

Gravity Problems

Defn Let $s(t)$ measure distance at time t

- 1) $s'(t)$ is instantaneous velocity at time t ,
usually denoted $v(t) = s'(t)$ with units $\frac{\text{distance}}{\text{time}}$
- 2) $s''(t)$ is instantaneous acceleration at time t ,
usually denoted $a(t) = s''(t)$ with units $\frac{\text{distance}}{\text{time}^2}$

For free-falling and projectiles on earth, assuming acceleration is only due to gravity ($g = -32 \text{ ft/sec}^2$), we have the following formulas:

- 1) $a(t) = s''(t) = -32 \text{ ft/sec}^2$
- 2) $v(t) = s'(t) = -32t + v_0 \longleftrightarrow \text{initial velocity (i.e. } v_0 = v(0))$
- 3) $s(t) = -16t^2 + v_0 t + s_0 \longleftrightarrow \text{initial position (i.e. } s_0 = s(0))$

Ex A ball is projected upward at 96 ft/sec from the top of a 256 ft high building.

- 1) How high does the ball go?
- 2) How long is ball in the air?
- 3) What is ball's velocity when:
 - a) $t = 1 \text{ sec}$
 - b) it strikes ground