3.2 Notes Day 1

Tuesday, November 3, 2015
11:48 AM

Precalculus – 3.2A Notes
Exponential Modeling

a) Determine if the exponential functions below represent growth or decay.
b) Find the constant percentage rate of growth or decay (write as a decimal.)

Function	Growth or Decay	Constant % Rate
$f(x)=103\bullet 2^x$	Growth	100% 1.00
$g(x)=5\bullet\left(\frac{1}{2}\right)^x$	Decay	50% .5
$h(x)=\frac{1}{3}\bullet 1.07^x$	Growth	7% .07
$j(x)=2\bullet\left(\frac{3}{2}\right)^x$	Growth	50% .5
$k(x)=\frac{1}{4}\bullet(0.93)^x$	Decay	7% .07

Exponential Model

If an amount is changing at a constant percentage rate r each year, then $\boxed{y=a\cdot b^x}$

Amount

$$A(t)=A_0(1\pm r)^t$$

Population

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

Initial Amt $=a, A_0, P_0$

Half-Life/Doubling Model

If an amount is halving over a certain time period, then

$$A(t)=A_0\left(\frac{1}{2}\right)^{t/HL}$$

Half Life (HL) time to halve

If an amount is doubling over a certain time period, then

$$A(t)=A_0(2)^{t/DT}$$

Doubling Time (DT)

Example #1: Tell whether the population model is an exponential growth function or exponential decay function, and find the constant percentage rate of growth or decay.

a) San Jose: $P(t)=782,248\bullet 1.0136^t$ G / D r = 1.36% = .0136

$1+r=1.0136$

b) Detroit: $P(t)=1,203,368\bullet 0.9858^t$ G / D r = 1.42% = .0142

$1-r=.9858$

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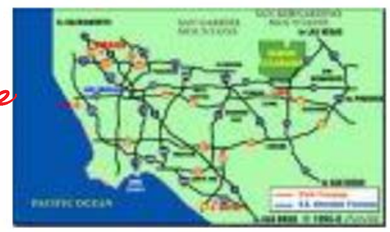
Writing and Using Exponential Functions

In part A, write an exponential function in terms of time, *t*, for each of the following situations, be sure to clearly define *t*. In part B, use the function from part A to answer the question.

1. A) The population of a small town near Rancho Cucamonga, CA has been growing by an average of 10.5% a year. The town was developed in 1950 with a population of 1255.

$P(t)=1255(1+.105)^t$



t = time in yrs since 1950

B) What will the population be in 2020?

$t=70$

$P(70)=1255(1.105)^{70}=1,361,455$ people

2. A) In 1990, college tuition averaged \$4,000.Tuition has grown 8% each year since.

$A(t)=4000(1+.08)^t$

B) When will the average tuition reach \$25,000?

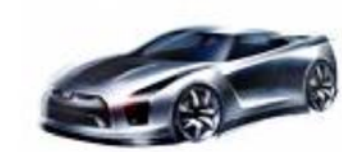
find t

$\frac{25,000}{4000}=\frac{4000}{4000}(1.08)^t$

$\frac{25}{4}=1.08^t$ $\quad \log_{1.08}\left(\frac{25}{4}\right)=t$ $\quad t\approx 24$ yrs

3. A) Congratulations! You just bought a new car! Unfortunately, information shows that your car will decrease in value by about 9% for each year you own the car. You paid \$24,599 for your new car.

B) When will your car be worth less than \$10,000?



4. A) The half-life of a radioactive substance is 20 days and there are 5 grams present initially.

base $=\left(\frac{1}{2}\right)$ $\quad A(t)=5\left(\frac{1}{2}\right)^{t/20}$

4. A) The half-life of a radioactive substance is 20 days and there are 5 grams present initially.

base= $\left(\frac{1}{2}\right)$

$$A(t) = 5\left(\frac{1}{2}\right)^{t/20}$$

B) When will there be less than 1 gram of the substance remaining?

$$1 = 5\left(\frac{1}{2}\right)^{t/20}$$

after $t \approx 46.4$ days