

Sections 3.3 and 3.4

Chain Rule, Product Rule, and Quotient Rule

1. The temperature H , in degrees Fahrenheit ($^{\circ}\text{F}$), of a can of soda that is put into a refrigerator to cool is given as a function of time, t , by

$$H = 40 + 30e^{-2t},$$

where t is hours since putting the can into the refrigerator.

- (a) Find a formula for the rate at which the temperature of the soda is changing (in $^{\circ}\text{F}/\text{hour}$).

- (b) What is the sign of $\frac{dH}{dt}$? Why?

- (c) When, for $t \geq 0$, is the magnitude of $\frac{dH}{dt}$ the largest? In terms of the can of soda, why is this?

2. The quantity q of a certain skateboard sold depends on the selling price p in dollars, so $q = f(p)$. Suppose you are told that $f(140) = 15,000$ and $f'(140) = -100$.

- (a) What do $f(140) = 15,000$ and $f'(140) = -100$ tell you about the sales of skateboards?

- (b) The total revenue, R , earned by the sale of skateboards is given by $R = pq$. Find $\left. \frac{dR}{dp} \right|_{p=140}$.

- (c) What is the sign of $\left. \frac{dR}{dp} \right|_{p=140}$? If the skateboards are currently selling for \$140 each, what happens to revenue if the price is increased to \$141 each?

3. If you invest P dollars in a bank account at an annual interest rate of $r\%$, then after t years you will have B dollars, where

$$B = P\left(1 + \frac{r}{100}\right)^t.$$

- (a) Find $\frac{dB}{dt}$, assuming P and r are constant. In terms of money, what does $\frac{dB}{dt}$ represent?

- (b) Find $\frac{dB}{dr}$, assuming P and t are constant. In terms of money, what does $\frac{dB}{dr}$ represent?