# Homework: Ch 2

1. What is the difference between distance and displacement?   Create an example when the two quantities would give different values. Create an example when the two quantities would give the same value?

2. What does it mean for the direction, x, to be negative?

3. What is the difference between speed and velocity?

4. What is the difference between a vector and a scalar? Give an example of each type.

5. What is the difference between instantaneous and average acceleration?

6. For each quantity below, record the abbreviation, the SI unit, and the unit abbreviation.

Quantity	Quantity Abbreviation	SI unit	Unit Abbreviation
length or position			
time			
mass			
velocity			
acceleration			

7. At one particular moment, a subway train is moving with a positive velocity and negative acceleration. Describes the motion of this train at this time. Assume the front of the train is pointing in the positive x direction.

8. In class we showed the five equations of linear motion at constant acceleration. Starting from the equation $v = v_0 + at$, derive the other four equations.

9. The acceleration due to gravity changes as you go higher in elevation. For example, at sea level $g = 9.80665$ m/s^2 but on the top of Mt. Everest $g = 9.78877$ m/s^2.
    a. Why does gravity change with altitude?
    b. How does the Earth's gravitational pull compare to the other 7 planets in our solar system? In other words, which planets have a higher g then Earth and which have lower.

10. A ball is thrown upward from the roof of a building that is 50.0 m high. If the maximum height attained by the ball is H = 75.0 m, with what speed will the ball strike the ground as it fall back? Ignore air resistance.

11. A pitcher throws a baseball upward and reaches a height of 15.5 m above the pitcher's hand. What is the initial velocity of the ball as it leaves the pitcher's hand? How long would it take to reach the maximum height of 15.5 m?

12. Two cars are on a deserted one lane highway. Car A is initially at rest at the origin of some coordinate system. It accelerates with $\mathbf{a_A} = +C\hat{\imath}$, where C is a positive constant. Car B is also initially at rest and sits at position $x = b$ on the positive x-axis. Car B is given an acceleration $\mathbf{a_B} = -C\hat{\imath}$. Show that at time $t = \sqrt{b/C}$ the two cars will collide.

13. When started an armadillo will leap upward. Suppose it rises 0.544 m in the first 0.200 s.
    a. What is the initial speed as it leaves the ground?
    b. What is final height of the armadillo?

14. In 1939, Joe Sprinz of the San Francisco Baseball Club attempted to break the record for catching a baseball dropped from the greatest height. Members of the Cleveland Indians had set the record the preceding year when they caught baseballs dropped about 210 m from atop a building. Sprinz used a blimp at 240 m. Ignore the effects of air on the ball and assume that the ball free-falls that distance.

15. For the four paths indicated on the figure below, A, B, C, and D, determine the distance traveled and the magnitude of the displacement from start to finish.
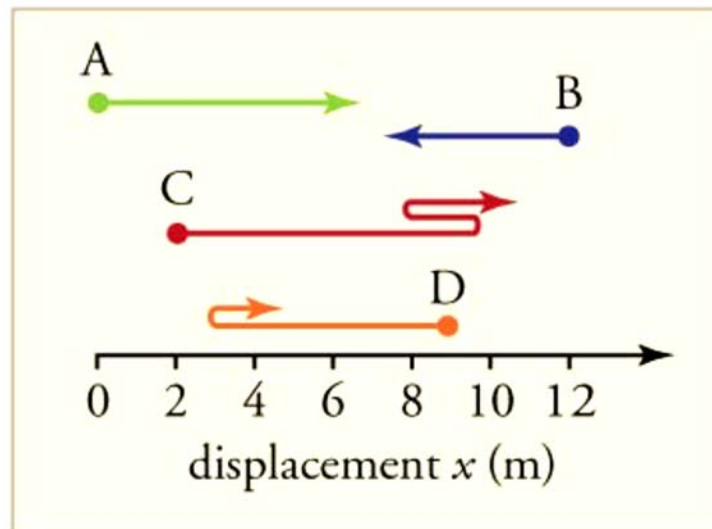
16. On September 26, 1993, Dave Munday went over the Canadian edge of Niagara Falls in a steel ball equipped with an air hole and then fell 48.0 m to the water (and rocks) below. Assume his initial velocity was zero, and neglect the effect of the air on the ball during the fall.
    a. How long did it take Munday to reach the water?
    b. What was Munday's velocity as he reached the water's surface?

17. You are driving to visit a friend who lives 77.0 km away. Starting from rest, you reach a velocity of 69.0 mph in 12.0 km. You then maintain a constant velocity for the next 60.0 km. Then in the last 5.00 km of the trip you slow down till the car comes to rest. How long does it take you to travel the total distance of 77.0 km?

18. A particle moving along an x axis slows from 50.0 m/s to 20.0 m/s at the rate of 4.00 m/s^2.
    a. How much time is required to accomplish this?
    b. How far did the particle move during this time?

19. A can is dropped from rest at a height of 40.0 m above ground. How much time does it spend in the bottom half of its fall?

20. Spotting a police car, you brake a Porsche from a speed of 100 km/h to a speed of 80.0 km/h during a displacement of 88.0 m, at a constant acceleration. What is this acceleration and how much time is required for the given decrease in speed?