Today's Learning Goal(s):

By the end of the class, I will be able to:

a) use logarithms to solve real world problems.

1.9.1: Solve Problems Arising from Real-World Contexts

Date: Feb. 20/18

Exponential Growth

Ex. 1 The population, P million, of Alberta can be modelled by the equation $P = 2.28(1.014)^n$, where n, is the number of years since 1981. Assume that this pattern continues. Determine when the population of Alberta might become 4 million.

Method 1

$$4 = 2.28(1.014)^n$$

$$\frac{4}{2.28} = 1.014^n$$

$$\log\left(\frac{4}{2.28}\right) = n\log(1.014)$$

$$\frac{\log\left(\frac{4}{2.28}\right)}{\log 1.014} = n$$

$$n \doteq 40.43$$

Method 2

$$4 = 2.28(1.014)^n$$

$$\log 4 = \log\left[2.28\cdot(1.014)^n\right]$$

$$\log 4 = \log 2.28 + n\log 1.014$$

$$\frac{\log 4 - \log 2.28}{\log 1.014} = n$$

$$\therefore 1981 + 40.4$$

$$\doteq 2021$$

The population might become 4 million in the year 2021.

Ex. 2 In 1995, Canada's population was 29.6 million, and was growing at about 1.24% per year. Estimate the doubling time for Canada's population growth.

Let P represent Canada's population, in millions.

Let n represent the number of years since 1995.

$$P = P_0(1 \pm r)^n$$

$$59.2 = 29.6(1 + 0.0124)^n$$

$$\frac{59.2}{29.6} = (1.0124)^n$$

$$2 = 1.0124^n$$

$$\log 2 = n\log 1.0124$$

$$n = \frac{\log 2}{\log 1.0124}$$

$$\doteq 56.24$$

The doubling time is 56 years.

Exponential Decay

Note: The *half-life* for caffeine in the bloodstream is about 6 h. The percent, P, of caffeine left in your body after n hours is represented by the equation:

$$P = 100(0.5)^{\frac{n}{6}}$$

$P = P_0 (1 \pm r)^n$

$P = P_0 (1 - 0.5)^n$

$P = P_0 (0.5)^n$

Ex.3 In April 1986, there was a major nuclear accident at the Chernobyl power plant in Ukraine. The atmosphere was contaminated with quantities of radioactive iodine-131, which has a half-life of 8.1 How long did it take for the level of radiation to reduce to 1% of the level immediately after the acciden

Solution:

Let $\boldsymbol{P}$ represent the percent of the original radiation that was present d days after the accident.

$P = 100(0.5)^{\frac{d}{8.1}}$

$1 = 100(0.5)^{\frac{d}{8.1}}$

$0.01 = 0.5^{\frac{d}{8.1}}$

$\log 0.01 = \frac{d}{8.1} \log 0.5$

$\frac{8.1 \cdot \log 0.01}{\log 0.5} = d$

$d \doteq 53.8$

it took about 54 days.

pp.352-353 #1(a,c),2(i,iii),3(a,b,c),4(a,b),5(a,b,c),8[lue](a,b,d),9(b,c)