Algebra 1 Unit 10: Exponential Functions Notes

Learning Goal 10.1: Exponential Functions

After completion of this unit, you will be able to…

Learning Target #1: Graphs and Transformations of Exponential Functions

- Evaluate an exponential function
- Graph an exponential function using a xy chart
- Create an exponential function from a table or graph
- Transform an exponential function by translating, stretching/shrinking, and reflecting
- Identfiy transformations from a function
- Identify domain, range, intercepts, zeros, end behavior, extrema, asymptotes, and intervals of increase/decrease
- Calculate the average rate of change for a specified interval from an equation or graph
- Create exponential models and use them to solve problems

Timeline for Unit 10

Monday	Tuesday	Wednesday	Thursday	Friday
9 *Day 1/2* Intro to Exponentials & Graphing and Writing Equatinons of Exponentials	10 *Day 2/3* Transformations of Exponentials	11 **Early Release** Finish Day 3 & Practice Day	12 *Day 4* Characteristics of Exponential Functions	13 *Day 5* Applications of Exponential Functions
16 Day 6 Application Practice	17 *Day 7* Review Day	18 *Day 8* ~~**Unit 10 Test**~~	Rev	10 Quiz

	Monday	Tuesday	Wednesday	Thursday	Friday
AM	Mrs. Jackson 7:45 – 8:15 Room 1210	Mr. Phillips 7:45 – 8:15 Room 1206	Mrs. Jackson & Mr. Webb 7:45 – 8:15 Room 1210 Room 1205	Mr. Watson & Mr. Phillips 7:45 – 8:15 Room 1208 Room 1206	Mr. Watson 7:45 – 8:15 Room 1208
PM	NONE	Mrs. Petersen 3:30 – 4:30 Room 1210	NONE	NONE	NONE

Day 5 – 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.

Option 1: move decimal **Option 2:** $\div 100$

25% = .25 6.5% = 0.065 2% = .02 10% = .10 3.05% = .0305

$\frac{25}{100} = 0.25$

d ⟷ P

Exponential Growth and Decay

As you have already begun to notice, we have been discussing growth and decay quite a bit with exponential functions. You already know how to identify a growth and decay function just from looking at the equation. In case you have forgotten, here are a few practice problems:

A. $y = 8(4)^x$ B. $f(x) = 2(5/7)^x$ C. $h(x) = 0.2(1.4)^x$ D. $y = ¾(0.99)^x$ E. $y = ½(1.01)^x$

b=4 b=5/7 b=1.4 b=0.99 b=1.01

growth 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:

Exponential Growth
$y = a(1 + r)^t$
where a>0

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

(1 + r) represents the growth factor

Exponential Decay
$y = a(1 - r)^t$
where a>0

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

(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.

$y = a(\ )^t$

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

Growth/Decay: g

Initial Amount: 3.5

Growth/Decay Factor: 1.03

$1.03 - 1 = .03$

Growth/Decay Percent: 3%

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

d → p

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

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

Growth/Decay: d

Initial Amount: 10,000

$1 - 0.95$

Growth/Decay Factor: .05

Growth/Decay Percent: 5%

d → p

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

Growth/Decay: d

$1 - 0.925$

Initial Amount: 400

Growth/Decay Factor: .075

Growth/Decay Percent: 7.5%

d →

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

Growth/Decay: g

Initial Amount: 2500

$1.2 - 1 = .2$

Growth/Decay Factor: 20

Growth/Decay Percent: 20

d →

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.

a, r

Growth or Decay: g

Starting value (a): 1400

Rate (as a decimal): 9% = 0.09

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

Function: $y = 1400(1+.09)^{25}$

$t = 25$

$\boxed{y = \$12{,}972.31}$ ← ?

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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.

$= r$ a t

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

Growth or Decay: Decay

Starting value (a): 1300

Rate (as a decimal): 1% = .01

Function: $y = 1300(1 - .01)^8$

2000 1300

8 yr

2008 1200

d ← P = 1200.1

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 tuition after 4 years.

a g t

Growth or Decay: Growth

Starting value (a): 12000

Rate (as a decimal): 6% = .06

Function: $y = 12000(1 + .06)^4 = \$15,149.72$

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?

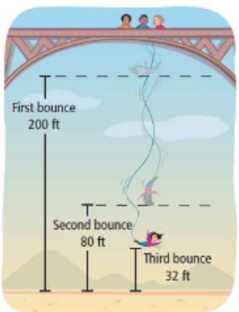
Growth or Decay: ______________________

Starting value (a): _________

Rate (as a decimal): _______

Function: ______________________

Example 6: A bungee jumper jumps from a bridge that is 500 feet high. The diagram shows the bungee jumper's height above the ground at the top of each bounce. What is the bungee jumper's height at the top of the 5th bounce?



Growth or Decay: ______________________

Starting Value: ___________

Rate (as a decimal): ________

Function: ___________________________