

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 TEKS-ALIGNED UNIT



EXPONENTIAL FUNCTIONS UNIT
Table of Contents

PAGE	TOPIC	RESOURCE
4	Sample Pacing Guide	
5-6	Ideas for Implementation and Helpful Hints	
7-15	Binder Covers, Dividers and Spine Labels	Student Handout 1
17-18	Intro to Exponential Functions	Homework 1
19-20	Intro to Exponential Functions	Student Handout 2
21-22	Graphing Exponential Functions	Homework 2
23-24	Graphing Exponential Functions	Student Handout 3
25-26	Writing Exponential Functions	Homework 3
27-28	Writing Exponential Functions	Student Handout 4
29-30	Exponential Growth and Decay	Homework 4
31-32	Exponential Growth and Decay	Quiz
33-34	Quiz: Exponential Functions	Student Handout 5
35-36	Applying Exponential Functions	Homework 5
	Applying Exponential Functions	Review

EXPONENTIAL FUNCTIONS STUDY GUIDE
Name _____ Date _____ Pd _____
Identify key features.
 $f(x) = 2 \cdot (0.4)^x$ $g(x) = -3 \cdot (1.5)^x$

For $g(x)$ above, list the following:
• y-intercept: _____
• Asymptote equation: _____
An ordered pair on the graph: _____
Mark each statement as true or false.

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				
Applying Exponential Functions				
Student Handout 5				

A MANEUVERING THE MIDDLE® RESOURCE

EXPONENTIAL FUNCTIONS



an 8 day TEKS-aligned unit

TEKS: A.9A, A.9B, A.9C, A.9D, A.9E

ready-to-go, scaffolded
student materials

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Table of Contents

PAGE	TOPIC	RESOURCE
4	Sample Pacing Guide	
5-6	Ideas for Implementation and Helpful Hints	
7-15	Binder Covers, Dividers and Spine Labels	
17-18	Intro to Exponential Functions	Student Handout 1
19-20	Intro to Exponential Functions	Homework 1
21-22	Graphing Exponential Functions	Student Handout 2
23-24	Graphing Exponential Functions	Homework 2
25-26	Writing Exponential Functions	Student Handout 3
27-28	Writing Exponential Functions	Homework 3
29-30	Exponential Growth and Decay	Student Handout 4
31-32	Exponential Growth and Decay	Homework 4
33-34	Quiz: Exponential Functions	Quiz
35-36	Applying Exponential Functions	Student Handout 5
37	Applying Exponential Functions	Homework 5
39-42	Exponential Functions Study Guide	Review
43-46	Exponential Functions Unit Test	Test

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EXPONENTIAL FUNCTIONS



an 8 day TEKS-aligned unit

TEKS: A.9A, A.9B, A.9C, A.9D, A.9E

student friendly + real-world application

multiple representations

Unit: Exponential Functions
Student Handout 3

Name _____
Date _____ Pd _____

WRITING EXPONENTIAL FUNCTIONS

We can write exponential functions of the form _____ to represent graphs or tables by identifying the values of a and b . Use the real-world example below to explore finding these values.

1. Homerun Hats is a start-up company that has seen exponential growth in hat production since their business. Use the equation and table the number of hats produced after t number of years. Complete a-c.

years	# of hats
0	1
1	2
2	4
3	8

a. How many hats did they produce when they started?

b. How can you find the initial number of hats?

c. Using the table, find the following ratios:

$$\frac{h(1)}{h(0)} = \frac{\quad}{\quad} = \frac{h(2)}{h(1)} = \frac{\quad}{\quad}$$

d. Where do you see the ratio found in part c?

For exponential functions of the form $y = a \cdot b^x$, the y -value of the function will grow by the factor b for each unit increase in x . Identify the parts of the exponential function in the table below.

EXPONENTIAL FUNCTIONS

In 2-3, find the values of a and b and then write the equation.

x	y
0	14
1	7
2	3.5
3	1.75

a: _____ b: _____
equation: _____

5. For 5-6 determine the values of a and b and write the equation.

a: _____ b: _____
equation: _____

7. Kayla wrote an equation to represent the exponential function shown in the table. Determine Kayla's error and then find the correct equation.

x	y
-1	1
0	1
1	1
2	1

a: 9 b: $\frac{1}{4}$
 $y = 9 \cdot (\frac{1}{4})^x$

A similar method can be applied to writing exponential functions from a graph. Use the example below to determine the values of a and b from the graph.

4. The graph shows the exponential function $g(x)$.

a. What is the value of a ? Explain.

b. List two coordinate points that could be used to find the value of b by setting up a ratio. What must be true about the x -values of those points?

c. Find the value of b .

d. Write the equation to represent $g(x)$.

For 5-6 determine the values of a and b and write the equation.

5. Kayla wrote an equation to represent the exponential function shown in the table. Determine Kayla's error and then find the correct equation.

x	y
-1	1
0	1
1	1
2	1

a: 9 b: $\frac{1}{4}$
 $y = 9 \cdot (\frac{1}{4})^x$

Unit: Exponential Functions
Homework 3

Name _____
Date _____ Pd _____

WRITING EXPONENTIAL FUNCTIONS

In 2012, marine biologists began studying the population of three different animal populations in a portion of the Pacific Ocean. Each population can be represented by an exponential function. Let x be the number of years since 2012 and let y be the number of animals recorded that year.

PUFFERFISH

JELLYFISH

x	y
0	425
1	850
2	1,700
3	3,400

SEA TURTLES

1. What is NOT true about the pufferfish population?

a. The initial amount of puffer fish is 100.
b. The common ratio of the function is $\frac{2}{3}$.
c. The population is exponentially increasing.
d. The range of the situation is $y \geq 100$.

2. The population of jellyfish each year since 2012 can be represented by $y = a \cdot b^x$. What is the value of b ?

3. Write a function to represent the population of jellyfish each year since 2012.

4. List two points that could be used to find the common ratio for the function that represents the sea turtles population each year since 2012?

5. Which of the following equations represents the function of the sea turtle population each year since 2012?

a. $y = 300 \cdot (\frac{5}{3})^x$
b. $y = 0.6x + 300$
c. $y = 180(0.6)^x$
d. $y = 300 \cdot (\frac{3}{5})^x$

6. Write an equation to represent the graph of the pufferfish population each year since 2012.

higher-level analysis

EXPONENTIAL FUNCTIONS



an 8 day TEKS-aligned unit

TEKS: A.9A, A.9B, A.9C, A.9D, A.9E

streamline your planning
process with unit overviews

EXPONENTIAL FUNCTIONS OVERVIEW	
STANDARD	
READINESS	SUPPORTING
<p>A.9C write exponential functions in the form $f(x) = ab^x$ (where b is a rational number) to describe problems arising from mathematical and real-world situations, including growth and decay</p> <p>A.9D graph exponential functions that model growth and decay and identify key features, including y-intercept and asymptote, in mathematical and real-world problems</p>	<p>A.9A determine the domain and range of exponential functions of the form $f(x) = ab^x$ and represent the domain and range using inequalities</p> <p>A.9B interpret the meaning of the values of a and b in exponential functions of the form $f(x) = ab^x$ in real-world problems</p> <p>A.9E write, using technology, exponential functions that provide a reasonable fit to data and make predictions for real-world problems</p>



key vocabulary



vertical alignment



sample
pacing
calendar

- DIG IDEAS**
- Many real-world and mathematical situations have certain unique characteristics.
 - Situations involving exponential growth and decay.
 - Technology can be used to make predictions.

- ESSENTIAL QUESTIONS**
- What characteristics are unique to exponential functions?
 - What features of an exponential function are related to its graph?
 - What do the values in an exponential function represent?
 - How can exponential functions be used to model real-world situations?

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	Exponential Functions Study Guide			
Student Handout 5 Homework 5	Review			



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.)

teaching
ideas



EXPONENTIAL FUNCTIONS



an 8 day TEKS-aligned unit

TEKS: A.9A, A.9B, A.9C, A.9D, A.9E

unit study guide + assessments



quizzes



editable unit test

Unit: Exponential Functions Quiz

Name _____ Pd _____

Date _____

Answers

1. _____

2. _____

3. _____

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 function $y = 5(0.5)^x$.

Unit: Exponential Functions Review

Name _____ Pd _____

Date _____

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. A.9D

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 of the following statements are true?

- _____ 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 vertical asymptote at $x = 2$.
- _____ e. Isabel's graph will have a horizontal asymptote at $y = 0$.

4. Label each graph with the function it represents.

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

ALGEBRA 1 CURRICULUM

EXPONENTIAL FUNCTIONS

UNIT TEN: ANSWER KEY

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answer keys
included

