

Math 1a. §3.3 Worksheet
Rates of Change in the Natural and Social
Sciences

Fall 2005

- Suppose that $C(s)$ gives the number of calories that an average adult burns by walking at a steady speed of s miles per hour for one hour.
 - What are the units of $\frac{dC}{ds}$?
 - Do you expect $\frac{dC}{ds}$ to be positive? Why or why not?
 - Interpret the statement $C'(3) = 25$.
- The height of a ball (in feet) t seconds after it is thrown is given by

$$s(t) = -16t^2 + 32t + 48 = -16(t + 1)(t - 3).$$

- Graph $s(t)$ for the values of t for which it makes sense. Graph $v(t)$ on the same axis.
- From what height was the ball thrown?
- What is the ball's initial velocity? Was it thrown up or down? How can you tell?
- Was the ball's height increasing or decreasing at $t = 2$?
- At what time did the ball reach its maximum height? What was the maximum height? What was the velocity at that time?
- How long was the ball in the air?
- What was the ball's acceleration? Does this make physical sense?

3. The Hubert H. Humphrey Metrodome, home of the Minnesota Twins, has a 195-foot ceiling. Many major league pitchers can throw a 95 mph (140 ft/sec) fast ball. We can measure the height of the ball at time t by

$$h(t) = 6 + 140t - 16t^2.$$

If the initial velocity is 140 ft/sec. Can a major league pitcher throw a ball to the ceiling? Why? What if the initial velocity is 100 ft/sec (68 mph)?

4. A car traveling at a constant speed of 80 mph along a straight highway fails to stop at a stop sign. Three seconds later, a state patrol car starts from a point of rest at the stop sign and maintains a constant acceleration of 8 ft/sec². How long will it take the patrol car to overtake the speeding automobile? How far from the stop sign will this occur? What is the speed of the patrol car when it overtakes the automobile?

5. The cost function for a certain commodity is

$$C(x) = 84 + 0.16x - 0.0006x^2 + 0.000003x^3.$$

(a) Find and interpret $C'(100)$.

(b) Compare $C'(100)$ with the cost of producing the 101st item.