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**Vector Problems Worksheet**

*(HS5.1.1.1, HS5.1.1.2, HS5.1.1.3, HS5.1.1.4.B)*

**Directions:** Solve the following problems by:

1. *Sketching the vector addition for each situation, showing the Resultant magnitude and direction*
2. *Using the Pythagorean Theorum to find the resultant magnitude*
3. *Using simple trigonometry to find the direction and angle of the Resultant*

1. A person walks 30 km west, then 20 km north, then 15 km east. What is her displacement?

2. Two dogs are pulling on the same bone. One pulls to the west with 50 N of force.

 The other pulls to the south with 30 N of force. What is the resultant force on the bone?

3. An escalator lifts a person vertically at 1 m/s while simultaneously moving the

 person 3 m/s horizontally. What is the person’s resultant velocity?

4. A hiker walks away from base camp 30 km north, then 20 km east, then 50 km south,

 then 40 km west, then 45 km north, then 35 km east. Exhausted, he radios to base

 camp to come get him. Which way and how far do his rescuers have to go to get him?

5. A motorboat heads east at 15 m/s directly across a 400 meter wide river with

 a current of 7 m/s south.

 a. Calculate the boat’s velocity while traveling on the river.

 b. Calculate the time it takes for the boat to cross.

 c. How far downstream will the boat be when it reaches the opposite shore?

 d. Calculate the angle upstream that the boat would have to head in order to end

 up directly east of where it started (no downstream drift).

 e. Calculate the boat’s eastward velocity as it heads across at the angle you

 found in part “d” above.

6. An airplane tries to fly due north at 100 m/s but a wind is blowing from the west

 at 30 m/s.

a. What is the plane’s resultant velocity?

b. What heading (angle and direction) should the plane take to go due north

 in spite of the wind?

 c. How fast will the plane be flying in the northward direction at the angle

 you found in part “b”?

 d. How long will it take the plane to get to a destination 30 km due north?

7. A plane is headed east with a speed of 150 m/s while an upper atmospheric jet

 stream wind blows from the west with a speed of 50 m/s.

1. How much time will it take for this plane to reach a destination 200 km east?
2. How much time will it take for this plane to return the same 200 km west?

8. A very lost goose flies 30 km north, then 50 km east, then 70 km south. Where is

 the goose now relative to its starting postion?

9. Add the following pairs of vectors, showing the resultant for each addition.

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10. A balloon rises upward with a speed of 10 m/s while simultaneously being blown **,**

 horizontally with an speed of 5 m/s. What is the balloon’s resultant velocity?

11. A falling body is simultaneously accelerated horizontally at 6 m/s2. What is its

 resultant acceleration?

12. A fly runs east at 1 m/s across the head of a passenger walking south at 2 m/s

 across the deck of a ship sailing west at 4 m/s. What is the fly’s resultant velocity?

13. A cannon ball is fired in an arcing trajectory and hits the ground with both a

 vertical velocity of 50 m/s and a horizontal velocity of 30 m/s. What is the cannon

 ball’s final velocity?

14. A ship sails west at 25 m/s across a 6 km wide river that has a 10 m/s current flowing

 due south.

 a. What velocity (magnitude and direction) does the ship have while sailing due

 to the current?

 b. How much time does it take for the ship to cross the river?

 c. How far downstream does the ship end up after crossing the river?

 d. At what angle upstream should the ship head in order to end up directly

 across the river from its starting point?

 e. How much time will it take for the ship to cross at the heading you found in “d”?

15. Subtract vector **B** from vector **A** for each of the the following vector pairs. Be sure to show

 the subtraction and show the resultant magnitude and direction clearly.

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16. What does the word “magnitude” mean?

17. What does the word “scalar” mean?