**Relative Motion**

**Reference Frame:**

Examples:

Inertial Frame:

Non-inertial Frame:

**Changing Reference Frames**

To change from one frame of reference to another you must \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the velocities.

Ex. Abby is standing on the ground. Abby sees Barry riding his bike 3m/s to the left and sees Charley walking 1m/s to the right. Draw the situation from the reference frame of:

Abby Barry Charley

Ex. Steve is sitting on a bench. He sees a train travelling 13m/s West. Jerry is on the train and is walking 3m/s West. How fast is Jerry going in Steve’s frame of reference?

Most situations will be presented to you using the reference frame of the ground. When there are multiple moving objects, it may be easier to try to solve the problem from the frame of reference of one of the moving objects.

Ex. Steve (still on the bench) sees Neal who is 130m West of Del sprinting at 5m/s West. Del is driving the automobile (12m/s West) how long until Del catches up to Neal?

**Boat & River or Airplane & Wind Problems**

Two very common examples used in relative motion problems are boats on rivers or airplanes flying through wind.

In these problems the travelling velocity of the boat/airplane is how fast it goes independent of any current/wind. To find the total (or resultant) velocity according to an observer on the ground you will have to add the velocities of the current/wind.

Ex. A boat’s maximum velocity is 5m/s. A river current is 2m/s North. How long would it take the boat to travel 100m South?

b) How long would it take the boat to make a round trip (100m South, then 100m North)?

Ex. Josh is flying his airplane at 95km/h West. There’s a breeze blowing at 15km/h North. What is the velocity of Josh and his airplane according to an observer on the ground?