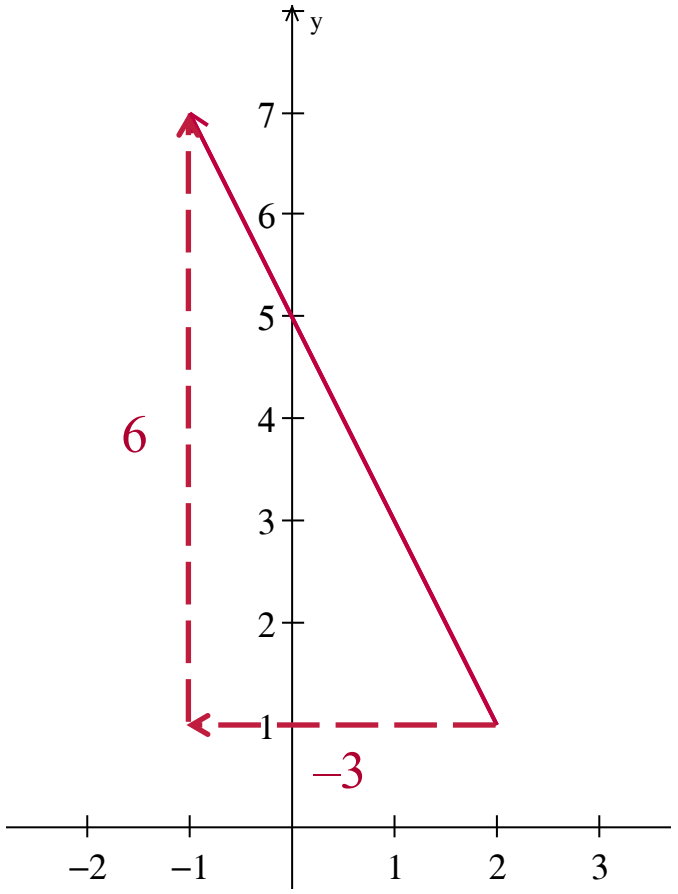
Find the component form, sketch and find the length of the vector with initial point (2, 1) and terminal point (–1, 7)

$$\langle -3,6 \rangle$$

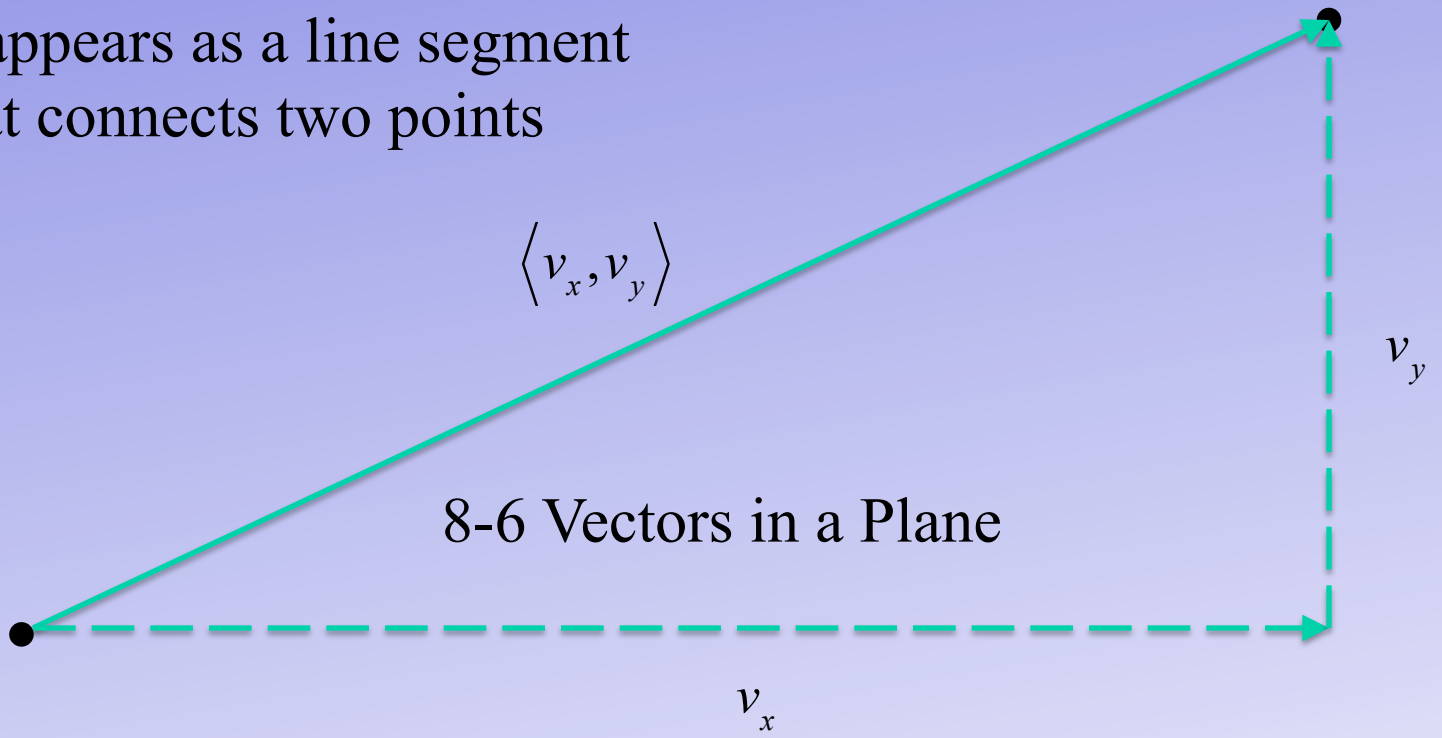
$$\sqrt{(-3)^2 + 6^2}$$

$$\sqrt{45} = 3\sqrt{5}$$



This is a Vector

It appears as a line segment
that connects two points

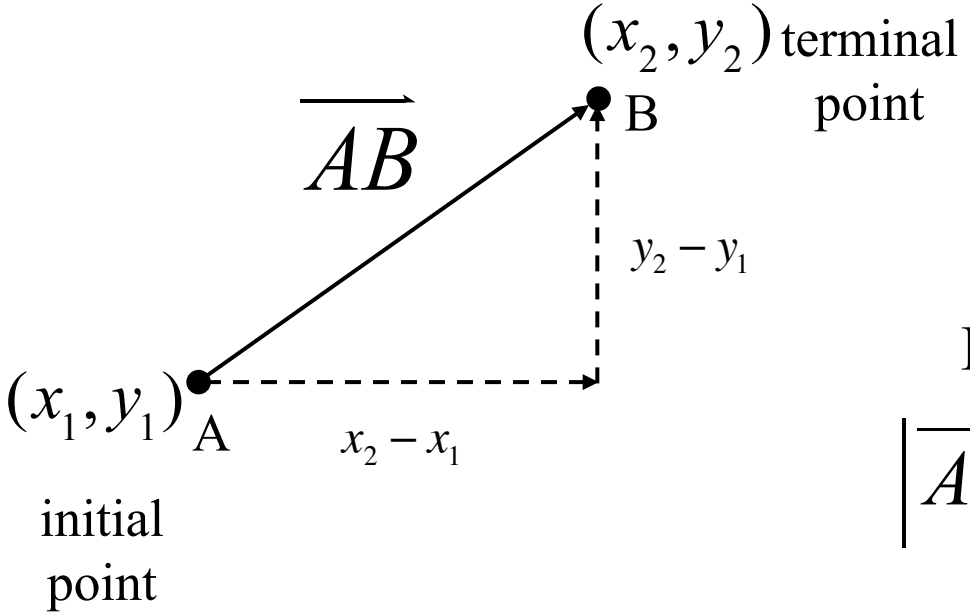


It also has something else: Direction

But the best part is it's really just the hypotenuse of a right triangle

What are those symbols next to each line segment?

We shall soon see.



The length is of this vector is written as

$$\left|\overrightarrow{AB}\right|$$

It can be calculated like this:

$$\left|\overrightarrow{AB}\right| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Look, it's just the distance formula

The component form of this vector is: $\overrightarrow{AB} = \langle x_2 - x_1, y_2 - y_1 \rangle$

The horizontal change in position

The vertical change in position

What is the component form of this vector?

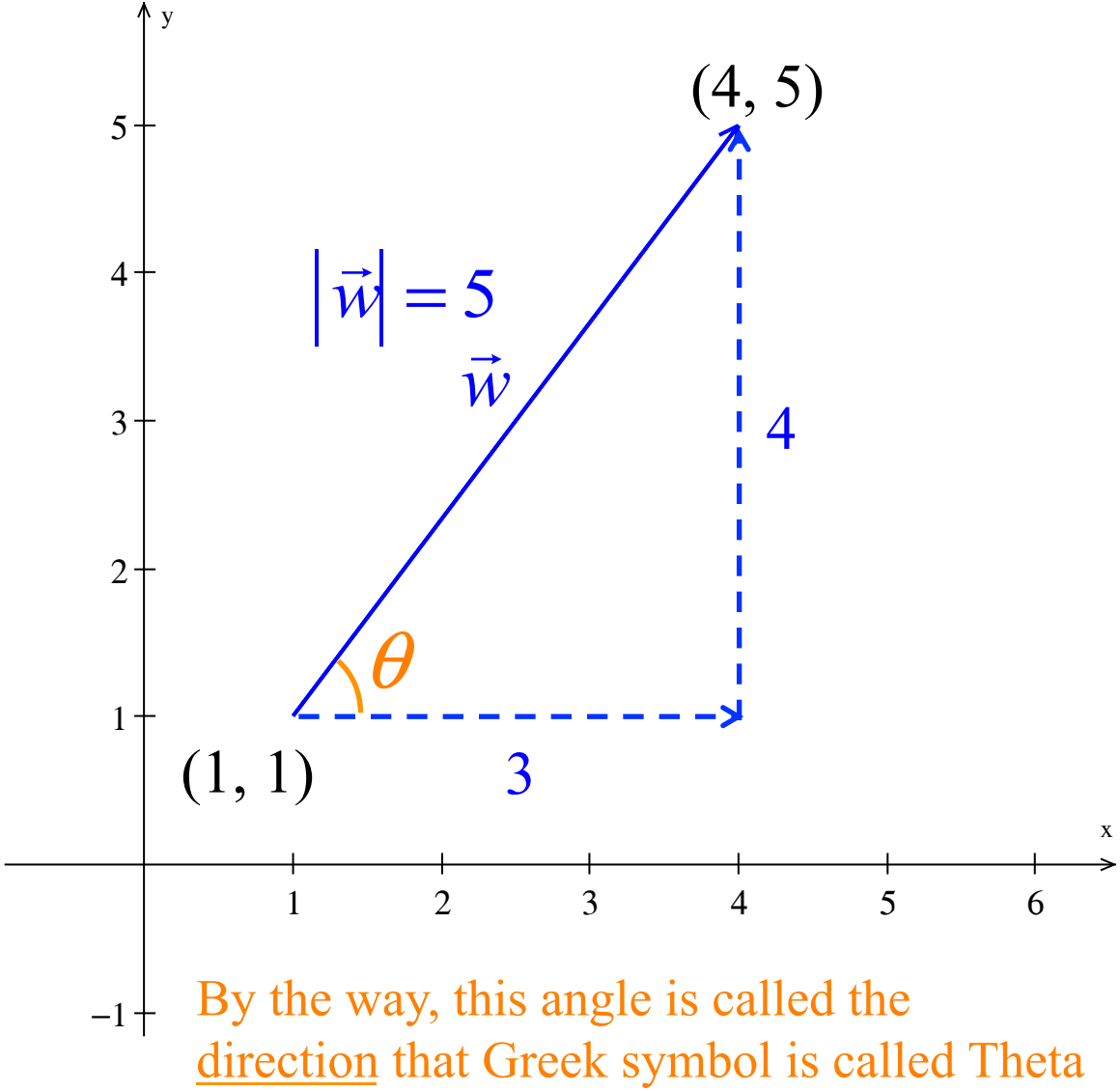
$$\vec{w} = \langle 4-1, 5-1 \rangle$$

$$\vec{w} = \langle 3, 4 \rangle$$

What is the length (or magnitude) of this vector?

Remember that the vector is just the hypotenuse

$$|\vec{w}| = \sqrt{3^2 + 4^2} = 5$$



By the way, this angle is called the direction that Greek symbol is called Theta

What is the measure of this angle?

Since $\tan\theta = \left(\frac{4}{3}\right)$ We'll just use the calculator $\theta = \tan^{-1}\left(\frac{4}{3}\right) \approx 53.13°$

Let's add a vector

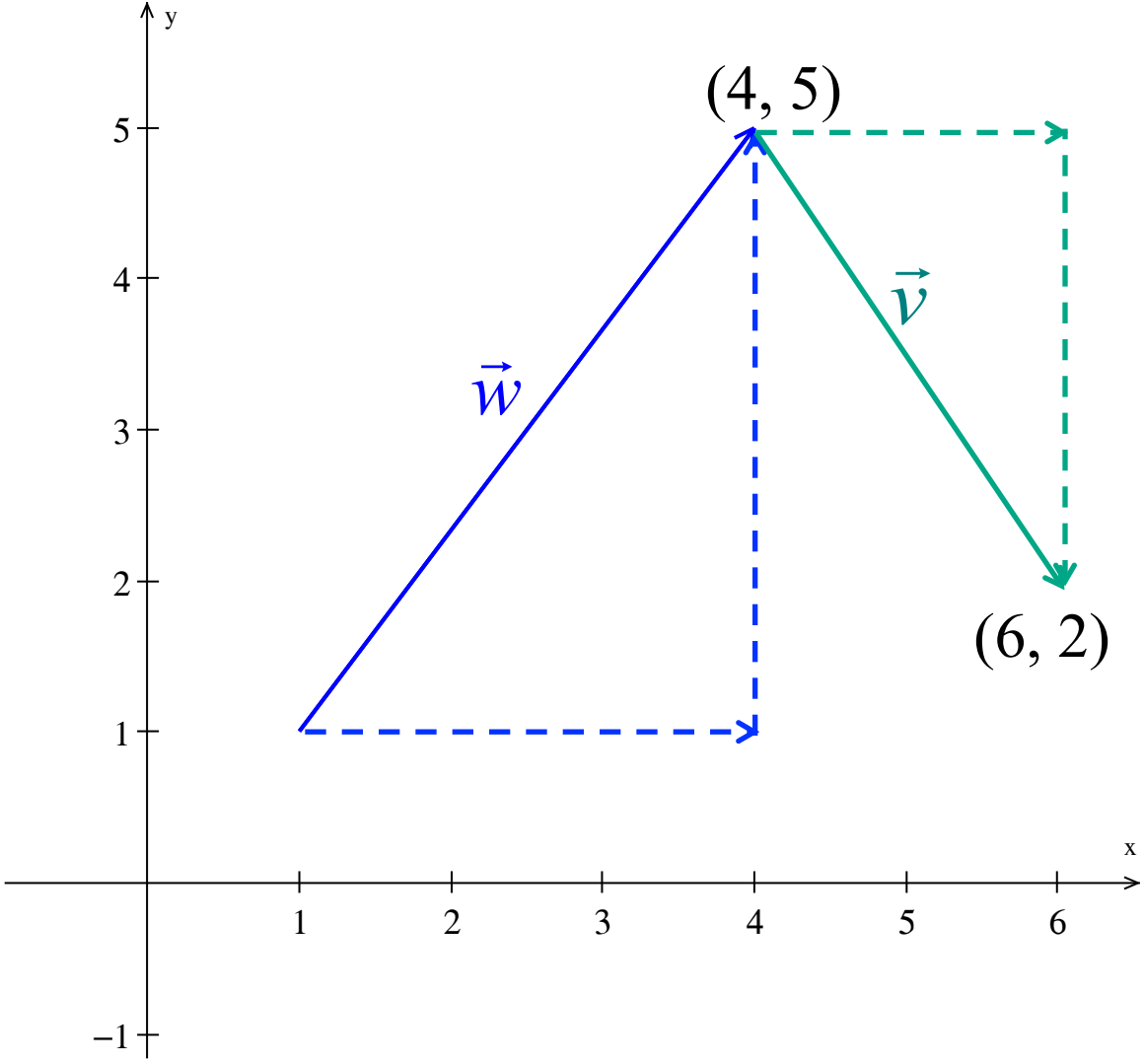
$$\vec{v} = \langle 6-4, 2-5 \rangle$$

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

And the length of this vector is

$$|\vec{v}| = \sqrt{2^2 + (-3)^2}$$

$$|\vec{v}| = \sqrt{4+9} = \sqrt{13}$$



Let's add these two vectors

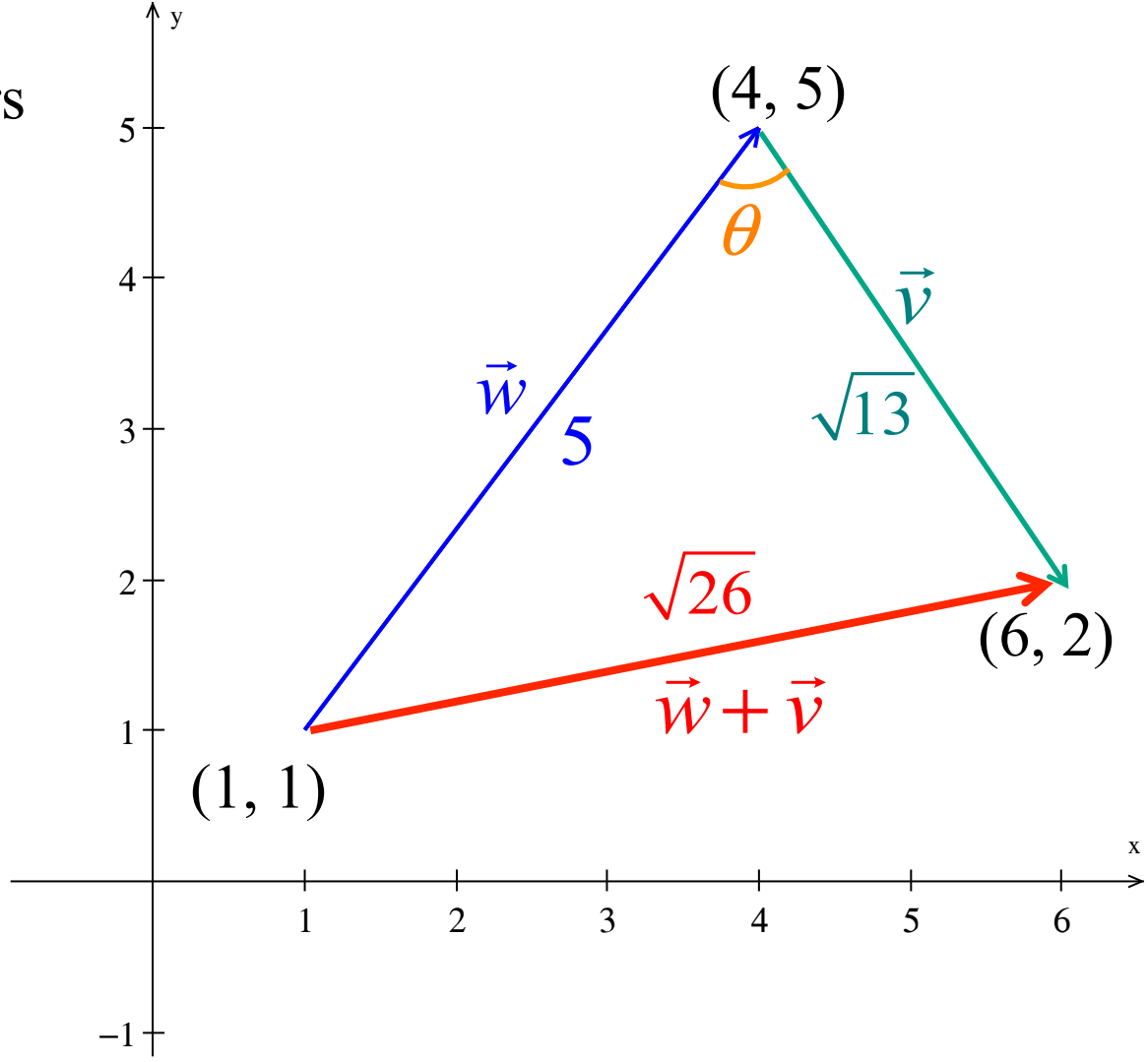
$$\vec{w}+\vec{v}=\langle 6-1,2-1\rangle$$

$$\vec{w}+\vec{v}=\langle 5,1\rangle$$

And the length of this vector is

$$\left|\vec{w}+\vec{v}\right|=\sqrt{5^2+1^2}$$

$$\left|\vec{w}+\vec{v}\right|=\sqrt{26}$$



What is the measure of this angle?

Notice that we have an acute triangle and we know all three sides

For this we will need the Law of Cosines

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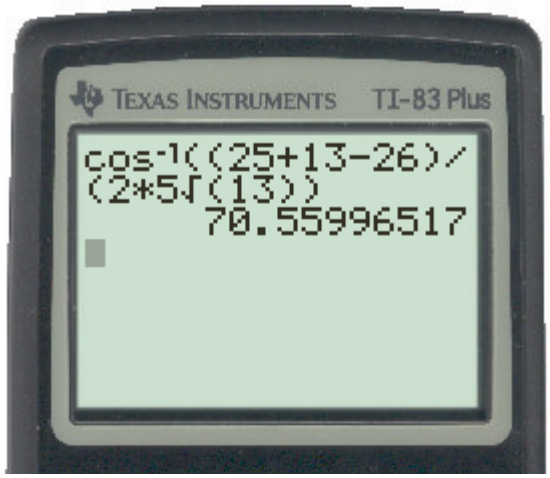
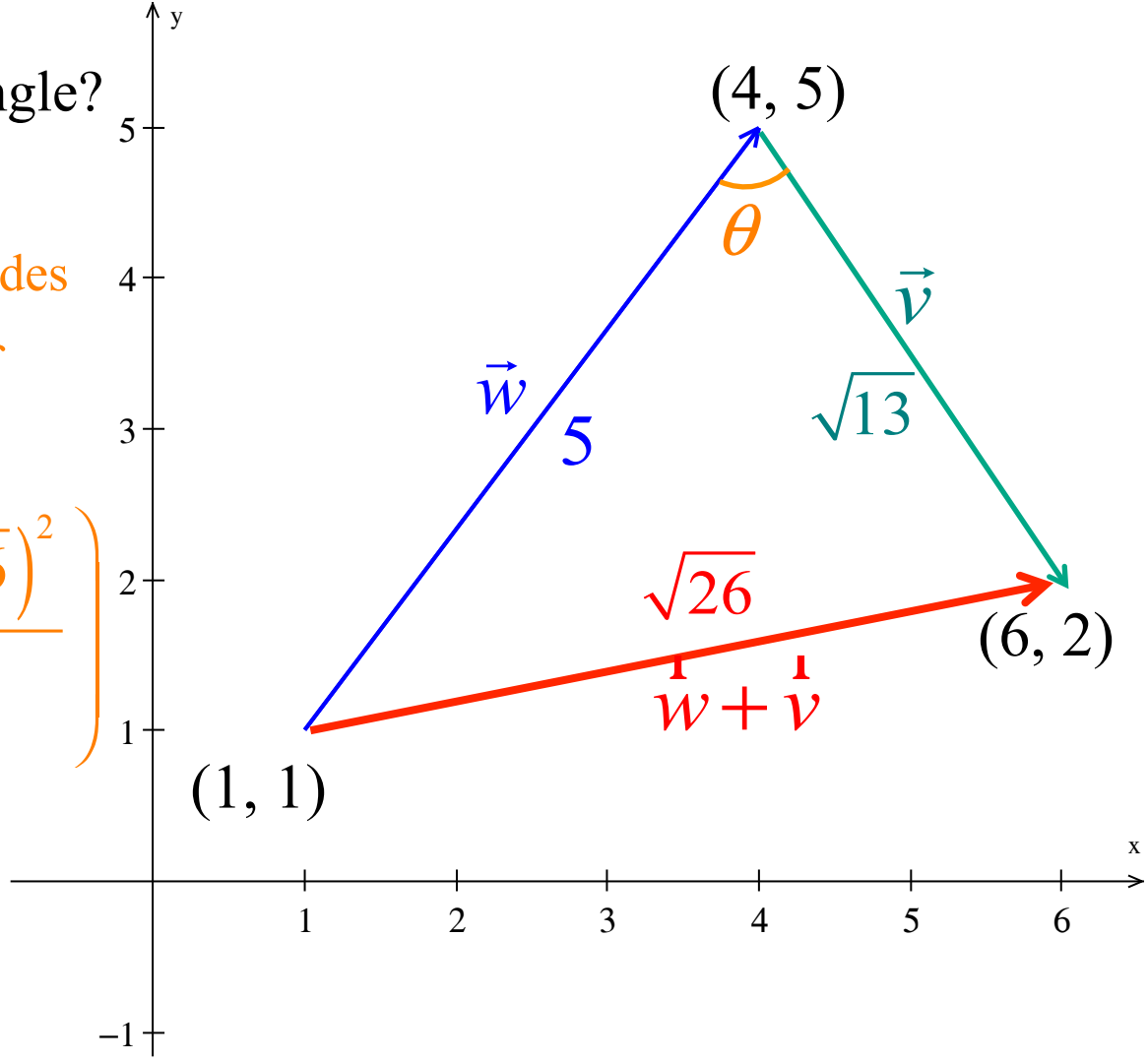
For this we will need the Law of Cosines

$$\theta = \cos^{-1}\left(\frac{5^2 + \left(\sqrt{13}\right)^2 - \left(\sqrt{26}\right)^2}{2(5)\sqrt{13}}\right)$$





$$\theta \approx 70.56°$$

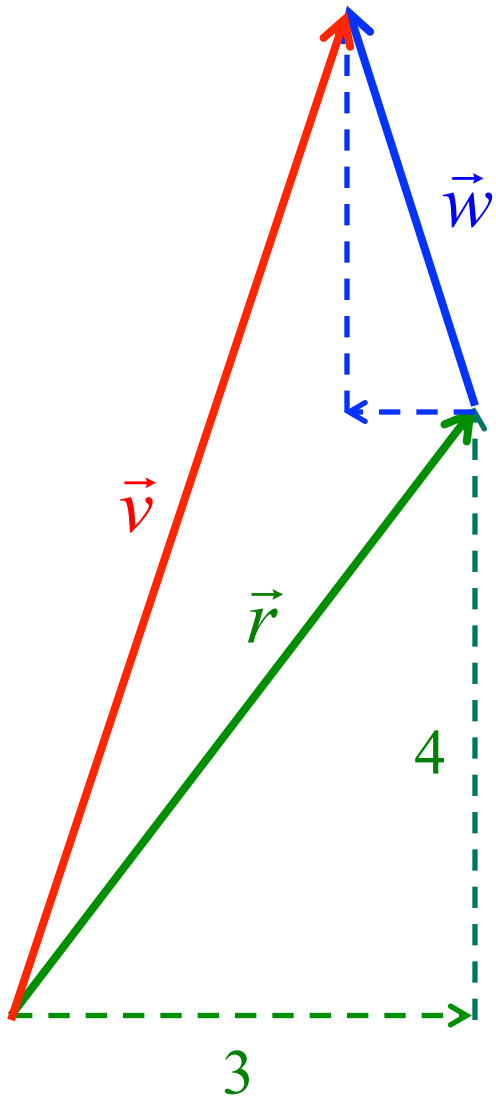
Now let's assume that this vector represents Mike May, Donovan Jones, and Mac Gates rowing a boat across Lake Merced at 5 mph.

The current of the lake is flowing in the direction of $\vec{w}$

$\vec{r} = \langle 3, 4 \rangle$ $\vec{w} = \langle -1, 2 \rangle$

How will the current affect the direction of their boat?

In other words find the resultant vector



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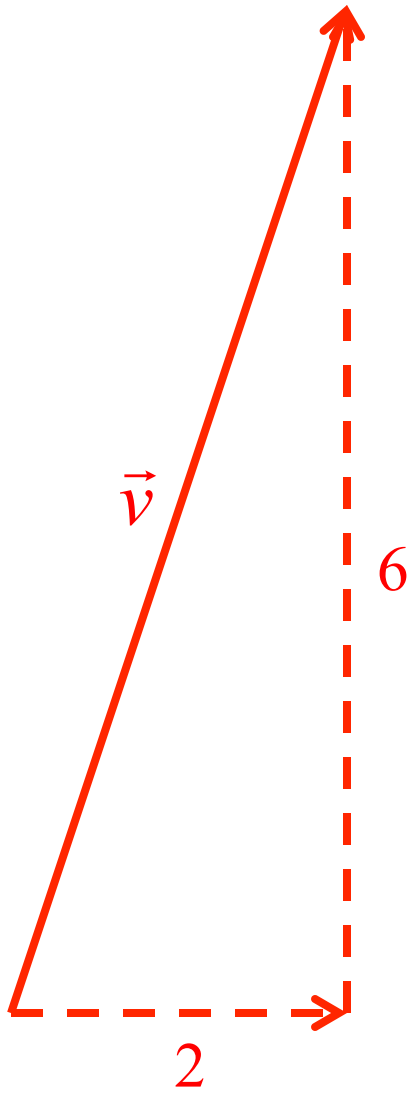
In other words find the resultant vector

$$\vec{v} = \vec{r} + \vec{w} = \langle 3,4 \rangle + \langle -1,2 \rangle =$$

$$= \langle 2,6 \rangle$$

Assuming units of miles per hour, how fast are they going after the current affects them?



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The current of the lake is flowing in the direction of

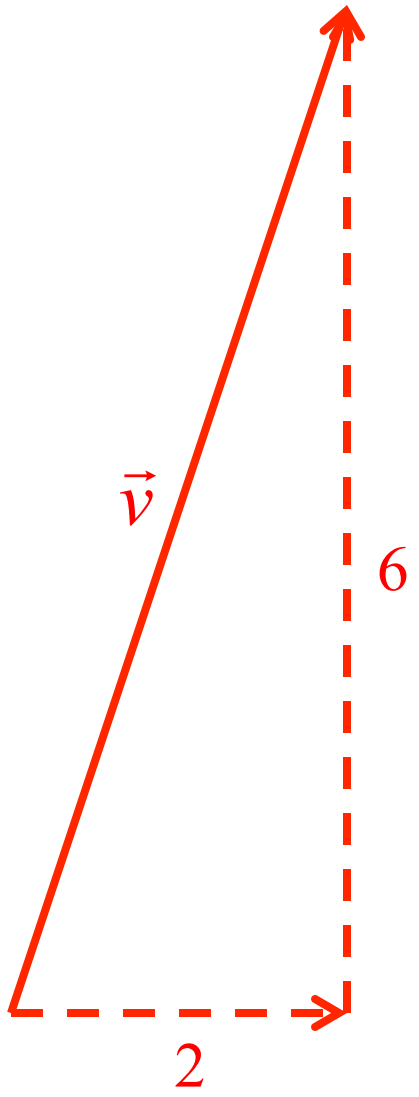
$$\vec{v} = \langle 2, 6 \rangle$$

Assuming units of miles per hour, how fast are they going after the current affects them?

In other words, what is the magnitude of the new vector?

$$|\vec{v}| = \sqrt{2^2 + 6^2}$$

$$|\vec{v}| = \sqrt{40} \approx 6.32 \text{ mph}$$



Now let's assume that this vector represents Mike May, Donovan Jones, and Mac Gates rowing a boat across Lake Merced at 5 mph.

The current of the lake is flowing in the direction of $\vec{w}$

How many degrees east of north are they now moving?

In other words what is the value of this angle?

$$\theta = \tan^{-1}\left(\frac{2}{6}\right) \approx 18.44°$$