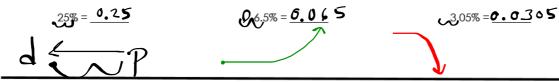
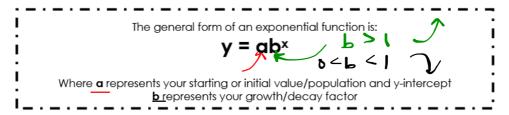
Algebra 1 Exponential Functions Notes

Applications of Exponential Functions - Growth/Decay

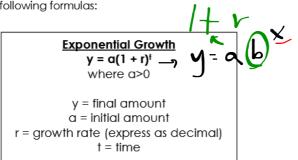
Review of Percentages: In order to be successful at creating exponential growth and decay functions, it is important you know how to convert a percentage to a decimal. Remember percentages are always out of 100.



Exponential Growth and Decay



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:



(1 + r) represents the growth factor

where a>0

y = final amount
a = initial amount
r = decay rate (express as decimal)
t = time

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

(1-r) represents the decay factor

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Algebra 1 Exponential Functions Notes

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)†

Growth/Decay:

Initial Amount: 3.

c. g(t) = $(0.925)^{\dagger}$

Growth/Decay:

Initial Amount: 400

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

Growth/Decay:_

Initial Amount: 10000

d. $y = (2,50)(1.2)^{\dagger}$

Growth/Decay: 6

Initial Amount: 2500

Growth and Decay Word Problems

Example 2: The <u>original value</u> 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): 1400

Rate (as a decimal): $\frac{9}{1}$ $\rightarrow 0.09$

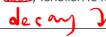
t - 25 4/s

09 25 M= a (Hr) t

y= \$12072.31

Example 3: The population of a town is decreasing at a rate of 1% per year. In 2000, there were 1000 people. Write an exponential decay function to model this situation. Then find the population in 2008.

Growth or Decay:



Starting value (a): 1360

Rate (as a decimal): 0.0

Function: _

to 62008

$$y = x(1-r)^{t}$$

 $y = 1308(1-0.01)^{8}$
 $y = 1200$ people

Exponential Functions Algebra 1 **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 y= ~ (1+r)t tuition after 4 years. Growth or Decay: Starting value (a): 12,660 2066 (1+0.66) Rate (as a decimal): 0 . 6 L 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): 18660 Rate (as a decimal): 0 . 2

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?

 $\int = 24 \text{ bd} \left(1+0.15\right)$

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?

 $y = 75000(1-0.23)^5$

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

Algebra 1 **Exponential Functions** Notes

Compound Interest

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

Compound Interest

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

A = balance after t years 4 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 afte (5) ears.

$$A = |000(1 + \frac{0.03}{4})$$

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

$$P = 16,000$$

 $A = 18,000 (1 + \frac{0.045}{1})$

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 = 1000

$$A = 4000 (1 + \frac{0.025}{12})^{12.11}$$

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