

learning focus:

- ✓ graph exponential functions and identify key features including domain and range
- ✓ interpret the meaning of the values a and b in functions of the form $y = ab^x$
- ✓ write exponential functions to describe growth and decay

EXPONENTIAL FUNCTIONS UNIT

8 DAY CCSS-ALIGNED UNIT

**ALG
1**



A MANEUVERING THE MIDDLE® RESOURCE

EXPONENTIAL FUNCTIONS

**ALG
1**

an 8 day CCSS-aligned unit

CCSS: A.SSE.1, A.SSE.3c, A.CED.1, F.IF.4-6, F.IF.8b,
F.BF.1a, F.LE.1-3, F.LE.5

**ready-to-go, scaffolded
student materials**

EXPONENTIAL FUNCTIONS UNIT

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student friendly + real-world application

graphic organizers

Unit: Exponential Functions
Student Handout 6

Name _____
Date _____ Pd _____

INVESTIGATING FUNCTIONS

Complete each chart to review the characteristics of linear and exponential functions.

LINEAR FUNCTION		EXPONENTIAL FUNCTION	
GRAPH:	EQUATION:	GRAPH:	EQUATION:
VERBAL DESCRIPTION:			

Use the information from the chart to classify the function.



A There are 14 fruit flies in a jar and the number of fruit flies doubles each day.

B _____

C The acres of field remaining to be plowed if a farmer plows 25% of the acres each week.

D _____

Record the letter of situations A-D next to the graph.



When a function is represented as a table, function type.

LINEAR				
• The y-values will change by a _____ over equal intervals of x-values.				
• The rate of change is _____.				

EXAMPLE:

x	0	1	2
y	-3	2	7

Describe how the y-values change as x increases by 1.

In 1-3, determine whether each table represents a function that is linear, exponential or neither. Justify your answers.

1.

x	y
-1	9
0	5
1	1
2	-3

2.

x	y
-2	8
-1	2
0	0

3.

x	y
-4	160
-3	80
-2	40

In 4-7, use your knowledge of functions to answer each question.

4. Tamisha determines the table below disagree? Explain your reasoning.

x	y
-1	250
0	100
1	40
2	16

5. Tien designed a new software, and a contract. Company A offers Tien \$2,000. Company B will offer Tien \$800 and will double the amount each month.

a. Identify the type of function that each company represents.

b. Fill in the tables below to determine the total payment for each company.

MONTHS	0	1	2
PAYMENT	2,000		

6. The table shows the number of coffee beans that a linear function should be used to model the data. Which student is correct? Justify your answer.

x	y
0	45
1	30
2	15
3	0

7. Three functions are given in the box below. Use your calculator to graph each function and sketch the functions on the graph of the coordinate plane.

a. Use your calculator to graph each function and sketch the functions on the graph of the coordinate plane.

b. Identify the type of each function.

c. For which function type will the y-values increase as x increases?

Unit: Exponential Functions
Homework 6

Name _____
Date _____ Pd _____

INVESTIGATING FUNCTIONS

For 1-6, use the table to classify each representation as linear, exponential or neither. Then justify your reasoning.

1.

x	-1	0	1	2
y	250	100	40	16

2. A photographer has 450 photos to edit from a wedding and he can edit 30 pictures each hour.

x	2	4	7	10
y	-2	-4	-8	-16

3.

x	2	4	7	10
y	-2	-4	-8	-16

4. In a debate competition there are 44 debaters. After each round, half of the debaters are eliminated.

# of days	0	1	2	3
# of coins	45	30	15	0


5. A baby elephant weighs 200 pounds at birth. His weight increases by 12% each week.


# of days	0	1	2	3
# of coins	45	30	15	0


FUNCTION TYPE	JUSTIFICATION
1	
2	
3	
4	
5	
6	


For 7-11, use your knowledge of functions to answer each question.

7. A geologist discovered a crystal in a mine that was 3 inches long. The crystal increases in length by 20% each year. Which of the following graphs could represent this situation?

a. 

b. 

c. 

d. 

skill application

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streamline your planning
process with unit overviews

✓ key vocabulary
✓ vertical alignment

sample
pacing
calendar

EXPONENTIAL FUNCTIONS OVERVIEW



STANDARDS

A.SSE.1 a. Interpret parts of an expression, such as terms, factors, and coefficients.
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P .

A.SSE.3c Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, simple rational & exponential functions.

F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

F.IF.5 Relate the domain of a function to its graph.

F.IF.6 Calculate and interpret the average rate of change over a specified interval. Estimate the rate of change from a graph.

F.IF.8b Use the properties of exponents to identify percent rate of change in a function and classify them as representing exponential growth or decay.

F.BF.1a Write a function that describes exponential growth or decay.

F.LE.1 a. Prove that linear functions grow by equal factors over equal intervals.
b. Prove that exponential functions grow by equal factors over equal intervals.

F.LE.2 Construct linear and exponential functions, a description of a relationship between two quantities.

F.LE.3 Observe using graphs a quantity increasing linearly, quadratically, or exponentially.

F.LE.5 Interpret the parameters of an exponential function.

EXPONENTIAL FUNCTIONS PACING GUIDE



DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
Intro to Exponential Functions	Graphing Exponential Functions	Writing Exponential Functions	Exponential Growth and Decay	Quiz: Exponential Functions
Student Handout 1 Homework 1	Student Handout 2 Homework 2	Student Handout 3 Homework 3	Student Handout 4 Homework 4	
DAY 6	DAY 7			
Applying Exponential Functions	Investigating Functions			
Student Handout 5 Homework 5	Student Handout 6 Homework 6			

EXPONENTIAL FUNCTIONS OVERVIEW



TOPIC	TEACHING TIPS
Intro to Exponential Functions	<ul style="list-style-type: none"> Exponential functions in the form of $y = ab^x$ can be written with a multiplication dot ($y = 5 \cdot 10^x$) or with parentheses ($y = 5(10)^x$). It is helpful to show students the different ways of writing to avoid confusion and/or thinking only one format is correct. As students fill in tables for exponential functions, it may be necessary and/or helpful to review rules of negative exponents. Search desmos.com for an activity called "Polygraph: Exponentials."
Graphing Exponential Functions	<ul style="list-style-type: none"> When students are viewing the graph of an exponential function, it will often appear that the function's curve touches the horizontal asymptote. It is helpful to have a conversation about the limitations of our graphs within certain windows/parameters, and that a table of values can be helpful to see that the graph does not actually touch the horizontal asymptote but comes increasingly closer to the asymptote. Zooming in on an exponential function using the graphing calculator on desmos.com can be helpful during a class discussion. Search desmos.com for an activity called "Two Truths and a Lie: Exponentials."
Growth and Decay	<ul style="list-style-type: none"> Allow students to build on prior knowledge by asking where they have heard of something growing "exponentially," and what they think this means. Similarly, consider asking students to brainstorm situations where exponential growth is a positive thing and when it can be a negative thing. As students discover that when $b > 1$ the value of $f(x)$ grows, and when $b < 1$ the value of $f(x)$ decays, it may help them to connect this relationship to scale factor (a factor > 1 enlarges a figure while a factor < 1 reduces a figure.)
Investigating Functions	<ul style="list-style-type: none"> As students find the rate of change of functions represented as tables, be sure to highlight the importance of x-values changing by equal intervals. Use the graph and tables to allow students to observe that the y-values of an exponential function will eventually exceed the y-values of linear and quadratic functions.

teaching
ideas

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unit study guide + assessments



quizzes



editable unit test

Unit: Exponential Functions
Quiz

Name _____
Date _____ Pd _____

QUIZ: EXPONENTIAL FUNCTIONS

Show all work and record your solutions in the box at the right.

1. Which of the following equations represents the exponential function shown at the right?

a. $y = 8 \cdot \left(\frac{2}{3}\right)^x$
b. $y = 8^x$
c. $y = 8 \cdot (1.5)^x$
d. $y = 12 \cdot 2^x$

2. Rainey graphed a function with exponential growth. Which of the following could represent the function?

a. $f(x) = 2(15)^x$
b. $f(x) = 15(3)^x$

GRAPH A

Use graphs A-C to answer questions 3-5.

3. Which graph represents $y = 5(0.5)^x$?

4. Sketch the graph of the exponential function $y = 5(0.5)^x$.

Unit: Exponential Functions
Review

Name _____
Date _____ Pd _____

EXPONENTIAL FUNCTIONS STUDY GUIDE

Solve each problem below. Be sure to ask questions if you need more help with a topic.

I CAN GRAPH EXPONENTIAL FUNCTIONS AND IDENTIFY KEY FEATURES.

1. Create a graph of the exponential functions $f(x) = 2 \cdot (0.4)^x$ and $g(x) = -3 \cdot (1.5)^x$ at the right.

2. For $f(x)$ above, list the following:

- y-intercept:
- Asymptote equation:
- An ordered pair on the graph:

3. Isabel plans to graph the exponential function $f(x) = 2 \cdot (0.4)^x$. Which graph will she have?

a. Isabel's graph will increase.
b. Isabel's graph will have a horizontal asymptote at $y = 2$.
c. As x increases, the y -value will decrease.
d. Isabel's graph will have a horizontal asymptote at $y = 0$.
e. Isabel's graph will have a horizontal asymptote at $y = 1$.

4. Label each graph with the function it represents.

5. Sketch the graph of the exponential function $f(x) = 2 \cdot (0.4)^x$.

answer keys
included



ALGEBRA 1 CURRICULUM

EXPONENTIAL FUNCTIONS

UNIT TEN: ANSWER KEY

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