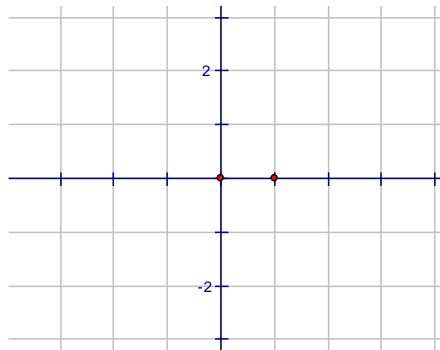


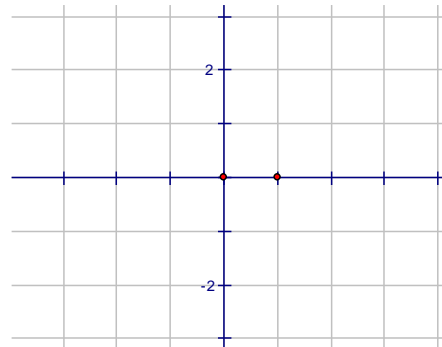
6.6 Operations with Algebraic Vectors in \mathbb{R}^2

Last day, we wrote that the vector that started at the origin and ended at $P(a, b)$ was called

$\vec{OP} = (a, b)$. A second way of writing this is with the use of the unit vectors \vec{i} and \vec{j} . The vectors $\vec{i} = (1, 0)$ and $\vec{j} = (0, 1)$ have magnitude 1 and lie on the x- and y-axes, respectively.



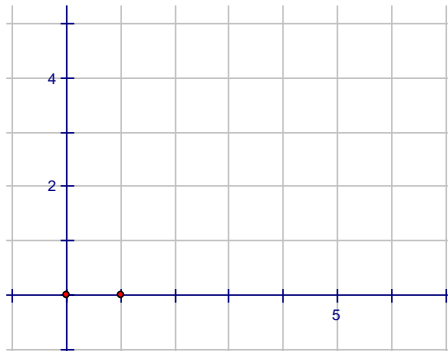
Example 1: a) Draw four position vectors, $\vec{OP} = (1, 2)$, $\vec{OQ} = (-3, 0)$, $\vec{OR} = (-4, -1)$ and $\vec{OS} = (2, -1)$. Write each of these vectors using the unit vectors \vec{i} and \vec{j} .



b) The vectors $\vec{OA} = -\vec{i}$, $\vec{OB} = \vec{i} + 5\vec{j}$, $\vec{OC} = -5\vec{i} + 2\vec{j}$ and $\vec{OD} = 2\vec{i} - 4\vec{j}$ have been written using the unit vectors \vec{i} and \vec{j} . Write them in component form (a, b) .

Addition of Two Vectors Using Component Form

Starting with $\vec{OA} = (a, b)$ and $\vec{OD} = (c, d)$ with A and D both on \mathbb{R}^2 , we can also write $\vec{OA} = a\vec{i} + b\vec{j}$ and $\vec{OD} = c\vec{i} + d\vec{j}$.



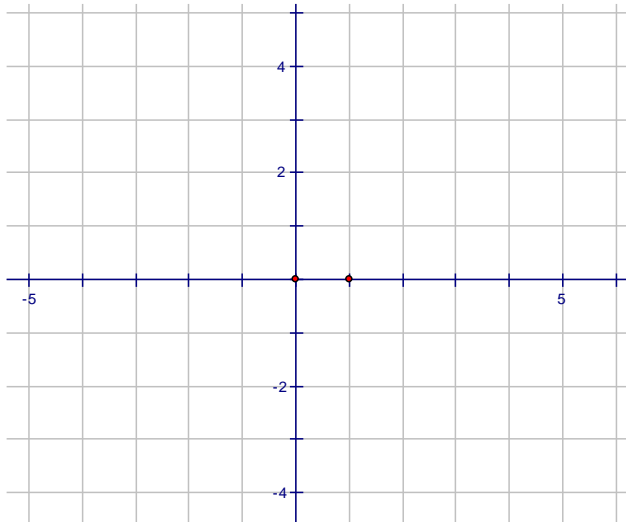
Add:

Subtract:

Scalar Multiplication of Vectors Using Components

When we want to multiply a scalar by a vector in component form, we must multiply each of the components by the scalar as follows:

Example 2: Given $\vec{a} = \overrightarrow{OA} = (1,3)$ and $\overrightarrow{OB} = \vec{b} = (4, -2)$, determine the components of $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$, and illustrate each of these vectors on the graph.



Position Vectors and Magnitudes in R^2

If $A(x_1, y_1)$ and $B(x_2, y_2)$ are two points, then the vectors $\overrightarrow{AB} = (x_2 - x_1, y_2 - y_1)$ is its related position vector

$$\overrightarrow{OP}, \text{ and } |\overrightarrow{AB}| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Example 3: A(-3, 7), B(5, 22), and C(8, 18) are three points in \mathbb{R}^2 .

a) Calculate the value of $|\overrightarrow{AB}| + |\overrightarrow{BC}| + |\overrightarrow{CA}|$, the perimeter of triangle ABC.

b) Calculate the value of $|\overrightarrow{AB} + \overrightarrow{BC}|$

Example 4: For the vectors $\vec{x} = 2\vec{i} - 3\vec{j}$ and $\vec{y} = -4\vec{i} - 3\vec{j}$, determine $|\vec{x} + \vec{y}|$ and $|\vec{x} - \vec{y}|$.