Name _____ Period _____

# Relative Motion Worksheet

## Part 1: Conceptual Understanding and Comparisons

1) What is meant by relative motion?

2) What is a frame of reference?

3) When you are asked what the motion of an object is relative to a frame of reference, what velocity does an observer in that frame of reference imagine that s/he has?

4) Tim is walking down the aisle of a speeding bus and tosses a coin into the air. Matthew is standing on the sidewalk outside.
   a) Draw the trajectory of the coin from Tim's frame of reference

   b) Draw the trajectory of the coin from Matthew's frame of reference.

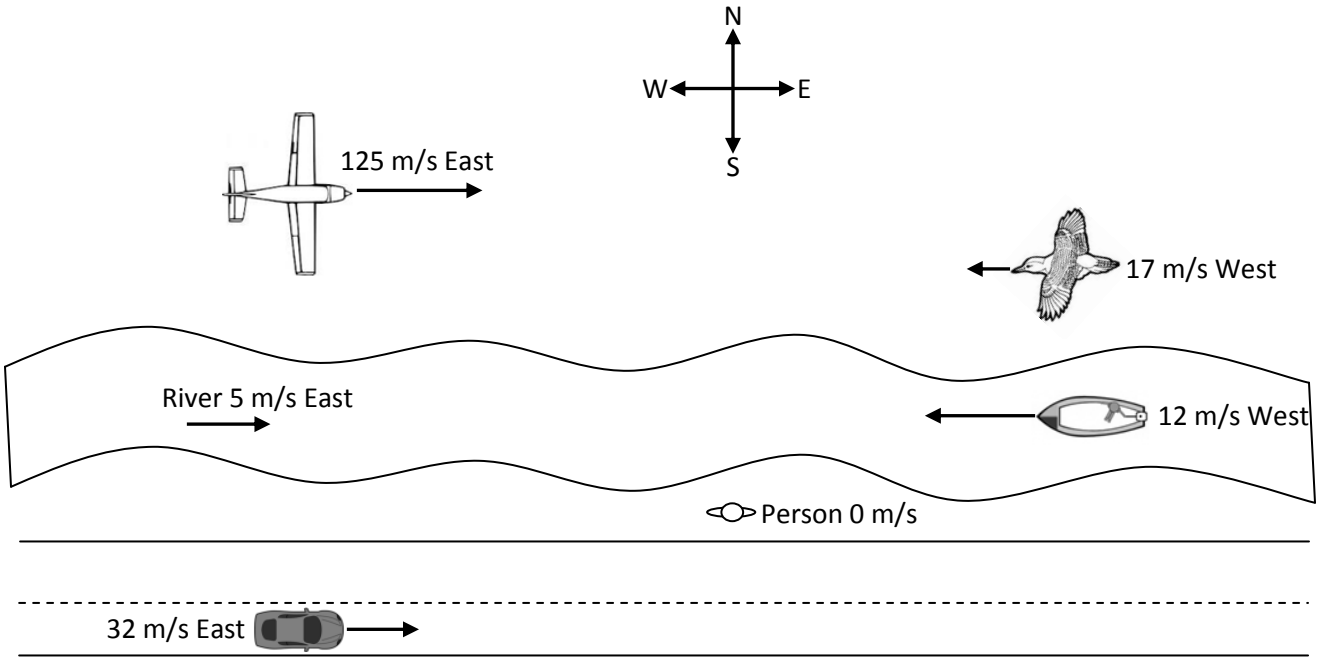
5) Tara is a pilot that is going to drop a bomb on an enemy storage depot. With a camera mounted under the plane, she watches the bomb drop. Annie is an observer on the ground who also watches the bomb drop. Assume air resistance is small.
   a) Draw the trajectory of the bomb from Tara's frame of reference.

   b) Draw the trajectory of the bomb from Annie's frame of reference.

6) An old-fashioned physics dilemma used to be- if a sailor in the crow's nest (a place way up high in the rigging) of a sailing ship that was moving at constant speed dropped a tool onto the deck of the ship, would it land directly beneath where he dropped it or since the ship was moving, would it land further back? <u>Explain your answer.</u>

7) You are in your friend's convertible. She is a crazy driver who is usually moving along at about 15 mph over the speed limit. You think, "If she is about to hit something, I'll just bail out and avoid getting hurt in an accident". You are on a road that is posted at 40 mph and she is driving at 55 mph. Good idea? Comment on why or why not

8) Washington, D. C. and San Francisco, CA are at about the same latitude. Comment on the feasibility of this plan. To travel between these cities, just ascend in a helicopter above Washington, D.C. and wait three hours until San Francisco passes below. (Hint: Do the earth and its atmosphere move together or separately?)




All velocities are given relative to the surface of the Earth.

Put both a magnitude and a direction for the relative motion of the following objects:

| **Object** | **Motion relative to the person standing on the ground** | **Motion relative to the river** | **Motion relative to the car** | **Motion relative to the powerboat** | **Motion relative to the plane** | **Motion relative to the bird** |
|---|---|---|---|---|---|---|
| Person | 0 | | | | | |
| River | | 0 | | | | |
| Car | | | 0 | | | |
| Powerboat | | | | 0 | | |
| Plane | | | | | 0 | |
| Bird | | | | | | 0 |