

12.0 Linear Motion (Unit 2 – Reassessment)

Before you begin, I must put something in front of you regarding ‘verticle motion.’ You’ve likely seen it before:

$$S(t) = \frac{1}{2}at^2 + v_0t + h_0$$

a is acceleration, H_0 is initial height,
 v_0 is initial velocity

1) A particle is moving with its position defined by $s(t) = 2t^3 - 12t^2 + 18t + 7$ where t is in seconds and s is in feet.

- What are the particle's velocity and acceleration functions?
- What is the total distance traveled by the particle in the first three seconds?
- What is the displacement of the particle after the first eight seconds?

2) A silver dollar is dropped from a building that is 1,296 feet in height. Time is in seconds.

- What are the silver dollar's height, velocity and acceleration functions?
- When does the silver dollar hit the ground and what is its impact velocity?
- How far does the silver dollar travel between 1 and 2 seconds?

3) The displacement in feet of a body moving along a line at any time t in seconds is given by

$$s(t) = \frac{4}{3}t^3 - 7t^2 - 8t + 4$$

- What are the velocity and acceleration functions?
- Find the total distance traveled in the first 5 seconds. Sketch a motion schematic.
- What is the velocity of the body when the position is 8 feet?

4) A marble is thrown straight down from the top of a 220-foot building. Its initial velocity was 22 feet per second.

- What are the marble's height, velocity, and acceleration functions?
- When does the marble hit the ground and what is its impact velocity?
- What are the velocity and position at three seconds?
- What is its velocity after falling 108 feet?

5) An object has its position defined by $s(t) = t^3 - 8t^2 + 5t + 2$ in feet. Time is in seconds.

- What are the velocity and acceleration functions?
- What is the total distance traveled by the object during the first eight seconds?
- What is the displacement of the object after the first eight seconds?
- What is the position when the velocity is 3.1 feet per second?
- What is the velocity when the acceleration is -2.7 feet per second²?

6) A bag of sugar is launched vertically upward from a height of 455 feet with an initial velocity of 102 feet per second.

- What are the bag's height, velocity, and acceleration functions?
- What is the position of the bag when the velocity is 6 feet per second?
- When will the bag hit the ground? What is its impact velocity?
- When will the bag reach its maximum height? What is its maximum height?
- What is the velocity of the bag when it is 250 feet above the ground?