Name: KEY

Topic: 8.2: Exponential Decay Date: _____

Summary:

$f(x) = ab^x$ $a >$ 0 *must be positive

0 $< b <$ 1 * Fraction or decimal

Difference between Growth and Decay

Growth	Decay
$b > 1$ *Could still be a fraction Ex. 3/2, 7/6, etc.	$0 < b < 1$

Identify whether the function represents Exponential Growth or Decay.

1. $f(x) = 2\left(\frac{1}{2}\right)^x$

ab^x

$b = \frac{1}{2}$

So it is **decay**

2. $f(x) = \frac{2}{3}(2)^x$

ab^x

$b = 2$

Growth

3. $f(x) = 0.44(2.1)^x$

ab^x

$b = 2.1$

Growth

4. $f(x) = 3.1(0.7)^x$

ab^x

$b = 0.7$

Decay

$$y = a(1-r)^t$$

$a =$ initial amount $\quad t =$ time (years)

$r =$ rate as a decimal

Example 1:

There are 40,000 homes in your city. Each year 10% of the homes are expected to disconnect from septic systems and connect to the sewer system.

a) Write an exponential decay model for the number of homes that still use septic systems.

$a = 40{,}000$
$r = 10\% = .1$
$t = ?$

$y = 40{,}000(1-.1)^t$

b) Use the model to estimate the number of homes using septic systems after 5 years.

$t = 5$ years

$y = 40{,}000(1-.1)^5$
$y = 40{,}000(.9)^5$
$y = 23{,}619.6$
$y = 23{,}620$ homes

Example 2:

A new car costs $23,000. The value decreases by 15% each year. Write an exponential decay model for the car's value.

$a = 23{,}000$
$r = 15\% = .15$
$t = ?$

$y = 23{,}000(1-.15)^t$

Use the model to estimate the value after 3 years.

$t = 3$ years

$y = 23{,}000(1-.15)^3$
$y = 23{,}000(.85)^3$
$y = 14{,}124.875$
$y = \$14{,}125.88$

Example 3:

From 1990 through 2010, the value of the dollar has been shrinking. That is, you cannot buy as much with a dollar today as you could in 1990. The shrinking value can be modeled by $V = 1.24(0.973)^t$, where t is the number of years since 1990.

How much was a 2010 dollar worth in 1992? $t = 2$

*How much was today's dollar worth back then?

$V = 1.24(0.973)^2$

$V = \$1.17$

How much was a 2010 dollar worth in 2002?

$t = 12$

$V = 1.24(0.973)^{12}$

$V = \$.89$