**Learning Intentions**

* How to calculate the velocity when an object travels through water or air that is moving.

**Definitions**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: The speed of the wind, relative to the ground.
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: The speed of a plane relative to the air.
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: The speed of a plane relative to the ground.
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: When the wind is blowing on the back of an airplane.
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: When the wind is blowing on the front of an airplane.
6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: When the wind is blowing on the side of an airplane.
7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: A tool that tells you the current speed of a vehicle.

**Notes**

1. When travelling on land, we do not have to worry about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because the land \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ relative to an observer standing on the  
   ground.
2. When travelling by water or by air, we have to worry about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
   because the medium (air or water) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ relative to an observer standing on the ground.
3. To find the velocity of a boat or plane relative to an observer on the ground, we must add the velocity of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the velocity of the boat or plane.
4. We add together vectors by placing the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of one vector next to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the other vector.

**Questions**

1. A boat is going downstream at 5.0 m/s [S]. The velocity of the stream is 2.0 m/s [S].  
   1. Draw a vector diagram showing the velocity of the boat relative to the water, the velocity of the stream relative to the shore, and the velocity of the boat relative to the shore.
   2. What is the velocity of the boat relative to an observer on the shore?
   3. What speed will the boat’s speedometer display?
2. The same boat is now going upstream at 5.0 m/s [N]. The velocity of the stream is still 2.0 m/s [S].  
   1. Draw a vector diagram showing the velocity of the boat relative to the water, the velocity of the stream relative to the shore, and the velocity of the boat relative to the shore.
   2. What is the velocity of the boat relative to an observer on the shore?
   3. What speed will the boat’s speedometer display?
3. A man is walking up an escalator at 3.0 m/s. The escalator is going down at 0.50 m/s. If the escalator is 50 m long, how long will it take him to reach the top of the escalator? Include a labeled vector diagram.
4. A bird is flying into the wind at 5.0 m/s [W]. The wind is blowing at 8.0 m/s [E]. What is the bird’s displacement after 10 seconds of flying? Include a labeled vector diagram.
5. Flying from Vancouver to Toronto takes 4.5 hours. Flying from Toronto to Vancouver takes 5.0 hours. If the distance (and displacement) is 3300 km, what is the wind speed of the plane? What is the velocity of the wind? Include a labeled vector diagram.