Read Section 3.4. Work the embedded problems.

1. A potato is launched vertically upward from a platform 20 feet off the ground. The distance in feet that the potato travels from the ground after t seconds is given by $s(t) = -16t^2 + 64t + 20$.

   (a) Find the initial velocity of the potato.

   $v(t) = s'(t) = -32t + 64$; initial velocity is when $t = 0$: $v(0) = 64$ ft/sec

   (b) Find the velocity and the acceleration of the potato when $t = 3$.

   $v(3) = -32(3) + 64 = -32$ ft/sec

   $a(t) = -32$ ft/sec^2

   (c) Is the potato speeding up or slowing down? Why?

   The potato is speeding up because $a(3)$ and $v(3)$ are both the same sign (ie negative)

   (d) What is the velocity of the potato when it reaches its maximum height and why?

   At maximum height $v(t) = 0$ because the potato stops going up (pos. vel) and starts going down (neg. vel) So it's zero.

   (e) What is the maximum height of the potato?

   Set $v = 0$ to find t: $0 = -32t + 64$. So $t = 2$.

   $s(2) = -16 \cdot 4 + 64 \cdot 2 + 20 = 84$ ft.

   (f) Assume the potato lands on the ground (not the platform). How long is the potato in the air?

   Find t when $s = 0$. $0 = -16t^2 + 64t + 20$

   $$t = \frac{-64 \pm \sqrt{64^2 - 4(-16)(20)}}{2(-16)} \approx 4.2913 \text{ s}$$

   Ignore the negative root!

   (g) What is the velocity of the potato when it hits the ground?

   $v(4.2913) = -32(4.2913) + 64 = -73.32$ ft/s

   (h) You should have observed in part (b) that the acceleration is constant. What does this number represent?

   It is the acceleration due to gravity on earth.