Math Virtual Learning

Precalculus with Trigonometry

Students will numerically and graphically add, subtract, and perform scalar multiplication of vectors.

May 11th, 2020

Precalculus with Trigonometry
Lesson: May 11th, 2020

Objective/Learning Target:
Students will numerically and graphically add, subtract, and perform scalar multiplication of vectors.

Let's Get Started!
Watch Video: Introduction to Vectors and Their Operations

Vector Operations

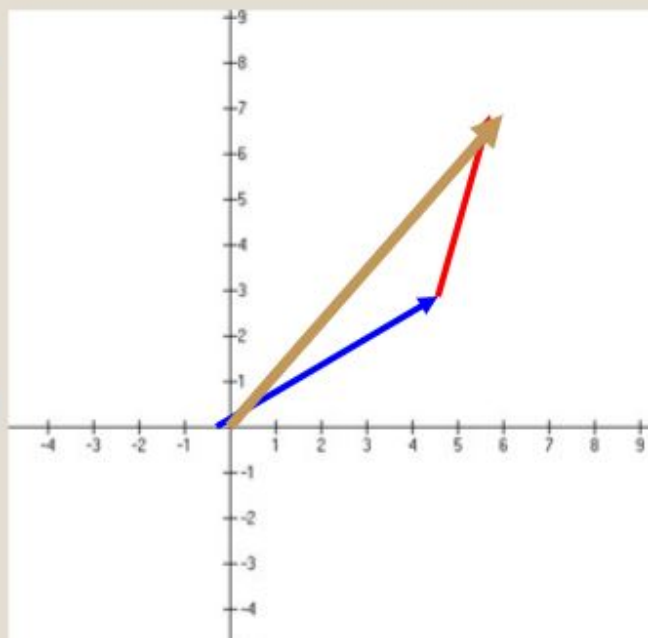To add vectors in component form, just add the horizontal components and the vertical components.

$$u + v = \left\langle u_1 + v_1, u_2 + v_2 \right\rangle$$

$$u = \left\langle 5, 3 \right\rangle \quad v = \left\langle 1, 4 \right\rangle$$

$$u + v = \left\langle 5 + 1, 3 + 4 \right\rangle = \left\langle 6, 7 \right\rangle$$

To add vectors graphically, just play "follow the leader." Then draw a new vector from the start of the first to the end of the second.

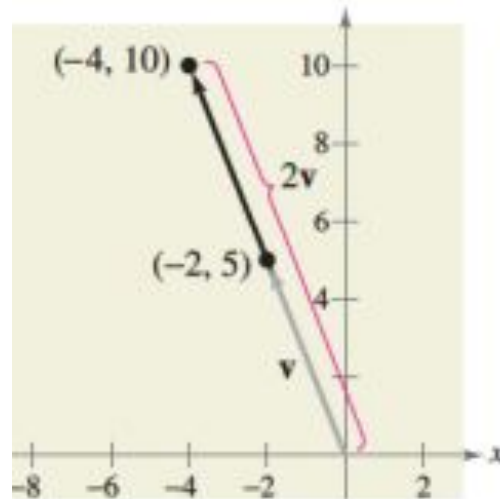The new vector is called the **_resultant_** or **_displacement vector_**.

Example:

Let $\mathbf{v} = \langle -2, 5 \rangle$ and $\mathbf{w} = \langle 3, 4 \rangle$, and find each of the following vectors.

a. $2\mathbf{v}$ **b.** $\mathbf{w} - \mathbf{v}$ **c.** $\mathbf{v} + 2\mathbf{w}$

Represent your solutions in component form and graphically

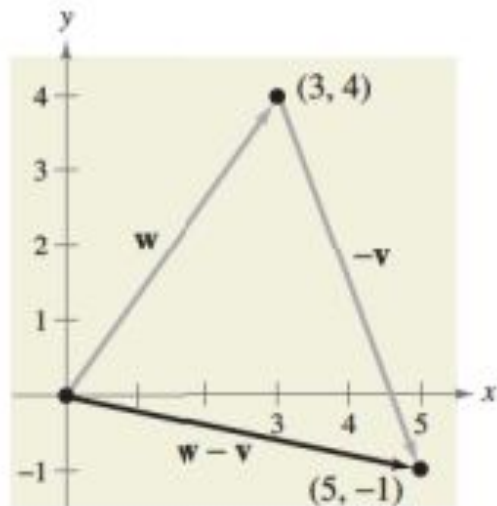**a.** Because $\mathbf{v} = \langle -2, 5 \rangle$, you have

$$2\mathbf{v} = 2\langle -2, 5 \rangle$$

$$= \langle 2(-2), 2(5) \rangle$$

$$= \langle -4, 10 \rangle.$$

Example:

b. The difference of **w** and **v** is

$$\mathbf{w} - \mathbf{v} = \langle 3, 4 \rangle - \langle -2, 5 \rangle$$
$$= \langle 3 - (-2), 4 - 5 \rangle$$
$$= \langle 5, -1 \rangle.$$

c. The sum of **v** and 2**w** is

$$\mathbf{v} + 2\mathbf{w} = \langle -2, 5 \rangle + 2\langle 3, 4 \rangle$$
$$= \langle -2, 5 \rangle + \langle 2(3), 2(4) \rangle$$
$$= \langle -2, 5 \rangle + \langle 6, 8 \rangle$$
$$= \langle -2 + 6, 5 + 8 \rangle$$
$$= \langle 4, 13 \rangle.$$
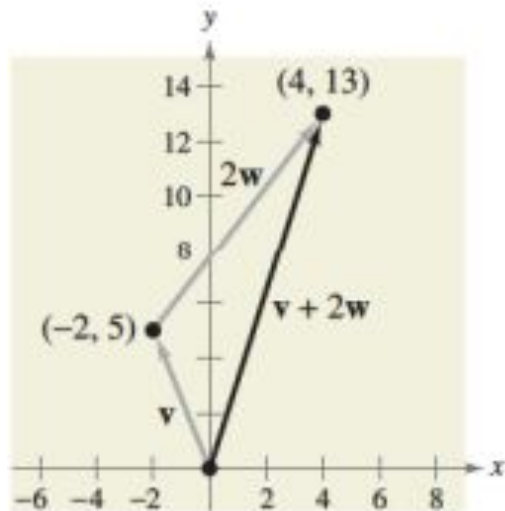
Practice

Perform the following operations. Express your solutions in component form and graphically.

1. Given vectors $\mathbf{u} = \langle 8, -4 \rangle$ and $\mathbf{v} = \langle -5, 7 \rangle$, find the sum $\mathbf{u} + \mathbf{v}$
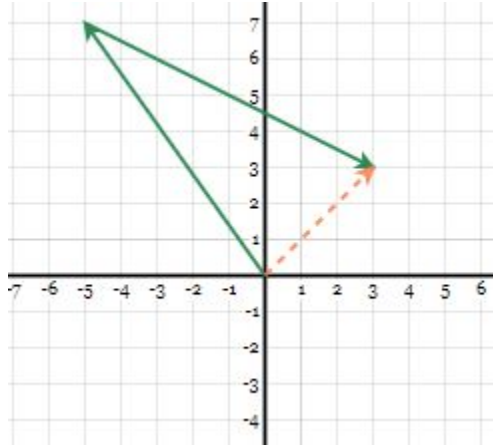
2. Given vectors $\mathbf{u} = \langle -2, -3 \rangle$ and $\mathbf{v} = \langle -2, 7 \rangle$, find the sum $\mathbf{u} + \mathbf{v}$

3. Given vectors $\mathbf{u} = \langle 3, 1 \rangle$ and $\mathbf{v} = \langle 2, 6 \rangle$, find the difference $\mathbf{u} - \mathbf{v}$
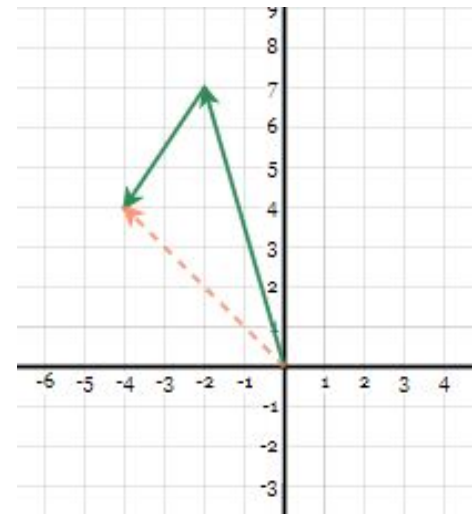
4. Given vector $\mathbf{u} = \langle 1, -4 \rangle$ and $\mathbf{v} = \langle -5, 1 \rangle$, determine the value of $3\mathbf{u} + \mathbf{v}$
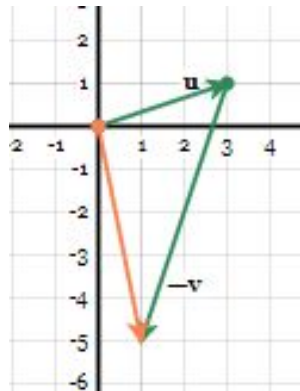
Practice - **ANSWERS**

1. <3, 3>

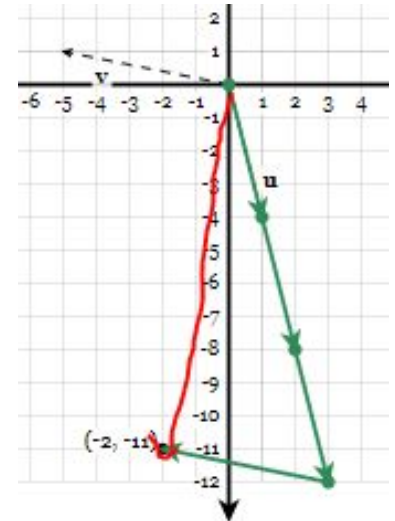2. <-4, 4>

3. <1, -5>

4. <2, -11>

Additional Practice and Resources:

Additional Resource Videos:
Graphically Adding and Subtracting Vectors

Combined Vector Operations

Additional Practice:
Adding and Subtracting Vectors

Graphically Add and Subtract Vectors

Combined Vector Operations Practice