The Falling Object Problem

1) Consider an object thrown straight up with an initial velocity of 112 feet/sec from the top of a building that is 160 feet tall.

Then *s* (the height of the object above the ground measured in feet) is a function of *t* (time elapsed in seconds) which is given by

$$s = -16t^2 + 112t + 160$$

a) Which variable is the *independent* variable and which is the *dependent* variable?

b) What will be the height of the object after 3 sec have elapsed?

c) When will the height of the object be 320 feet?

d) At what time will the object reach its maximum height?

e) What is the maximum height attained?

f) When will the object hit the ground?

g) What is the *domain* and *range* of the function?

h) What is the *average* velocity between times $t = 1$ and $t = 3$?

i) What is the *average* velocity between times $t = 5$ and $t = 8$?

**j) What is the *instantaneous* velocity at time $t = 3$?

**k) What is the *instantaneous* velocity at time $t = 8$?

**l) What is the *instantaneous* velocity at arbitrary time $t = a$?

2) At graduation, an overly exuberant BHSEC student throws their cap up in the air, giving it an initial velocity of 144 ft/sec. The height of the cap as a function of time is given by

$$s = -16t^2 + 144t$$

where height is measured in feet and time is measured in seconds.

a) When will the cap hit the ground?

b) How high will the cap go?

c) What is the *average* velocity of the cap between $t = 1$ and $t = 6$? Discuss the significance of the sign.

d) Using the technique discussed in class, find the *instantaneous* velocity at $t = 6$. Discuss the significance of the sign.

e) What is the *instantaneous* velocity of the cap when it is 320 feet above the ground?