

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  $s'(t)$ ,  $|s'(t)|$ , 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) When  $t = 1$ , 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?