Name Key Period ______

Lesson 7.6 Notes (Growth and Decay)

Objectives:

- Solve problems involving exponential growth.
- Solve problems involving exponential decay.

Exponential Growth – an initial amount increases at a steady rate (same percent) over time

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

a is the initial amount.

t is time.

y is the final amount.

r is the rate of change expressed as a decimal, $r > 0$.

1. The prize for a radio contest begins with a \$100 gift card. Each day, a name is announced. The winner has 5 minutes to call or the prize increases by 2.5% the next day.

   a. Write an equation to represent the amount of the gift card in dollars after t days with no winners.

   $y = 100(1 + .025)^t$

   $\boxed{y = 100(1.025)^t}$

   b. How much will the gift card be worth if no one wins after 10 days?

   $y = 100(1.025)^{10} \approx \boxed{\$128.01}$

2. A college's tuition has risen 5% each year since 2000. The tuition in 2000 was \$10,850.

   a. Write an equation for the amount of the tuition t years after 2000.

   $y = 10{,}850(1 + .05)^t$

   $\boxed{y = 10{,}850(1.05)^t}$

   b. Predict the cost of tuition for this college in 2015.

   $y = 10{,}850(1.05)^{15} \approx \boxed{\$22{,}556.37}$

Compound Interest – interest earned on the initial investment and previously earned interest

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

A is the current amount.

n is the number of times the interest is compounded each year, and t is time in years.

P is the principal or initial amount.

r is the annual interest rate expressed as a decimal, $r > 0$.

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3. Maria's parents invested \$14,000 at 6% per year compounded monthly. How much money will there be in the account after 10 years?

$A = P(1+\frac{r}{n})^{nt}$

$= 14{,}000(1+\frac{.06}{12})^{12(10)} = 14{,}000(1.005)^{120}$

$\approx \boxed{\$25{,}471.55}$

4. Determine the amount of an investment if \$300 is invested at an interest rate of 3.5% compounded monthly for 22 years.

$A = P(1+\frac{r}{n})^{nt}$

$= 300(1+\frac{.035}{12})^{12(22)} = 300(1+\frac{.035}{12})^{264}$

$\approx \boxed{\$647.26}$

<u>Exponential Decay</u> – an initial amount decreases at a steady rate (same percent) over time

Ex. Radioactive decay and depreciation

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

a is the initial amount.

t is time.

y is the final amount.

r is the rate of decay expressed as a decimal, $0 < r < 1$.

5. A raft for a pool is losing 6.6% of its air every day. The raft originally contained 4500 cubic inches of air.

a. Write an equation to represent the loss of air.

$y = 4500(1-.066)^t \Rightarrow \boxed{y = 4500(.934)^t}$

b. Estimate the amount of air in the raft after 7 days.

$y = 4500(.934)^7 = \boxed{2790 \text{ cubic inches}}$

6. The population has been decreasing at an average rate of about 0.3% per year. In 2000, the population was 88,647.

a. Write an equation to represent the population since 2000.

$y = 88{,}647(1-.003)^t \Rightarrow \boxed{y = 88{,}647(.997)^t}$

b. If the trend continues, predict the population in 2010.

$y = 88{,}647(.997)^{10} \approx \boxed{86{,}023}$