

# Motion in 2 Dimensions Homework 2

Name: \_\_\_\_\_

Hour: \_\_\_\_\_ Date: \_\_\_\_\_

1. A soccer ball is kicked with an initial velocity of 25 m/s at an angle of  $53.1^\circ$  and lands at the same height from which it was launched.

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- a. What is the vertical displacement of the ball?
- b. What is the initial vertical velocity of the ball?
- c. How long was the ball in the air?
- d. What is the horizontal velocity of the ball?
- e. What is the horizontal range of the ball?
- f. At what time was the ball at its maximum height?
- g. What was the max height of the ball?
- h. What was the speed of the ball at its max height?
- i. What was the velocity (speed and angle with the horizontal) of the ball when it hit the ground? (hint: who is your friend)
- j. Using the drawing above, draw a motion map for the ball (including  $v_x$ ,  $v_y$  resultant  $v$  and a arrows).

2. A plane has a top speed of 120 m/s in still air. Find the resultant speed relative to the ground if the plane encounters a:
- 50 m/s tailwind.
  - 50 m/s headwind.
  - 50 m/s cross wind.
  - Draw an arrow picture to show how you got each of the answers above.

3. A boat with a speed of 8 m/s is traveling North across a river with a current of 6 m/s to the East. The river is 400 m wide.



- How long would it take the boat to cross if the current were shut off?
- How long would it take the boat to cross with the current at 6 m/s?

- How far downstream will the boat land when it reaches the other side?



- What is the resultant velocity of the boat as seen by an observer on the shore (speed and angle)?
- Draw an arrow picture to show how you got the above answer.
- Draw a motion map for the boat with each dot representing 10 seconds.

4. You get in your plane in Traverse City and point it south attempting to fly to Lansing. Unfortunately, you encounter a crosswind blowing west and end up in Grand Rapids. Your plane has a top speed of 72 m/s. It is 216 kilometers (216000 meters) from Traverse City to Lansing and 90 kilometers (90000 meters) from Lansing to Grand Rapids

★  
Traverse City



a. How long would it have taken you to make it to Lansing without the wind?

b. How long were you in the air when you got to Grand Rapids?

c. What is the speed of the crosswind?

★  
Grand Rapids

★  
Lansing

d. What is the resultant velocity of the plane as seen by an observer on the ground (speed and angle)?

e. Draw an arrow picture to show how you got the above answer.

f. Draw a motion map for the plane with each dot representing 10 minutes (600 seconds).