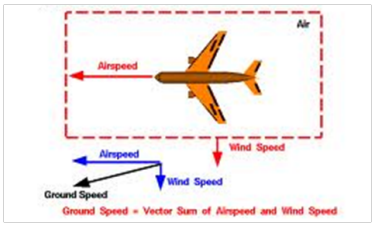
3.5 Relative Velocity



Who here has been a stationary car, and seen a neighboring car pull away, and slammed on the brakes because you thought you were moving?

Relative Velocity

Def: Depending on reference frame, velocities can change. In other words, velocity depends on the observer. Commonly, we consider the ground to be stationary, and things move with respect to it.

Example 1: Car A is stationary, and Car B is moving in the positive x direction at 10 m/s.
What is the velocity of Car A relative to Car B?
One dimensional notation:

$$\vec{v}_{AB} = \vec{v}_A - \vec{v}_B = 0\ m/s - 10\ m/s = -10\ m/s$$

In other words, it appears that Car A is traveling at 10 m/s in the negative x direction.

Two Dimensional

You can compensate for the movements of objects through fluids (air or water) using vector analysis.

Example 2:

A boat's maximum speed is 3.5 m/s. If it were trying to go straight across a river with a current of 0.25 m/s, what angle would it have to maintain to keep on a straight course?

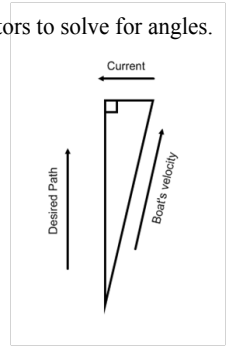
Draw a diagram.
The hypotenuse of your triangle represents the maximum velocity that the boat can go.

Example 2:

This becomes a trig problem, using vectors to solve for angles.

$$\sin\theta = \frac{opposite}{hypotenuse} = \frac{0.25\,m/s}{3.5\,m/s}$$

$$\theta = \sin^{-1}\left(\frac{0.25\,m/s}{3.5\,m/s}\right) = 4.1^{\circ}\ upstream$$



Homework

3.5 Problems in your Booklets
Due: Next Class