

## 7.6 Study Guide - Growth and Decay

**NOTES - EXPONENTIAL GROWTH**  
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1) Exponential Growth – Population increases and growth of monetary investments are examples of Exponential Growth. This mean that in initial amount increases at a steady rate over time.

2) The general equations for an exponential growth is  $y = a(1 + r)^t$

$y$  represents the final amount

$a$  represents the initial amount

$r$  represents the rate of change expressed as a decimal

$t$  represents the time

**EXAMPLE 1**

3) POPULATION: The population of Johnson City, in 2005 was 25,000. Since then, the population has grown at an average rate of 3.2% each year.

a. Write an equations to represent the population of Johnson City since 2005.

b. According to the equation, what will the population of Johnson City be in 2015?

**EXAMPLE 2**

4) INVESTMENT: The Garcias have \$12,000 in a savings account. The bank pays 3.5% interest on saving accounts, compounded monthly. Find the balance in 3 years.

**YOU TRY**

5) POPULATION: The population of the United States has been increasing at an average annual rate of 0.91%. If the population was about 303,146,000 in 2008, predict the population in 2012.

6) INVESTMENT: Determine the value of an investment of \$2500 if it is invested at an interest rate of 5.25% compounded monthly for 4 years.

## NOTES - EXPONENTIAL DECAY

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7) Radioactive decay and depreciation are examples of exponential decay. This means that an initial amount decreases at a steady rate over a period of time.

8) The general equation for exponential decay is  $y = a(1 - r)^t$ .

$y$  represents the final amount

$a$  represents the initial amount

$r$  represents the rate of decay expressed as a decimal

$t$  represents the time

### EXAMPLE 1

9) DEPRECIATION: The original price of a tractor was \$45,000. The value of the tractor decreases at a steady rate of 12% per year.

a. Write an equation to represent the value of the tractor since it was purchased.

b. What is the value of the tractor in 5 years?

### EXAMPLE 2

10) POPULATION: The population of Bulgaria has been decreasing at an annual rate of 0.89%. If the population of Bulgaria was about 7,450,349 in the year 2005, predict its population in the year 2015.

### EXAMPLE 3: HALF LIFE

11) ARCHAEOLOGY: The half-life of a radioactive element is defined as the time that it takes for one half a quantity of the element to decay. Radioactive carbon-14 is found in all living organisms and has a half-life of 5720 years. Consider a living organism with an original concentration of carbon-14 of 100 grams.

a. If the organism live 5730 years ago, what is the concentration of carbon-14 today?

b. If the organism lived 11,460 years ago, determine the concentration of carbon-14 today.