Relative Motion

Any time two observers record measurements of an event there is a possibility that those measurements are different.

One reason for a difference arises from the state of motion of the observers.

Think about riding in a car or a plane. If the ride is smooth you can easily imagine that the surroundings are moving toward you rather than you toward the surroundings.

In equation form we can note this by

$$V_{AB} = -V_{BA}$$

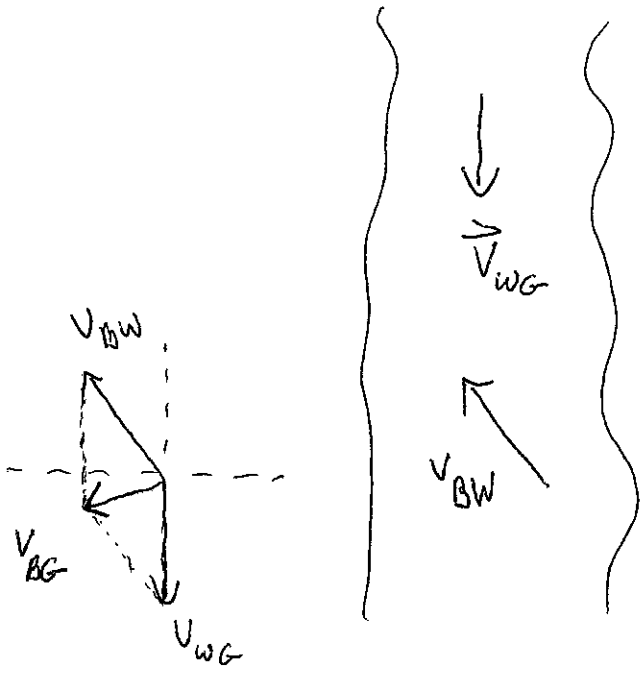
V_{AB}: Velocity of you (A) with respect to ground (B)

V_{BA}: Velocity of ground (B) with respect to you (A)

Now imagine you are in a boat that can travel a certain speed on the water. Sometimes it is nice to not only know how fast you are traveling on the water but how fast you are traveling with respect to the shore.

V_{BW} - velocity of boat (B) with respect to the water (W)

V_{WG} - velocity of the water (W) with respect to ground (G)



V_{BG} - velocity of boat (B) with respect to the ground (G)

$$V_{BG} = V_{BW} + V_{WG}$$

A nice way to remember how to determine relative velocity is to write the sum in such a way that the subscripts letters in the middle match

$$V_{BG} = V_{BW} + V_{WG}$$

match

This relationship will work for 1D and 2D relative velocities.

(we will not address 3D case.)