

## SPH3U: Relative Velocities Practice

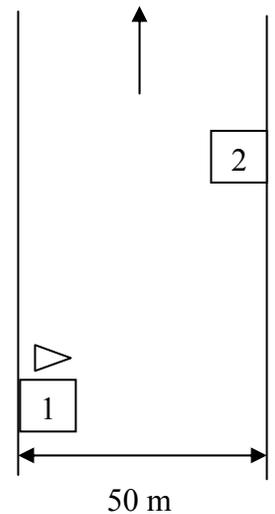
You are the pilot of a small aircraft leaving the Toronto Island Airport. After climbing to 12 000 ft you set the plane cruising with an airspeed of 400 km/h [W]. You are advised by ground control of strong winds and rough weather conditions.

Complete the chart to show the effect of different winds on your flight. For each situation draw a vector diagram for the velocities. Measure and label the resultant vector. Draw a scale vector diagram showing the path the plane follows and its displacement relative to the start in Toronto after 1 hour of travel. Indicate your scales. Use the symbols  $p$  for the plane,  $a$  for the air and  $g$  for the ground.

Wind	Velocity Diagram (1 cm = )	Position Picture (1 cm = )
100 km/h [W]		
150 km/h [N]		
120 km/h [E]		
200 km/h [S20°E]		

You are driving a boat across a river starting from Dock 1. The current runs due north at 2 m/s and the boat travels at 5 m/s relative to the water.

Direction of Boat	$\vec{V}_g$	$\Delta\vec{d}$ after 10 s
[E]		
[E 30° N]		
[E 24° S]		



1. According to your chart which way should you point the boat if you wish to travel to the dock on the other side of the river?

2. In which situation do you have the largest velocity relative to the ground?

3. In which situation will you cross the river in the least time? Careful!

**CHALLENGE!** A sunbather, drifting downstream on a raft, dives off the raft just as it passes under a bridge and swims against the current for 15 min. She then turns and swims downstream, making the same total effort and overtaking the raft when it is 1.0 km downstream from the bridge. What is the speed of the current in the river? (Sir Isaac Newton Physics Competition, 1975)