Before we begin, are there any questions from last day's work?
p.344 #9 and Worksheet 1.8.2
(Since the quiz is **NOT** on logs, correct after quiz.) 5bd

"Show What You Know: 1.2" is first...

Today's Learning Goal(s):

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

a) use logarithms to solve real world problems.

5. Solve for x (round to three decimal places where necessary).

a) $\log x = -3$

b) $\log_x 49 = 2$

$x^2 = 49$

$x = \pm 7$

$\therefore x = 7 \; [\because x > 0]$

c) $5^x = 8$

d) $3^{x+2} = 5$

$\log_3 5 = x+2$

$\frac{\log 5}{\log 3} = x+2$

e) $\log_4 \frac{1}{64} = x$

or d) $3^{x+2} = 5$

$\log 3^{x+2} = \log 5$

$(x+2)\log 3 = \log 5$

$x+2 = \frac{\log 5}{\log 3}$

$x = \frac{\log 5}{\log 3} - 2$

$\doteq 1.46 - 2$

$\doteq -0.5350$

$\doteq -0.535$

1.9.1: Solve Problems Arising from Real-World Contexts

Date: Feb. 21/17

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

$4 = 2.28(1.014)^n$

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

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

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

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

$n \doteq 40.43$

Method 2

$4 = 2.28(1.014)^n$

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

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

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

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

$n \doteq 40.43$

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.

$r = 0.0124$

Let P represent Canada's population, in millions.

Let n represent the number of years since 1995.

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

$= 29.6(1 + 0.0124)^n$

$59.2 = 29.6(1.0124)^n$

$\dfrac{59.2}{29.6} = 1.0124^n$

$2 = 1.0124^n$

$\log 2 = n \log 1.0124$

[redacted]

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

$n \doteq 56.245$

$\doteq 56.2$

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.

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

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

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

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

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

$$d \doteq 53.81$$

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[**blue**](a,b,d),9(b,c)