

**Rectilinear Motion ( Rates of Change ) Problems**

*Calculus*

1. A silver dollar is dropped from 1362 feet above the ground and models the equation  $s(t) = -16t^2 + v_0t + s_0$  where  $v_0$  = initial velocity and  $s_0$  = initial position.

a) Find the position function  $s(t)$  :

Find the velocity function  $v(t)$  :

b) Find the average velocity on  $[ 1 , 2 ]$ .

c) Find the instantaneous velocity at time  $t = 1$  and time  $t = 2$ .

d) Find the time at which the coin reaches the ground.

e) Find the instantaneous velocity of the coin just before hitting the ground.

2. A ball is thrown out of a window 220 feet above the ground with an initial velocity of -22 ft/sec.
- a) Using the fact that  $s(t) = -16t^2 + v_0t + s_0$ , find the position function  $s(t)$
- b) Find the ball's velocity after it has traveled 3 seconds.
- c) Find the ball's velocity after it has fallen 108 feet.
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3. A tennis ball machine has made it on MTV's Pimp My Toys. It has been modified to shoot a tennis ball at the rate of 384 ft/s. If this is pointed straight up in the air find:
- a) The velocity after 5 seconds:
  - b) The velocity after 10 seconds:
4. A stone is dropped out of the window of a building into a large puddle. The stone makes a splash in the puddle 6.8 seconds after it has been dropped out of the window.

Find the height of the window: **(Hint:  $s(t) = -16t^2 + v_0t + s_0$  )**