

## 1.5 - Relative Velocity Practice

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***For all problems: Give magnitudes and directions. Follow the rules of significant figures. Do on this paper or on a whiteboard (with teacher sign off).***

1. A sled rope exerts a force of 100. N at an angle of  $30^\circ$  above the horizontal.
  - a) What is the horizontal component of the force?
  - b) What is the vertical component of the force?
  
2. A balloon rises at 5.0 m/s toward the north while being pushed horizontally by the wind at 3.0 m/s toward the east. What is the balloon's resultant velocity?
  
  
  
  
  
  
  
3. An airplane flies with an airspeed of 400. km/h while heading due east. A steady wind blows from the north at 40. km/h. What is the airplane's ground velocity (speed and direction)?
  
  
  
  
  
  
  
4. A steamer can travel at 12 km/h in still water. The tide flows at 3.0 km/h. How long will it take the steamer to travel:
  - a) 2.0 km against the tide?
  - b) 2.0 km with the tide?
  - c) 2.0 km at right angles to the tide?

5. An airplane maintains a heading of due north with an airspeed of 320. km/h. A jet stream moves toward the east at 42 km/h.

- a) In what direction does the plane actually travel over the ground?
- b) What is the plane's ground speed?
- c) How much ground distance does the plane travel in 45 minutes?
- d) If the pilot is unaware of the jet stream, how far off course would the plane be after 45 minutes?
- e) In what direction should the pilot head to travel due north relative to the ground?

6. A man rows a boat across a river at 4.0 km/h, always pointing directly perpendicular to the current. The river flows at 6.0 km/h and is 0.20 km wide.

- a) In what direction does the boat actually travel relative to the shore?
- b) How long does it take him to cross the river?
- c) How far downstream does he land?
- d) How long would it take him to cross the river if there were no current?

**Answers** 1a 86.6 N, 1b 50.0 N | 2 5.8 m/s @ 31° E of N | 3  $4.0 \times 10^2$  km/h @ 5.7° S of E | 4a 0.22 h, 4b 0.13 h, 4c 0.17 h | 5a 7.5° E of N, 5b  $3.2 \times 10^2$  km/h, 5c  $2.4 \times 10^2$  km, 5d 32 km E, 5e 7.5° W of N | 6a 56° downstream, 6b 0.050 h, 6c 0.30 km, 6d 0.050 h