Name ____ Date __________

6.4 Comparing Linear and Exponential Functions

For use with Exploration 6.4

Essential Question How can you compare the growth rates of linear and exponential functions?

1 EXPLORATION: Comparing Values

Work with a partner. An art collector buys two paintings. The value of each painting after t year is y dollars. Complete each table. Compare the values of the two paintings. Which painting's value has a constant growth rate? Which painting's value has an increasing growth rate? Explain your reasoning.

t	$y = 19t + 5$
0	
1	
2	
3	
4	

t	$y = 3^t$
0	
1	
2	
3	
4	

2 EXPLORATION: Comparing Values

Work with a partner. Analyze the values of the two paintings over the given time periods. The value of each painting after t years is y dollars. Which painting's value eventually overtakes the other?

t	$y = 19t + 5$
4	
5	
6	
7	
8	
9	

t	$y = 3^t$
4	
5	
6	
7	
8	
9	

3 EXPLORATION: Comparing Graphs

Work with a partner. Use the tables in Explorations 1 and 2 to graph $y = 19t + 5$ and $y = 3^t$ in the same coordinate plane. Compares the graph of the functions.

Communicate Your Answer

3. How can you compare the growth rates of linear and exponential functions?

4. Which function has a growth rate that is eventually much greater than the growth rates of the other function? Explain your reasoning.

Name ____ Date __________

6.4 Practice

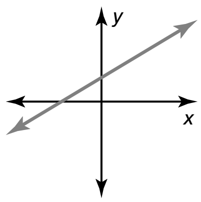
For use after Lesson 6.4

Core Concepts

Linear, Exponential, and Quadratic Functions

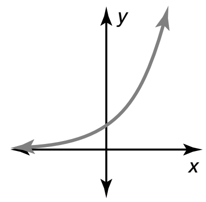
Linear Function

$y = mx + b$



Exponential Function

$y = ab^x$



Notes:

Differences and Ratios of Functions

You can use patterns between consecutive data pairs to determine which type of function models the data.

- **Linear Function** The differences of consecutive *y*-values are constant.
- **Exponential Function** Consecutive *y*-values have a common *ratio*.

In each case, the differences of consecutive *x*-values need to be constant.

Notes:

Comparing Functions Using Average Rates of Change

As *a* and *b* increase, the average rate of change between $x = a$ and $x = b$ of an increasing exponential function $y = f(x)$ will eventually exceed the average rate of change between $x = a$ and $x = b$ of an increasing linear function $y = g(x)$. So, as *x* increases, $f(x)$ will eventually exceed $g(x)$.

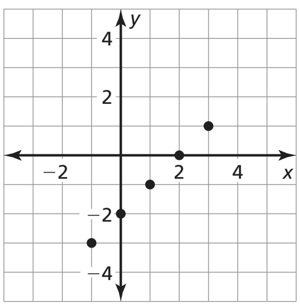
Notes:

Worked-Out Examples

Example #1

Plot the points. Tell whether the points appear to represent a linear function, an exponential function, or neither.

(–1, –3), (0, –2), (1, –1), (2, 0), (3, 1)



The points appear to lie on a straight line. So, they appear to represent a linear function.

Example #2

Tell whether the table of values represents a linear or an exponential function. Then write the function.

+1 +1 +1 +1

x	−2	−1	0	1	2
y	$\frac{1}{5}$	1	5	25	125

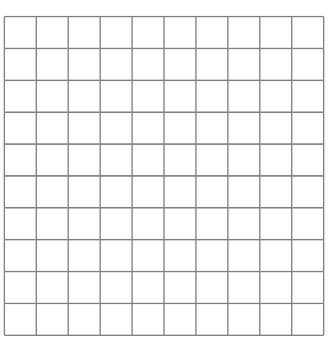
×5 ×5 ×5 ×5

Consecutive y-values have a common ratio of 5, and the y-intercept is 5. So, the table represents the exponential function $y = 5(5)^x$.

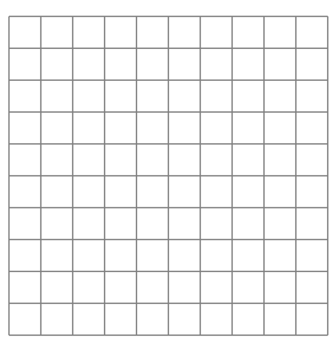
Practice A

In Exercises 1–4, plot the points. Tell whether the points appear to represent a *linear function*, an *exponential function*, or *neither*.

1. $(-3, 2), (-2, 4), (-4, 4), (-1, 8), (-5, 8)$

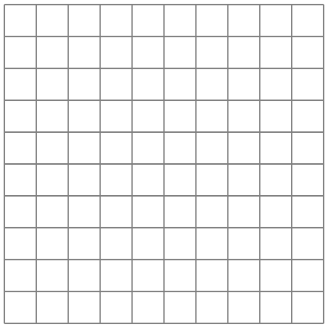


2. $(-3, 1), (-2, 2), (-1, 4), (0, 8), (2, 14)$

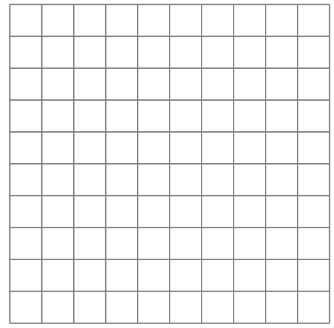


6.4 Practice (continued)

3. $(4, 0), (2, 1), (0, 3), (-1, 6), (-2, 10)$



4. $(2, -4), (0, -2), (-2, 0), (-4, 2), (-6, 4)$



In Exercises 5 and 6, tell whether the table of values represents a *linear*, or an *exponential* function.

5.

x	−2	−1	0	1	2
y	7	4	1	−2	−5

6.

x	−2	−1	0	1	2
y	$\frac{1}{18}$	$\frac{1}{3}$	2	12	72

In Exercises 7 and 8, tell whether the data represent a *linear*, or an *exponential* function. Then write the function.

7. $(-2, -4), (-1, -1), (0, 2), (1, 5), (2, 8)$

8. $(-2, 1.75), (-1, 3.5), (0, 7), (1, 14), (2, 28)$

9. A person invests \$1000 into an account that earns compound interest. The table shows the amount A (in dollars) in the account after t (in years) time has passed. Tell whether the data can be modeled by a *linear* or an *exponential* function. Explain.

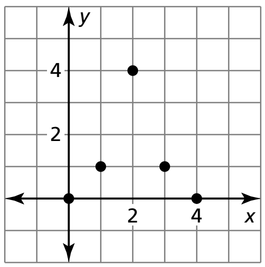
Time, *t*	0	1	2	3	4
Amount, *A*	1000	1050	1102.50	1157.63	1215.51

Name____ Date__________

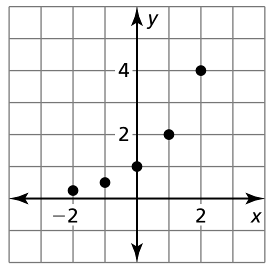
Practice B

In Exercises 1 and 2, tell whether the points appear to represent a *linear function*, an *exponential function*, or *neither*.

1.



2.



In Exercises 3–6, plot the points. Tell whether the points appear to represent a *linear function*, an *exponential function*, or *neither*.

3. $\left(2, \frac{1}{16}\right), \left(1, \frac{1}{4}\right), (0, 1), (-1, 4), (-2, 16)$

4. $(-1, 5), (0, 0), (1, -1), (2, 0), (3, 5)$

5. $(-4, -3), (-2, -2), (0, -1), (2, 0), (4, 1)$

6. $(-3, -6), (-2, -4), (-1, -2), (0, 0), (1, 2)$

In Exercises 7–10, tell whether the table of values represents a *linear*, or an *exponential* function. Then write the function.

7.

x	−3	−2	−1	0	1	2
y	8	4	2	1	0.5	0.25

8.

x	1	2	3	4	5	6
y	2	0	−2	−4	−6	−8

9.

x	1	2	3	4	5	6
y	−8	−5	−2	1	4	7

10.

x	−1	0	1	2	3
y	3	$\frac{3}{2}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{16}$

11. Write a function that has an average rate of change that is constant.