Motion Problem Set # 4
(Free Falling - neglect air resistance)

1. A ball is thrown vertically upward.
    a. What happens to the ball's velocity while the ball is in the air?
    b. What is its velocity when it reaches its maximum altitude?
    c. What is its acceleration when it reaches its maximum altitude?
    d. What is its acceleration just before it hits the ground?
    e. Does its acceleration increase, decrease, or remain constant?

2. A juggler throws a bowling pin into the air with an initial velocity ***v***. Another juggler drops a pin at the same instant. Draw a vt-graph of each juggler on the same vt-graph! Compare the accelerations of the two pins while they are in the air.

3. A bouquet is thrown upward and then caught by some lucky future bride.
    a. Will the magnitude of the total distance covered always equal the magnitude of the displacement? If not, when will they be different. When would they be the same?
    b. Will the magnitude of the bouquet's velocity be the same as the bouquet is moving? If not, describe how it would change.
    c. Will the magnitude of the bouquet's acceleration be the same as the bouquet is moving? If not, describe how it would change.

4. A worker drops a wrench from the top of a tower 80.0 m tall. With what velocity does the wrench strike the ground?

5. A physics student throws a softball straight up into the air. The ball was in the air for a total of 3.56 s before it was caught at its original position.
    a. What was the initial velocity of the ball?
    b. How high did it rise?

6. A gumdrop is released from the rest at the top of Empire State Building, which is 381 m tall. Disregarding air resistance, calculate the displacement and velocity of the gumdrop after 1.00, 2.00, and 3.00 s.

7. A ball thrown vertically upward is caught by the thrower after 5.0 s.
    a. Find the initial velocity of the ball.
    b. Find the maximum height it reaches.

8. A peregrine falcon dives at a pigeon. The falcon starts downward from rest with free-fall acceleration. If the pigeon is 76.0 m below the initial position of the falcon, how long does it take the falcon to reach the pigeon? Assume that the pigeon remains at rest.

+ Points: Do problem # 9 correctly and completely and you will raise your score on this problem set **a third of a letter grade!!!!**

9. A ball is thrown vertically upward with a speed of 25.0 m/s from a height of 2.0m.
    a. How high does the ball rise?
    b. How long does it take to reach its highest point?
    c. How long does the ball take to **hit the ground**?
    d. What is the ball's velocity when it returns to the level from which it started?