Warm Up 12/06

Solve.

1)
$$7^{\frac{x}{2}} = 5^{1-x}$$

 $\sqrt{-\frac{b^{\frac{1}{2}}\sqrt{b^{\frac{2}{2}}}}{4\alpha c}}$
2) $\log_2(x^2 - x - 2) = 4$
 $\sqrt{\frac{2}{2}}\sqrt{\frac{2}{16}}\sqrt{\frac{2}{16}}$
 $\sqrt{\frac{2}{2}}\sqrt{\frac{2}{16}}\sqrt{\frac{2}{16}}$

Lesson 4-5 Modeling with **Exponential Functions**

Objective

Students will...

 Be able to solve word problems involving exponential growth/decay.

Exponential Functions in the Real World

Many processes that occur in nature, such as population growth, radioactive decay, heat diffusion ,and numerous others, can be modeled using exponential functions.

We already saw that the exponential number e has a big role when it comes to compounding interest. This number, e, has many other significant roles in real life.

Exponential Growth

One of the most significant situation involving e is the **exponential** growth model.

<u>Exponential Growth Model</u>- A population that experiences exponential growth increases according to the model,

$$n(t) = n_0 e^{rt}$$
 where

 $n(t) = ext{population at time } t$ $n_0 = ext{initial size of the population}$ $r = ext{relative rate of growth}$ $t = ext{time}$

Examples

a) Find a function that models the number of bacteria after t hours.

No=500 r=0.4. t=t

b) What is the estimated count after 10 hours?

In 2000 the population of the world was 6.1 billion and the relative rate of growth was 1.4% per year. It is claimed that a rate of 1.0% per year would make a significant difference in the total population in just a few decades. Test this claim by estimating the population of the world in the year 2050 using a relative rate of growth of a) 1.4% per year and b) 1.0% per year. Ω

$$N_0 = 6.1 \, billion.$$
 $r = 0.01 \, t = 50$

$$N(50) = 6.1 \, e^{(0.01.50)}$$

A certain breed of rabbit was introduced onto a small island about 8 years ago. The current rabbit population on the island is estimated to be 4100, with a relative growth rate of 55% per year.

a) What was the initial size of the rabbit population?

Radioactive Decay

Exponential function is also often used to model some form of decay. One of the most significant use is done modeling radioactive decay.

Radioactive Decay - Decay of radioactive mass is modeled by,

$$m(t) = m_0 e^{-rt}$$
 where,

r = the rate of decay

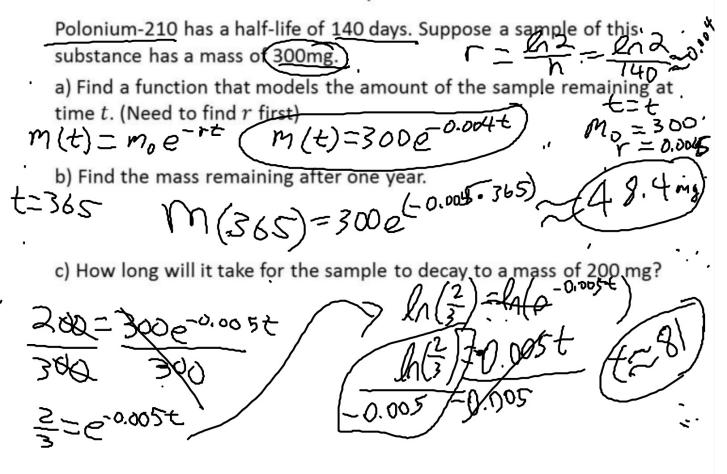
 $m_0 = {
m the\ initial\ mass}$

h = half-life

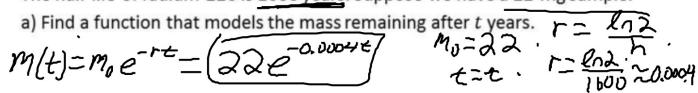
t = time remaining

. The rate r can be then modeled as γ

Examples

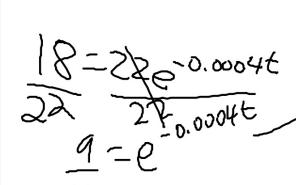


The half-life of radium-226 is 1600 years. Suppose we have a 22-mg sample.



b) How much of that sample will remain after 4000 years?

c) After how long will only 18 mg of the sample remain?



Homework 12/06

TB pg. 380 #6, 9, 12, 15, 17