SECTION 3-4: DERIVATIVES AS RATES OF CHANGE

1. Suppose $p(t)$ gives the number of bacteria in hundreds after t hours in some lab experiment.

   (a) Interpret $p(10) = 1000$ and $p'(10) = 20$.

   (b) Estimate the number of bacteria when $t = 11$.

2. Suppose $s(t)$ gives the position of an object where s is measured in feet and t is measured in seconds.

   (a) Determine the units of $s'(t)$ and $s''(t)$ and interpret them in the context of the problem.

   (b) Can $s'(t)$ be negative? What would that mean?

   (c) If $s'(5) = 20$ and $s''(5) = 2$, estimate $s'(6)$. Is the object speeding up or slowing down?

   (d) If $s'(5) = 20$ and $s''(5) = -2$, estimate $s'(6)$. Is the object speeding up or slowing down?

   (e) If $s'(5) = -20$ and $s''(5) = -2$, estimate $s'(6)$. Is the object speeding up or slowing down?

3. 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.

   (b) Find the velocity and the acceleration of the potato when $t = 1$.

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

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

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

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

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

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