Inspiring Greatness

INDEPENDENCE SCHOOL DISTRICT

Math Virtual Learning

Algebra 1 S2

April 29th, 2020

Algebra 1 S2
Lesson: April 29th, 2020

Learning Target:

Students will compare linear, exponential, and quadratic functions and compare their rates of change for a given interval.

Warm-Up

Click here to practice comparing linear, quadratic, and exponential functions from a graph.

*Set timers to beat your scores.

Review of Functions

Identifying from an equation:

Linear	Quadratic	Exponential
Has an x with no exponent. $y = 5x + 1$ $y = \frac{1}{2}x$ $2x + 3y = 6$	Has an x^2 in the equation. $y = 2x^2 + 3x - 5$ $y = x^2 + 9$ $x^2 + 4y = 7$	Has an x as the exponent. $y = 3^x + 1$ $y = 5^{2x}$ $4^x + y = 13$

You Try!

Examples: Are the following LINEAR, QUADRATIC or EXPONENTIAL?

1. $y = 6^x + 3$ _____
2. $y = 7x^2 + 5x - 2$ _____
3. $9x + 3 = y$ _____
4. $4^{2x} = 8 + y$ _____

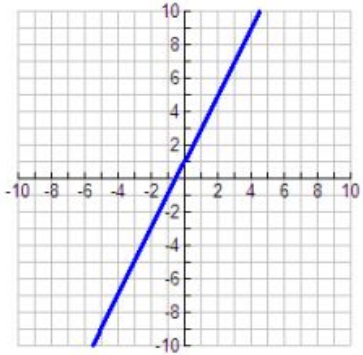
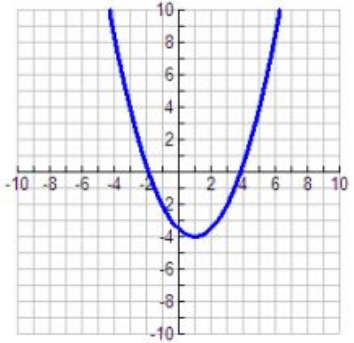
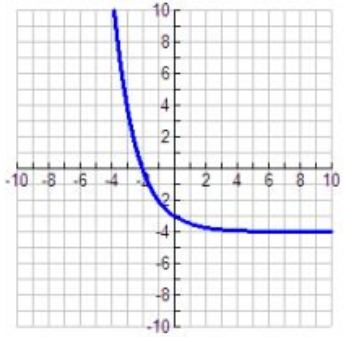
You Try!

Examples: Are the following LINEAR, QUADRATIC or EXPONENTIAL?

1. $y = 6^x + 3$ **Exponential**
2. $y = 7x^2 + 5x - 2$ **Quadratic**
3. $9x + 3 = y$ **Linear**
4. $4^{2x} = 8 + y$ **Exponential**

Review of Functions

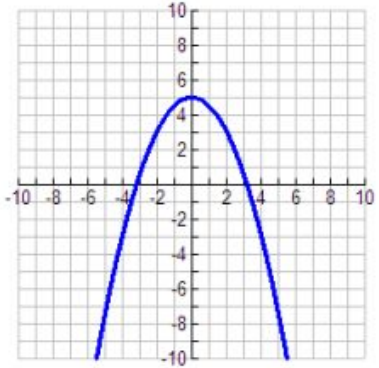
Identifying from a graph:

Linear	Quadratic	Exponential
Makes a straight line	Makes a parabola	Rises or falls quickly in one direction
		

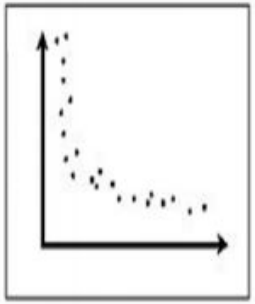
You Try!

Examples: Are the following LINEAR, QUADRATIC, or EXPONENTIAL?

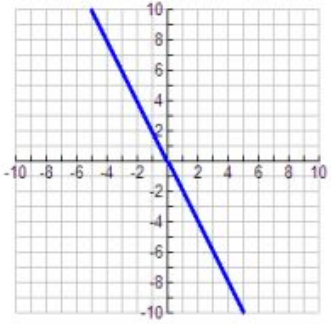
A.



B.



C.

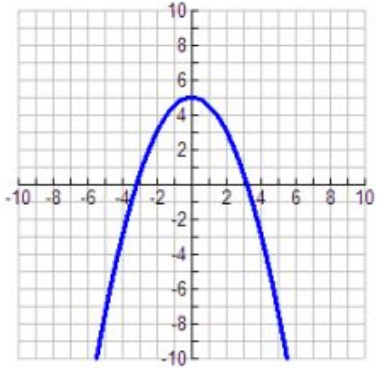


_____ _____ _____

You Try!

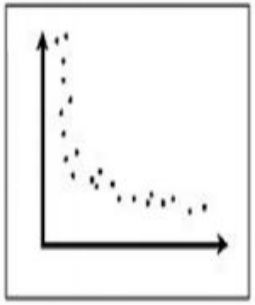
Examples: Are the following LINEAR, QUADRATIC, or EXPONENTIAL?

A.



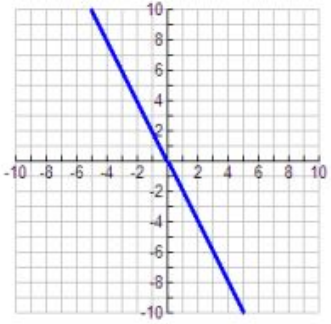
Quadratic

B.



Exponential

C.



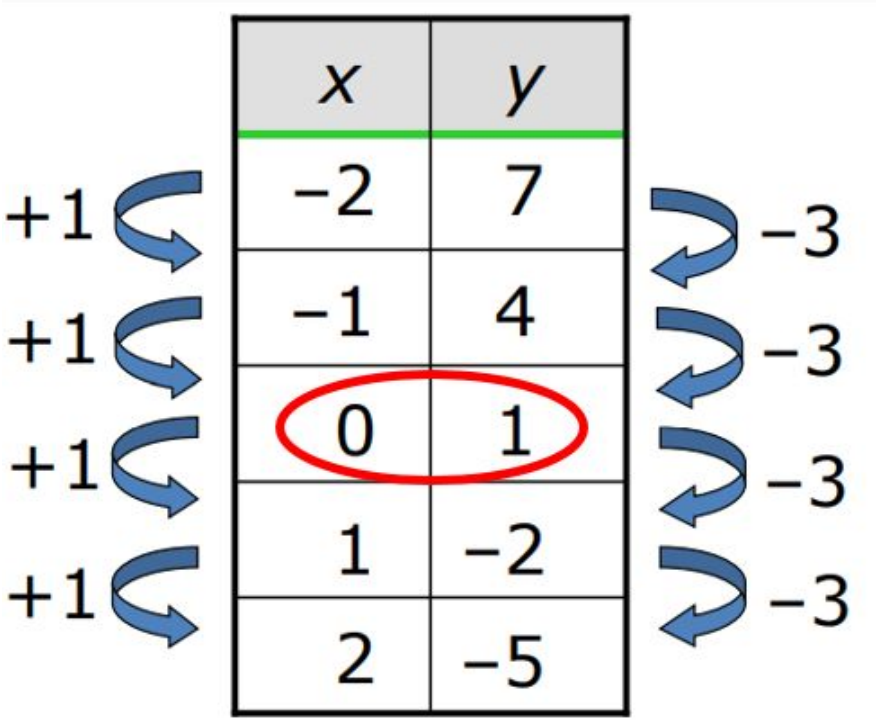
Linear

Linear, Exponential or Quadratic: *Comparing Rates of Change*

x	y
−2	7
−1	4
0	1
1	−2
2	−5

- How are the y-values changing as the x-values increase?
- What type of function has this kind of rate of change?
- What is the equation of this function?

Linear, Exponential or Quadratic: *Comparing Rates of Change*



Linear functions have constant **first differences**.

$$y = -3x + 1$$

Constant rate of change, or 1st difference

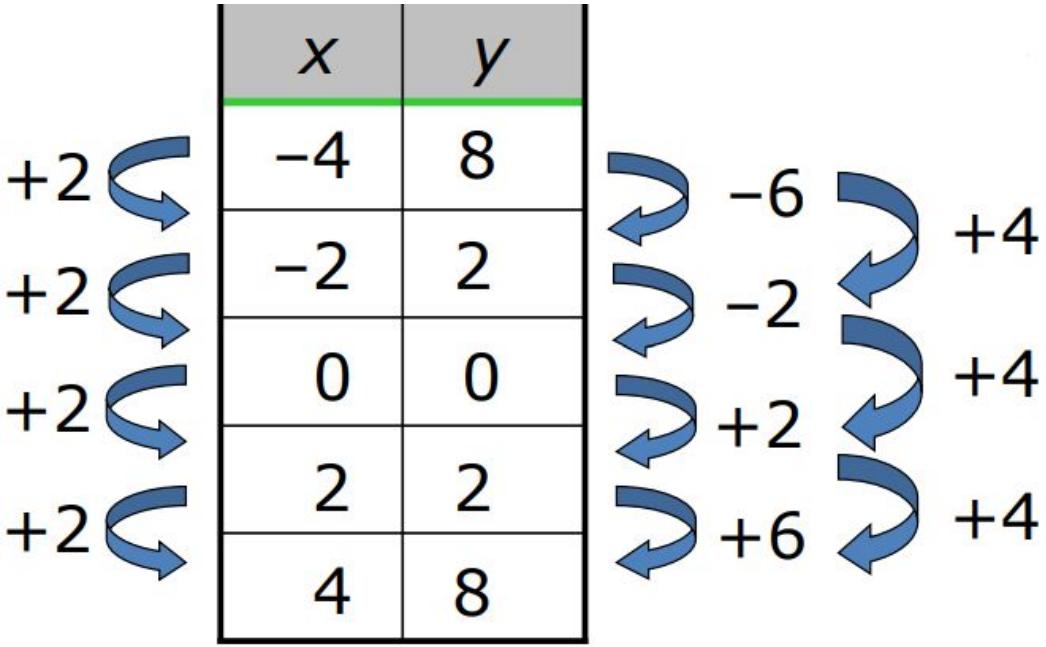
y-intercept, or zero term

Linear, Exponential or Quadratic: *Comparing Rates of Change*

x	y
−4	8
−2	2
0	0
2	2
4	8

- How are the y-values changing as the x-values increase?
- What type of function has this kind of rate of change?
- What is the equation of this function?

Linear, Exponential or Quadratic: *Comparing Rates of Change*



Quadratic functions have constant **second differences**.

$$y = \frac{1}{2}x^2$$

Notice that if you take each x value and square it and then take half of it you get the y-value. So for example, take the x value of 4. If we square it we get 16. Then if we take half of it we get 8, which is our y-value. This is why the equation is: $y = \frac{1}{2}x^2$

Linear, Exponential or Quadratic: *Comparing Rates of Change*

x	y
0	1
1	2
2	4
3	8
4	16

- How are the y-values changing as the x-values increase?
- What type of function has this kind of rate of change?
- What is the equation of this function?

Linear, Exponential or Quadratic: *Comparing Rates of Change*

	x	y	
	0	1	
+1	1	2	×2
+1	2	4	×2
+1	3	8	×2
+1	4	16	×2

Exponential functions have a **constant ratio**.

$$y = 1(2)^x$$

y-intercept, or zero term

multiplier, or common ratio

You Try: *Comparing Rates of Change*

Height of Golf Ball	
Time (s)	**Height (ft)**
0	4
1	68
2	100
3	100
4	68

Determine the rate of change in the table and identify whether this data is linear, exponential or quadratic.

You Try: *Comparing Rates of Change*

Height of Golf Ball	
Time (s)	**Height (ft)**
0	**4**
1	**68**
2	**100**
3	**100**
4	**68**

+ 1, + 1, + 1, + 1

+ 64, + 32, 0, –32

–32, –32

For every constant change in time of +1 second, there is a constant second difference of –32.

The data appear to be quadratic.

You Try: *Comparing Rates of Change*

Money in CD	
Time (yr)	Amount ($)
0	1000.00
1	1169.86
2	1368.67
3	1601.04

Determine the rate of change in the table and identify whether this data is linear, exponential or quadratic.

You Try: *Comparing Rates of Change*

Money in CD	
Time (yr)	Amount ($)
0	1000.00
1	1169.86
2	1368.67
3	1601.04

Hint: You may have noticed that the amount of money does not go up by a constant rate. Maybe there's a common ratio. To check, take the ratio (divide) one amount by the amount before it. For example, calculate:

$$\frac{1169.86}{1000} = \qquad \frac{1368.67}{1169.86} =$$

You Try: *Comparing Rates of Change*

Money in CD	
Time (yr)	Amount ($)
0	1000.00
1	1169.86
2	1368.67
3	1601.04

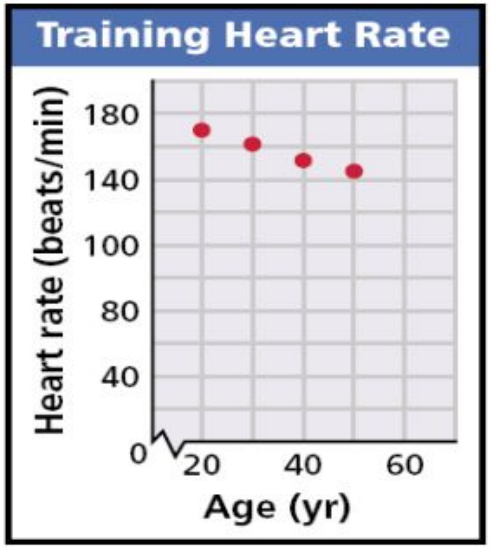
+ 1
+ 1
+ 1

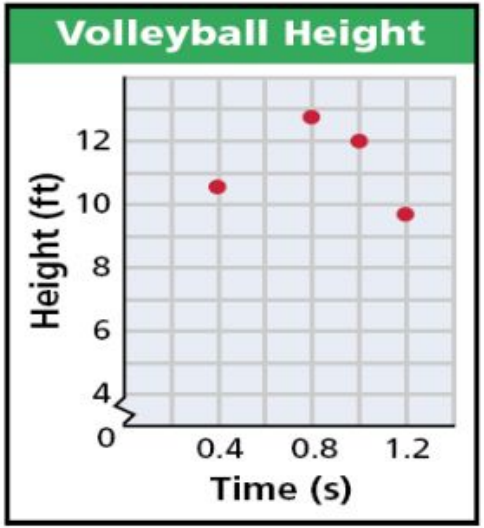
× 1.17
× 1.17
× 1.17

For every constant change in time of + 1 year there is an approximate constant ratio of 1.17.

The data appear to be exponential.

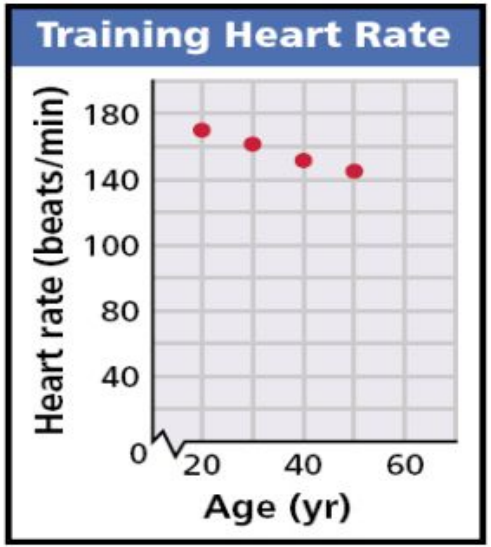
What best describes each graph - Linear, Exponential or Quadratic?



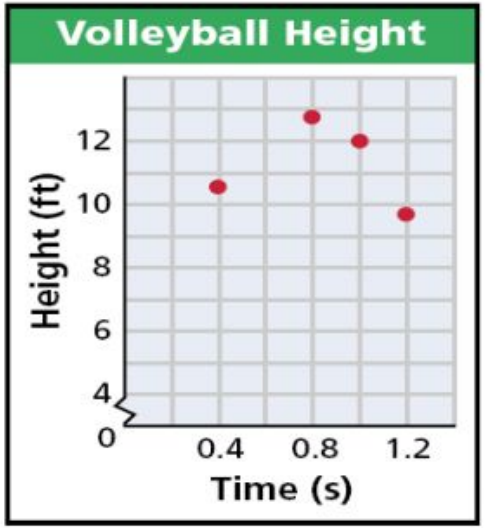


In the real world, people often gather data and then must decide what kind of relationship (if any) they think best describes their data.

What best describes each graph - Linear, Exponential or Quadratic?



Linear



Quadratic

Exponential

Lesson Quiz

Which kind of model best describes each set of data?

1.

Time (s)	Height of Ball (ft)
0	200
1	184
2	136
3	56

2.

Value of Townhouse	
Age (yr)	Value ($)
0	100,000
1	102,000
2	104,040
3	106,121

Lesson Quiz

3. Use the data in the table to describe how the amount of water is changing. Then write a function that models the data. Use your function to predict the amount of water in the pool after 3 hours.

Water in a Swimming Pool	
Time (min)	**Amount of Water (gal)**
10	327
20	342
30	357
40	372

Lesson Quiz - KEY

1.

Time (s)	Height of Ball (ft)
0	200
1	184
2	136
3	56

-16, -48, -80

-32, -32

2nd diff is constant

quadratic

2.

Value of Townhouse	
Age (yr)	Value ($)
0	100,000
1	102,000
2	104,040
3	106,121

$\frac{102,000}{100,000} = 1.02$

$\frac{104,040}{102,000} = 1.02$

$\times 1.02$

exponential

common ratio or multiplier is 1.02

Lesson Quiz - KEY

3. Use the data in the table to describe how the amount of water is changing. Then write a function that models the data. Use your function to predict the amount of water in the pool after 3 hours.

Water in a Swimming Pool	
Time (min)	**Amount of Water (gal)**
10	327
20	342
30	357
40	372

Increasing by 15 gal every 10 min;

$y = 1.5x + 312$;

582 gal

Starting amount of water at 0 minutes is 312 gallons. Go backwards in the table 327-15

3 hours = 60 minutes x 3 = 180 minutes

1.5(180)+312 = 582 gallons

Independent Practice

Here is the practice worksheet. Complete it and compare your answers with the key.

Additional Practice:

Click on the links below to get additional practice and to check your understanding!

Extra Practice with all methods.

*KEY