Ch. 2.2-2.4 Vertical Motion Quiz Review Problems

- 1) The Position function of a particle is given by: $s(t) = 3(6t 2)^2 + 5$
 - a.) Find the average velocity of the particle in feet per second over the interval [0, 1]
 - b.) Find the equation for the instantaneous velocity of the particle at any given point.
 - c) Find the equation for the acceleration of the particle at any given point.
- d) Find the velocity and the acceleration at time t = 2.
- 2) A ball is dropped from the top of a building that is 900 feet tall.

$$s(t) = -25t^2 + v_0 t + s_0$$

a.) How long after being released does is take the ball to impact the ground?

- b.) What is the velocity of the ball at the time of impact?
- c.) What is the average velocity of the ball over the interval [1, 4]

3) A ball is thrown straight down from the top of a 600-foot building with an initial velocity of -30 feet per second.

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

- a) Determine the position and velocity equations for the ball.
- b) Find the instantaneous velocity when t=1 and t=3.
- c) Find the time required for the ball to reach the ground .
- d) Find the velocity of the ball at impact.
- e) Find the average velocity on the interval [1,5]
- 4) A ball is thrown off of a 320 ft. tall building with an initial velocity of 96 ft/sec

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

- a) What is the maximum height achieved by the ball?
- b) What is the velocity of the ball at the instant when the ball hits the ground? Give units.

- c) What is the velocity of the ball when it is 128 feet above the ground?
- d) What is the average velocity of the ball from the time it is released until it hits the ground?

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- 1) The Position function of a particle is given by: $s(t) = 3(6t 2)^2 + 5$

a.) Find the average velocity of the particle over the interval
$$[0,1]$$
.

 $S(1) = 53$ | Avg. velocity = change in position = $S(1) - S(0)$ = $\frac{53 - 17}{1 - 0}$ = $\frac{36 + 1}{1 - 0}$

b.) Find the equation for the instantaneous velocity of the particle at any given

point.
$$V(t) = 3 \cdot 2(6t-2)'(6) + 6$$

 $V(t) = 36(6t-2) = 216t-72$

c) Find the equation for the acceleration of the particle at any given point.

d) Find the velocity and the acceleration at time t = 2.

$$V(2) = 360 \text{ ft/s}$$
 $a(2) = 216 \text{ ft/s}^2$

$$V(2) = 360 \text{ ft/s} \qquad a(2) = 216 \text{ ft/s}^2$$
2) A ball is dropped from the top of a building that is 900 feet tall.
$$s(t) = -25t^2 + v_0 t + s_0 \qquad s(t) = -25t^2 + 0t + 900 \qquad \left(\frac{s(t)}{s(t)} = -25t^2 + 900\right)$$
3) How long after being released does is take the ball to impact the ground?

a.) How long after being released does is take the ball to impact the ground

$$t = 36$$
 $t = 36$
 $t = 36$
 $t = 6$
 $t = 6$
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 $t = 6$

b.) What is the velocity of the ball at the time of impact?

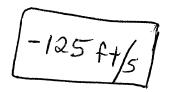
$$v(t) = -50t$$

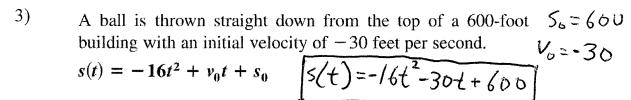
 $v(6) = -50(6) = [-300 ft/s]$

c.) What is the average velocity of the ball over the interval [1, 4]

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Aug. velocity =
$$\frac{5(4)-5(1)}{4-1} = \frac{500-875}{4-1} = \frac{-375}{3} = \frac{-375}{4-1}$$





$$s(t) = -16t^2 - 30t + 600$$

 $v(t) = -32t - 30$

$$V(1) = -32(1)-30 = -62 \text{ ft/s}$$

 $V(3) = -32(3)-30 = -126 \text{ ft/s}$

c) Find the time required for the ball to reach the ground
$$*$$
 set $s(t) = 0$

$$0 = -16t^2 - 30t + 600$$
$$= -2(8t^2 - 15t + 300)$$

$$V(5.25) = -32(5.25) - 30$$

 $V(5.25) = -198 ft/s$

$$s(t) = -16t^2 + v_0t + s_0$$
 $s(t) = -16t^2 + 96t + 320$

the ball? when the ball hits the group
$$V(t) = -32t + 96$$
 $(3) = 464$ ft $0 = -16t^2 + 96t + 320$ $0 = -16(t^2 - 6t - 20)$ $32t = 96$ $t = -2.38$ 8.382 $t = 3$

b) What is the velocity of the ball at the instant when the ball hits the ground? Give units. (set
$$s(t)=0$$
)

$$0 = -16(t^{2} - 6t - 20)$$

$$t = -2.38, 8.385$$

c) What is the velocity of the ball when it is 128 feet above the ground?

$$128 = -16t^{2} + 96t + 320$$

$$0 = -16t^{2} + 96t + 192$$

$$t = -1.58, t = 7.583$$

$$V(7.583) = [-146.66 + 1/5]$$

Aug. velocity =
$$\frac{5(8.385) - 5(0)}{8.385 - 0}$$

= $\frac{0 - 320}{8.385} = \frac{-38.16311}{5}$