

Vector Addition Wksheet 2

Assume that you want to swim across a river. The river has a current of 1.5 m/s. If you try to swim straight across the river with a velocity of 2 m/s you will end up with a velocity partially downstream and partially straight across the river. But how much of each? It might seem simple to assume that you would just add the river's velocity to your velocity to get

$$2 + 1.5 = 3.5 \text{ m/s}$$

but that is not correct, and furthermore it tells you nothing about the direction you will be heading in.

Your velocity and the river's velocity are both **vectors**. And you must add them in the way that we learned to add vectors.

The following notation will help

V_{ys} = your velocity relative to the shore (how someone on the shore would measure your velocity)

V_{yw} = your velocity relative to the water

V_{ws} = the water's velocity relative to the shore

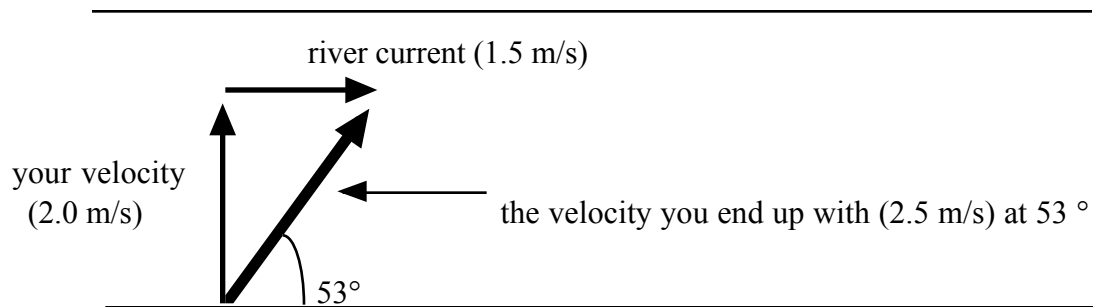
V_{ys} , V_{yw} , and V_{ws} are all vectors and will have both **i** and **j** coordinates.

To find V_{ys} (**Your velocity relative to the shore**)

Use $V_{ys} = v_{yw} + v_{ws}$

1. Set downstream as your **i** direction and across the river as your **j** direction
2. $V_{yw} = 0 \mathbf{i} + 2 \mathbf{j}$ and $V_{ws} = 1.5 \mathbf{i} + 0 \mathbf{j}$
3. Add the **i**'s together and the **j**'s together to get V_{ys} . You will get $1.5 \mathbf{i} + 2 \mathbf{j}$.
4. Now convert these to polar coordinates.

You should get 2.5 m/s at 53° .



Try the two following problems.

1. You try to swim straight across the river with a velocity V_{YW} of 3.5 m/s (make this your positive \mathbf{j} direction). The velocity of the water V_{WS} is 1.8 m/s (make this your positive \mathbf{i} direction). What is your velocity relative to the shore (V_{YS})? Be sure to give direction as well as magnitude.

2. A plane travels due north (make this your positive \mathbf{j} direction) at 500 km/h. A wind blows towards the east at 100 km/h (make east your positive \mathbf{i} direction). At what velocity (magnitude and direction) does the plane end up flying at?