Topic 4.2 – Straight-Line Motion: Connecting Position, Velocity and Acceleration

A particle is moving along a horizontal line with position function as given. Perform an analysis of the particle's direction, acceleration, motion (speeding up or slowing down), and position by completing the given number lines.

1.) $s(t) = -t^3 + 9t^2 - 24t + 1$

$v(t)$

0

$a(t)$

0

motion

0

position

2.) $s(t) = t + \dfrac{9}{t+1} + 1$

$v(t)$

0

$a(t)$

0

motion

0

position

3.) A 45-caliber bullet fired straight up from the surface of the moon would reach a height of $s = 832t - 2.6t^2$ feet after t seconds. On Earth, in the absence of air, its height would be $s = 832t - 16t^2$ feet after t seconds. How long would it take the bullet to hit the ground in either case?

Earth	**Moon**

4.) A dynamite blast propels a heavy rock straight up with a launch velocity of 160 ft/sec (about 109 mph). The rock reaches a height $s(t) = 160t - 16t^2$ feet after t seconds.

a.) How high does the rock go?

b.) What is the velocity of the rock when it is 256 ft above the ground

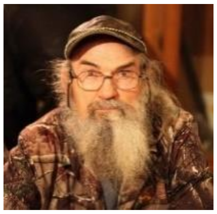
i.) on the way up?

ii.) on the way down?

c.) What is the acceleration of the rock at any time t during its flight (after the blast)?

d.) When does the rock hit the ground?

5.) Uncle Si's four-wheeler runs out of gas as it goes up a hill. The vehicle rolls to a stop then starts rolling backwards. As it rolls, its displacement $d(t)$ in feet from the bottom of the hill at *t* seconds since the vehicle ran out of gas is given by $d(t) = 145 + 31t - t^2$.



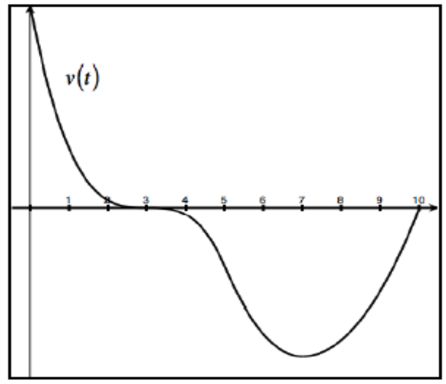
a.) How far from the bottom of the hill was Uncle Si when he ran out of gas?

b.) When is his velocity positive? What does this mean in the context of the problem?

c.) How far was the four-wheeler from the bottom of the hill when it starts to roll backwards?

d.) If Si keeps his foot off the brake, how long will it take for him to be at the bottom of the hill? What will his speed be at that time?

6.) The velocity $v(t)$ of a particle moving along the x-axis is shown in the figure to the right with t measured in seconds. Later in this course, you will learn ways to justify each response as well as finding how far the particle traveled.



a.) At what time t is the particle farthest to the right?

b.) At what time intervals is the particle speeding up?