Algebra 1 Exponential Functions Notes

Applications of Exponential Functions – Growth/Decay

Review of Percentages: In order to be successful at creating exponential growth and decay functions, it is important you know how to convert a percentage to a decimal. Remember percentages are always out of 100.

25% = _______ 6.5% = _______ 3.05% = _______

Exponential Growth and Decay

The general form of an exponential function is:

$$y = ab^x$$

Where **a** represents your starting or initial value/population and y-intercept
b represents your growth/decay factor

Exponential Growth is where a quantity increases over time where **exponential decay** is where a quantity decreases over time. When we discuss exponential growth and decay, we are going to use a slightly different equation than $y = ab^x$. When you simplify your equation, it will look like $y = ab^x$, but to begin, you will use the following formulas:

Exponential Growth	Exponential Decay
$y = a(1 + r)^t$ where $a>0$	$y = a(1 - r)^t$ where $a>0$
y = final amount a = initial amount r = growth rate (express as decimal) t = time	y = final amount a = initial amount r = decay rate (express as decimal) t = time
(1 + r) represents the growth factor	(1 – r) represents the decay factor

Finding Growth and Decay Rates

Example 1: Identify the following equations as growth or decay. Then identify the initial amount, growth/decay factor, and the growth/decay percent.

a. $y = 3.5(1.03)^t$

Growth/Decay: ________

Initial Amount: _________

b. $f(t) = 10{,}000(0.95)^t$

Growth/Decay: ________

Initial Amount: _________

c. $g(t) = 400(0.925)^t$

Growth/Decay: ________

Initial Amount: _________

d. $y = 2{,}500(1.2)^t$

Growth/Decay: ________

Initial Amount: _________

Growth and Decay Word Problems

Example 2: The original value of a painting is $1400 and the value increases by 9% each year. Write an exponential growth function to model this situation. Then find the value of the painting in 25 years.

Growth or Decay: ___________________________

Starting value (a): ___________

Rate (as a decimal): ________

Function: ___________________________

Example 3: The population of a town is decreasing at a rate of 1% per year. In 2000, there were 1300 people. Write an exponential decay function to model this situation. Then find the population in 2008.

Growth or Decay: ___________________________

Starting value (a): ___________

Rate (as a decimal): ________

Function: ___________________________

Example 4: The cost of tuition at a college is $12,000 and is increasing at a rate of 6% per year. Find the cost of tuition after 4 years.

Growth or Decay: ____________________

Starting value (a): ________

Rate (as a decimal): ______

Function: ____________________

Example 5: The value of a car is $18,000 and is depreciating at a rate of 12% per year. How much will your car be worth after 10 years?

Growth or Decay: ____________________

Starting value (a): ________

Rate (as a decimal): ______

Function: ____________________

Summary of Exponential Word Problems

Creating a Growth Function Given a Percentage Rate

The number of chickens in the farm of Sunny House is currently 2,400. The farm grows at an annual rate of 15%. How many chickens will be there in 7 years?

Growth: $y = a(1 + r)^t$
Increase
Grow
Appreciate
Gains

Creating a Decay Function Given a Percentage Rate

A limousine costs $75,000 new but depreciates at a rate of 23% per year. What is the value of the limousine after five years?

Decay: $y = a(1 - r)^t$
Decreases
Decays
Depreciates
Loses

Compound Interest

Compound Interest is interest earned or paid on both the principal and previously earned interest.

Compound Interest

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

A = balance after t years
P = Principal (original amount)
r = interest rate (as a decimal)
n = number of times interest is compounded per year
t = time (in years)

Example 1: Write a compound interest function that models an investment of $1000 at a rate of 3% compounded quarterly. Then find the balance after 5 years.

P = _________

r = _________

n = _________

t = _________

Example 2: Write a compound interest function that models an investment of $18,000 at a rate of 4.5% compounded annually. Then find the balance after 6 years.

P = _________

r = _________

n = _________

t = _________

Example 3: Write a compound interest function that models an investment of $4,000 at a rate of 2.5% compounded monthly. Then find the balance after 10 years.

P = _________

r = _________

n = _________

t = _________