Derivatives and Rates of Change- HW problems

1. A particle is moving in a line and its position is given by
$s(t) = \frac{1}{3}t^3 - 3t^2 + 8t$ for $t \geq 0$.

$a.$ Find the velocity and acceleration functions.

$b.$ What is its acceleration at $t = 4$?

$c.$ When is the particle at rest?

$d.$ When is the particle moving in the positive direction? What about the negative direction?

$e.$ Find the total distance travelled by the particle in the first 6 seconds.

2. A ball is thrown up in the air at 96 ft/sec from the edge of the top of a building 112 ft above the ground. The position of the ball above the ground (in feet) at $t \, sec$ is given by: $s(t) = -16t^2 + 96t + 112$.

$a.$ Determine the velocity of the ball at time $t$.

$b.$ When does the ball reach its highest point?

$c.$ What is the ball's highest point above the ground?

$d.$ When does the ball hit the ground?

$e.$ With what velocity does the ball hit the ground?

$f.$ What is the acceleration when the ball hits the ground?

$g.$ How far has the ball travelled when it hit the ground?

3. At time $t = 0$ the breaks of a car are applied and the position of a car is given by $s(t) = -8.25t^2 + 66$.

a. Find the velocity and acceleration at $t = 0$.

b. When does the car stop?

c. How far did the car travel between the time the brakes were applied and the time it stopped?

4. Suppose the cost (in dollars) of producing $x$ items is $C(x) = -.1x^2 + 200x + 500$ for $0 \le x \le 200$.

a. Determine the average cost function and the marginal cost function.

b. Determine the average cost of producing 50 items. 100 Items.

c. Determine the marginal cost after producing 50 items. 100 items.