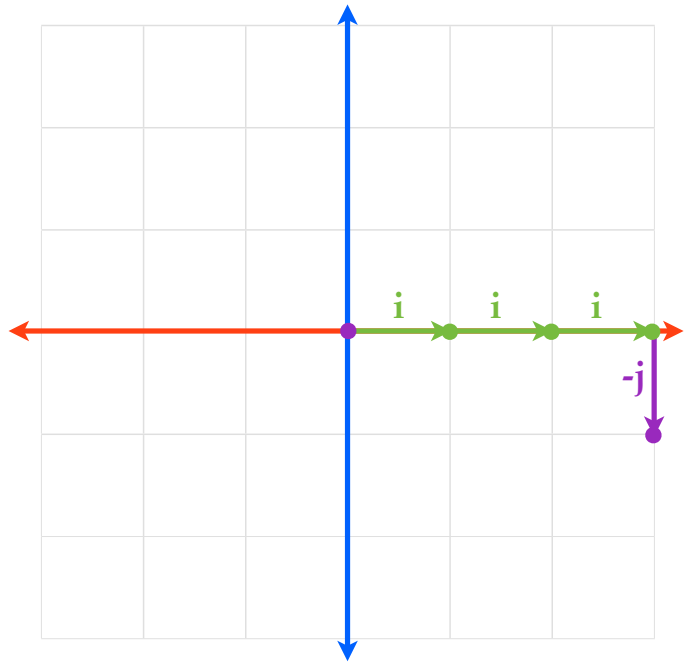
$$\mathbf{v} = 3\mathbf{i} - \mathbf{j}$$

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

$a = 3$, horizontal component

$b = -1$, vertical component

$$\mathbf{v} = \langle 3, -1 \rangle$$



$$\mathbf{v} = \langle a, b \rangle = a\langle 1, 0 \rangle + b\langle 0, 1 \rangle = a\mathbf{i} + b\mathbf{j}$$

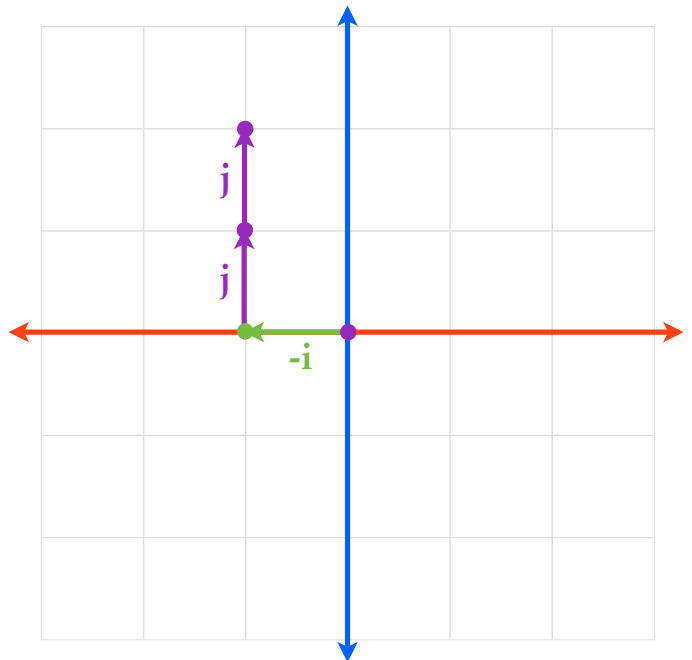
$$\mathbf{v} = -\mathbf{i} + 2\mathbf{j}$$

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

$a = -1$, horizontal component

$b = 2$, vertical component

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



Given a **vector** expressed in $\langle a, b \rangle$ component form...

$$\mathbf{v} = \langle a, b \rangle = a\mathbf{i} + b\mathbf{j}$$

Given a **vector** expressed in $a\mathbf{i} + b\mathbf{j}$ form...

$$\mathbf{v} = a\mathbf{i} + b\mathbf{j} = \langle a, b \rangle$$