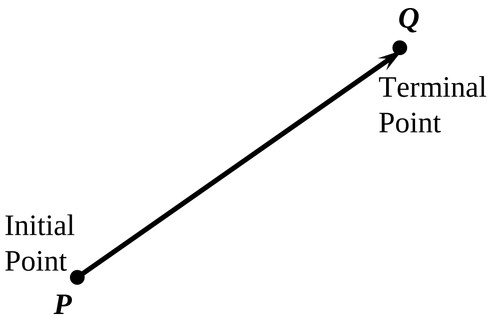
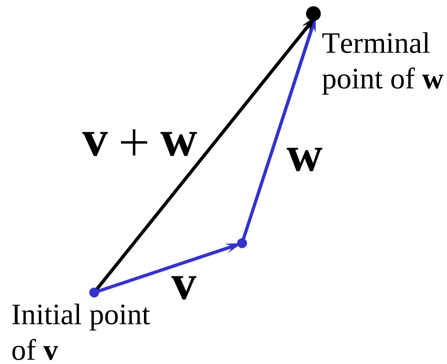


Directed line segment



Vector addition is **commutative.**

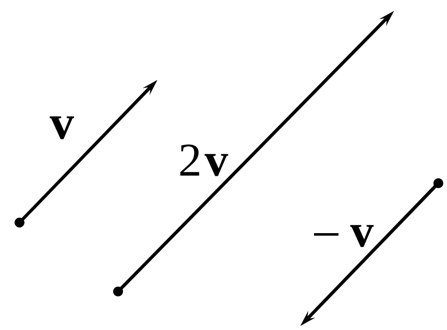
$$\mathbf{v} + \mathbf{w} = \mathbf{w} + \mathbf{v}$$

Vector addition is **associative.**

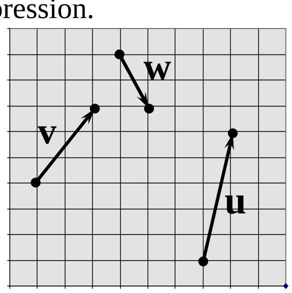
$$\mathbf{u} + (\mathbf{v} + \mathbf{w}) = (\mathbf{u} + \mathbf{v}) + \mathbf{w}$$

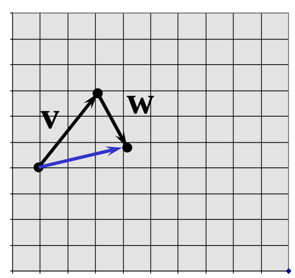
$$\mathbf{v} + \mathbf{0} = \mathbf{0} + \mathbf{v} = \mathbf{v}$$

$$\mathbf{v} + (-\mathbf{v}) = 0$$

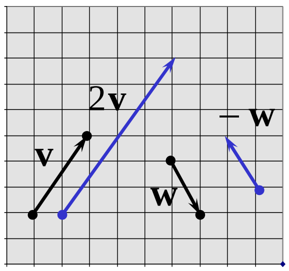


Use the vectors illustrated below to graph each expression.

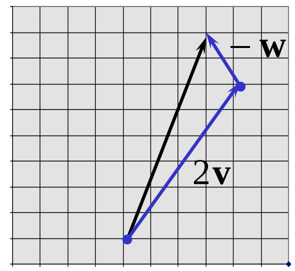




$\mathbf{v} + \mathbf{w}$



$2\mathbf{v}$ and $-\mathbf{w}$



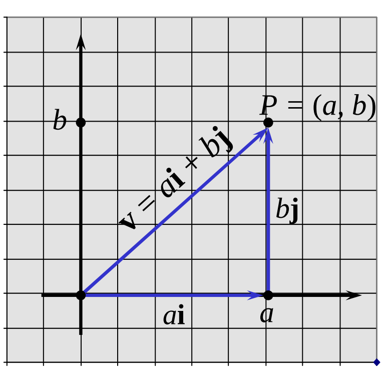
$2\mathbf{v} - \mathbf{w}$

If $\mathbf{v}$ is a vector, we use the symbol $\|\mathbf{v}\|$ to represent the **magnitude** of $\mathbf{v}$.

A vector $\mathbf{u}$ for which $\|\mathbf{u}\| = 1$ is called a **unit vector**.

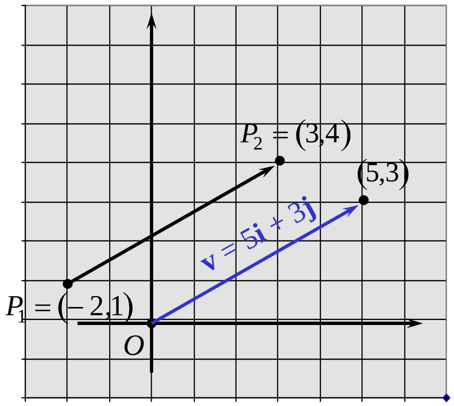
Let **i** denote a unit vector whose direction is along the positive *x*-axis; let **j** denote a unit vector whose direction is along the positive *y*-axis. If **v** is a vector with initial point at the origin *O* and terminal point at $P = (a, b)$, then

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



Find the position vector of the vector $\mathbf{v} = \overrightarrow{P_1P_2}$ if $P_1 = (-2,1)$ and $P_2 = (3,4)$.

$$\mathbf{v} = (x_2 - x_1)\mathbf{i} + (y_2 - y_1)\mathbf{j}$$



If $\mathbf{v} = 3\mathbf{i} + 2\mathbf{j}$ and $\mathbf{w} = -4\mathbf{i} + \mathbf{j}$, find

(a) $2\mathbf{v} + 3\mathbf{w}$ (b) $\|\mathbf{v}\|$

Theorem Unit Vector in Direction of v

For any nonzero vector **v**, the vector

$$\mathbf{u} = \frac{\mathbf{v}}{\|\mathbf{v}\|}$$

is a unit vector that has the same direction as **v**.

Find a unit vector in the same direction as v = 3i - 5j.