

Math 16A

Kouba

Gravity Problems (The following problems ignore the effects of air friction and theoretical terminal velocities of falling objects.). Assume that the height function is

$$s(t) = -16t^2 + v_0t + s_0 ,$$

where s_0 is the initial height and v_0 is the initial velocity.

- 1.) A baseball is projected *upward* from the top of a 128-ft. high building at 112 ft/sec.
 - a.) How high does the baseball go ?
 - b.) How long is the baseball in the air ?
 - c.) What is the baseball's velocity when $t = 3$ seconds ? $t = 4$ seconds? the ball strikes the ground ?

- 2.) A hard-boiled egg is projected *downward* from the top of a 320-ft. high building at 16 ft/sec.
 - a.) In how many seconds will the egg strike the ground ?
 - b.) What is the egg's velocity when $t = 1$ second ? $t = 2$ seconds? the egg strikes the ground ?

- 3.) An avocado is thrown *upward* from ground level and reaches its highest point in two seconds.
 - a.) How high does the avocado go ?
 - b.) What is the avocado's initial velocity ?

- 4.) A rock falls from a 1600-ft. high cliff.
 - a.) In how many seconds will the rock strike the ground ?
 - b.) What is the rock's velocity when $t = 5$ seconds ? the rock strikes the ground (in ft./sec. and miles/hr. where 1 mile = 5280 ft.) ?

- 5.) A watermelon is thrown *upward* from ground level and reaches a maximum height of 144 feet.
 - a.) How long does it take the watermelon to reach its highest point ?
 - b.) How long is the watermelon in the air ?
 - c.) What is the watermelon's initial velocity ?
 - d.) What will happen to the watermelon when it strikes the ground ?

- 6.) A bowling ball falls from an airplane at an elevation of 8000 feet.

- a.) How long will it take the ball to reach an elevation of 1600 feet ?
- b.) What is the ball's velocity at the elevation of 1600 feet ?

7.) A bottle of Snapple is thrown *downward* from a hovering helicopter from an unknown height and with an unknown initial velocity. The bottle falls from a height of 4000 feet to a height of 2400 feet in five (5) seconds and its velocity when $t = 10$ seconds is -400 ft./sec.

- a.) What is the bottle's initial velocity ?
- b.) What is the bottle's initial height ?
- c.) How long is the bottle in the air ?
- d.) What is your favorite kind of Snapple drink ?

8.) A water balloon is dropped from the top of a dormitory building. It strikes the ground in 5 seconds.

- a.) How high is the building ?
- b.) What is the balloon's velocity after 1 second ? after 3 seconds ?
- c.) What is the balloon's velocity as it strikes the ground (in ft./sec) ? (in miles per hour) ?