

## Vector Lab - FORMAL

Purpose - to apply vector concepts to determine the effects of rivers on boats and wind on airplanes.

### Part 1 - Day 1 - Experimentation

#### Procedure -

##### Part I

- 1.) Open the Interactive Physics Player program and use File → Open → Sim 05 to access the simulation.
- 2.) Record the x and y velocity components of the boat.
- 3.) Run the simulation and record the time to cross the river. Show a calculation using this time to determine the width of the river.
- 4.) Determine the resultant velocity of the boat.
- 5.) Sketch the path of the boat as viewed from the shore person.
- 6.) Reset and change the Reference frame to that of the fishing boat. Run and sketch the path of the boat as viewed from the fishing boat.
- 7.) Show a calculation of the heading which will allow the boat to travel straight across the river. Verify your calculation with the simulation.

##### Part II

- 1.) Open the Interactive Physics Player program and use File → Open → Sim 06 to access the simulation.
- 2.) Using the scales on the side of the diagram record the X and Y displacement to the airport. Show a calculation of the angle between the plane and the airport.
- 3.) The airplane will always have  $\vec{v}_p = +206 \frac{m}{s}$ , now set the wind speed to  $50 \frac{m}{s}$  and the wind direction to  $45^\circ$  (this is  $45^\circ N$  of  $E$ ). Show a calculation of the ground speed of the plane.
- 4.) Run the simulation, do you land at the airport?
- 5.) Use the angle you found in procedure 2 as the direction for  $\vec{v}_g$  its magnitude will be  $247.23 \frac{m}{s}$ . Then use the formula  $\vec{v}_p + \vec{v}_w = \vec{v}_g$  (where  $\vec{v}_p$  is plane,  $\vec{v}_g$  is ground and  $\vec{v}_w$  is wind) to find the components of  $\vec{v}_p$ , show detailed calculations of the components of  $\vec{v}_g$ ,  $\vec{v}_w$ , and  $\vec{v}_p$ .
- 6.) Determine and record the magnitude and direction of  $\vec{v}_p$ . Verify your answer by entering your angle as the aircraft heading.