Rates of Change

(1): The position of a particle is given by the equation

$$s = f(t) = t^3 - 6t^2 + 9t$$

where t is measured in seconds and s in meters.

(a) Find the velocity at time t.

(b) When is the particle at rest?

(c) When is the particle moving to the left? To the right?

(2): A spherical snowball starts at 70 cm. As it melts, its radius decreases at a constant rate of 2 cm per minute. How fast is the volume decreasing half an hour later?

(3): Coroners estimate time of death using the rule that a body cools about 2 degrees Fahrenheit in the first hour a 1 degree for each additional hour. Assuming an air temperature of 68 degrees and a living body temperature is 98.6 degrees, the temperature T(t) of a body in degrees Fahrenheit is given by

$$T(t) = 68 + 30.6e^{-kt}$$

- (a) For what value of k will the body cool by two degrees in the first hour?
- (b) Using the value of k found above, after how many hours will the temperature of the body be decreasing by 1 degree an hour?
- (c) Compare what the model predicts and what the coroner's rule predicts after 24 hours.