Word Problems for section 7.1

Average value of a function.

1. The number of grocery stores in the U.S. can be modeled by the function

\[ f(x) = 17311x^{-0.028} \quad 1 \leq x \leq 6 \]

where \( x \) is the number of years from 1989 and \( f(x) \) represents the number of grocery stores. Determine the average number of grocery stores in the U.S. from 1990 to 1994.

2. The concentration of a certain drug during the first 20 hours after it has been administered can be approximated by

\[ p(x) = \frac{300x}{6x^2 + 5} \quad 0 \leq x \leq 20 \]

where \( x \) is the time in hours after the medication is taken and \( p(x) \) is the concentration in percent. Determine the average concentration during the first ten hours after the medication was taken.

3. The Country Day Company determines that the daily cost pf producing lawn tractor tires is given by

\[ C(x) = 100 + 40x - 0.001x^2, \quad 0 \leq x \leq 300 \]

where \( x \) represents the number of tires produced each day and \( C(x) \) is the cost, in dollars, of producing the tires.

(a) Determine the average value of the cost function on the interval \([0,300]\).

(b) Determine \( AC(300) \). Why are these answers different?

4. Bob deposits $4000 into an account earning 6% interest compounded continuously.

(a) Find the function that would give the balance \( x \) years after the account has been started.

(b) Determine the average balance of the account during the first three years of the account.

(c) If you got a bonus of 0.75% of the average balance in the account at the end of the three years, how much is Bob’s bonus?
5. Sue has an account which had $2960.12 at the end of the first year. Where the rate of change of the account $x$ years after the initial deposit is given by $193.2e^{0.07x}$.

   (a) How much did the account change from the end of the second year to the end of the fifth year?

   (b) What was the average value of the account over the first 5 years?

Continuous Stream on Income
6. The rate of change of income produced by a vending machine is given by

   \[ f(x) = 3000e^{-0.57x}, \quad 0 \leq x \leq 5 \]

where $x$ is the time since the installation of the vending machines and $f(x)$ is in dollars per year.

   (a) Determine the total income generated by the vending machine during the first year.

   (b) Determine the total income generated by the vending machine during the first five years.