**Physics – Honors**

**Kinematics**

**Vectors, Distance, Displacement, Speed, Velocity**

1. Vectors have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Circle the vectors:

*distance displacement speed velocity*

1. From the time you were in class on Tuesday to right now, what is your displacement?
2. Does a car’s odometer measure distance or displacement? Explain your answer.
3. Does a car’s speedometer measure speed or velocity? Explain your answer.
4. Would someone using a treadmill want to see their displacement displayed on the screen? Why or why not?
5. You are in a car driving down Route 50 at 55 miles per hour. You look beside you and see another car traveling at 55 miles per hour in the same direction. What is the speed of the car you see according to:
   1. your reference frame?
   2. the reference frame of someone standing beside the highway?
6. Under what circumstance are the magnitudes (*sizes*) of distance and displacement the same?
7. **A student makes the following movements:**

6 steps to the right 7 steps to the left

10 steps to the right 2 steps to the left

9 steps to the right

3 steps to the left

1. In units of steps, how much distance has this student covered?
2. In units of steps, what is this student’s displacement?

**Suppose it takes 1.0 minute to take all of these steps.**

1. What is the student’s speed?
2. What is the student’s velocity?
3. Are the speed and velocity the same? If not, why not?
4. What must be your car’s average speed in order to travel 235 km in 3.25 h?
5. A bird can fly 25 km/h. How long does it take to fly 15 km?
6. If you are driving 110 km/h along a straight road and you look to the side for 2.0 s, how far do you travel during this inattentive period?
7. A rolling ball moves from x1 = 3.4 cm to x2 = - 4.2 cm during the time from t1 = 3.0 s to t2 = 6.1 s. What is its average velocity?
8. A particle at t1 = - 2.0 s is at x1 = 3.4 cm and at t2 = 4.5 s is at x2 = 8.5 cm. What is its average velocity?
9. Mr. Reincke jogs eight complete laps around a quarter-mile track in a total time of 12.5 min.
   1. Calculate Mr. Reincke’s average speed.
   2. Calculate Mr. Reincke’s average velocity.
10. A horse runs away from its owner in a straight line, moving 116 m away in 14.0 s. It then turns abruptly and gallops halfway back in 4.8 s.
    1. Calculate the horse’s average speed.
    2. Calculate the horse’s average velocity for the entire trip.