

LESSON

14

Avi and Benita's Repair Shop

LEARNING OBJECTIVES

- Today I am: deciding which hiring option is best.
- So that I can: see how quickly an exponential function can grow.
- I'll know I have it when I can: look at a table, graph or equation and determine if it represents a nonlinear function.

Opening Exercise

Avi and Benita run a repair shop. They need some help, so they hire you. Avi and Benita have different options for how much they'll pay you each day. In this Desmos activity, you'll explore those options. Let's get started!

You will need: the class code for Avi and Benita's Repair Shop, Chromebook



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1. Use the class code given to you by your teacher and begin the *Avi & Benita's Repair Shop* activity on Desmos.

Once you are finished with the Desmos activity, discuss the following questions in your group.

2. Did your opinion of each option change as you completed the activity? Explain.

3. On Screen 8, a new employee starts working at Avi and Benita's repair shop. What advice did you give the new employee? Why?

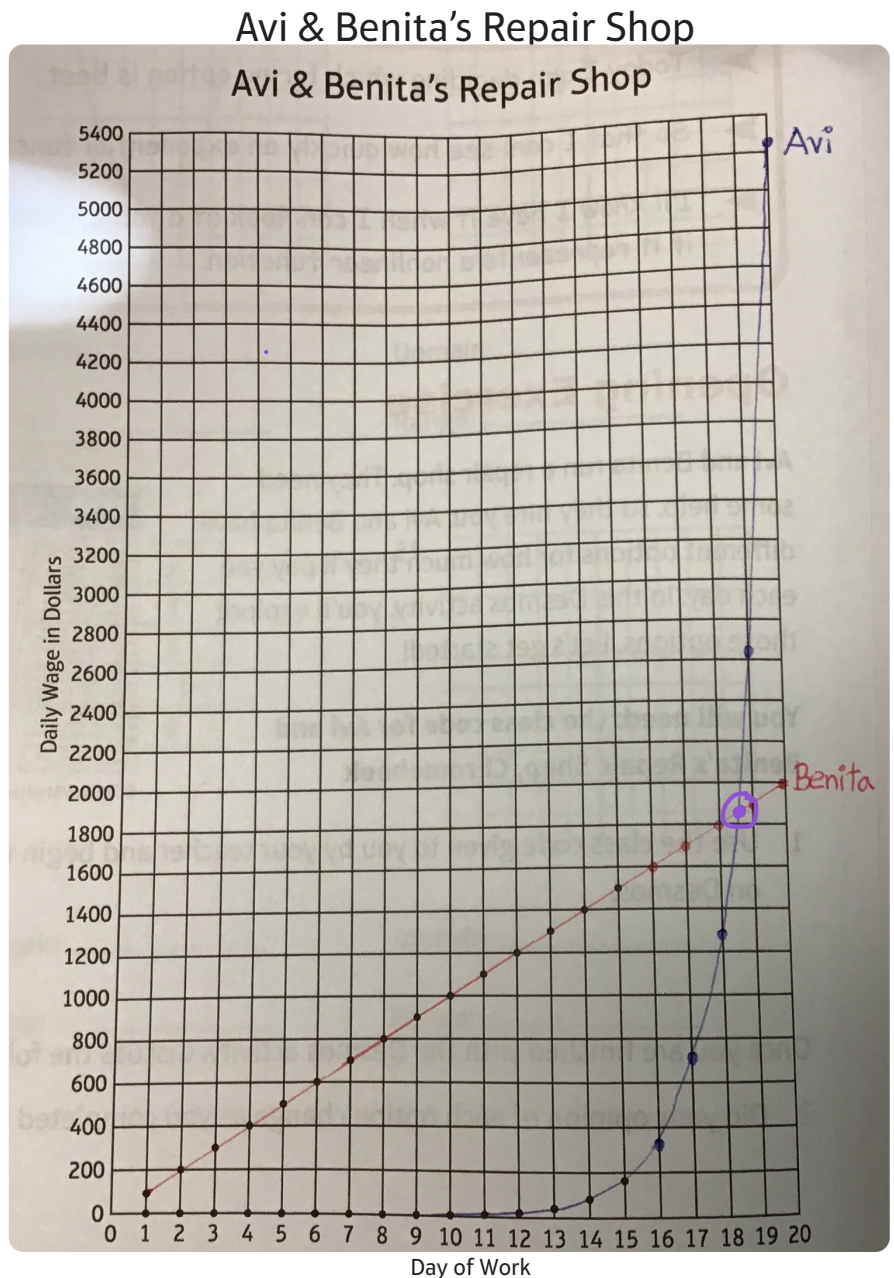
Benita → day 1-18
 Avi → day 19 and on

4. On Screen 9, you are asked to decide which option is best if you are NOT allowed to change once you choose an option. Which option do you think is best? Explain your thinking.

5. On Screens 3 and 6, you are asked to complete a table of values for each option. Use the table below to recreate those values. Then graph them on the grid provided. Be sure to include a legend.

Day	Avi's Rule in dollars	Benita's Rule in dollars
1	0.01	100
2	0.02	200
3	0.04	300
4	0.08	400
5	0.16	500
6	0.32	600
7	0.64	700
8	1.28	800
9	2.56	900
10	5.12	1000
11	10.24	1100
12	20.48	1200
13	40.96	1300
14	81.92	1400
15	163.84	1500
16	327.68	1600
17	655.36	1700
18	1310.72	1800
19	2621.44	1900
20	5242.88	2000

*



6. A. Estimate the day Avi's option became a better choice than Benita's. How can you tell?

Between day 18-19

- B. Estimate the day Benita's option became a better choice than Avi's. How can you tell?

Day 1-18

Although the data is discrete, we'll connect the points so that we can write equations for each function as if they were continuous.

7. Discuss with your partner the difference between discrete and continuous data.

↳ individual points.

8. A. Benita's option is a linear function. What is the slope of this function?

$$y = mx + b$$

$$m = \frac{\$100}{1 \text{ day}}$$

- B. What is the y-intercept of this function?

$$b = 0$$

- C. What is the equation for Benita's data?

$$y = 100x$$

9. Avi's option is a nonlinear function.

- A. What type of function could model Avi's data?

Exponential (growth)
 $d \geq 0$

- B. The explicit formula $f(d) = a \cdot b^d$ can be used to model Avi's data. In this case, a represents the initial amount, b represents the growth factor and d represents the day. Use the data in the table to write the equation for Avi's data.

Geometric $\rightarrow f(d) = 0.01(2)^{d-1}$ for $d \geq 1$

Exp $\rightarrow f(d) = a \cdot b^d$ $d \geq 0$

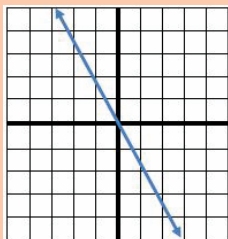
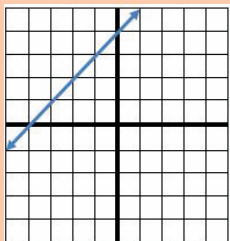
Lesson Summary

The Venn diagram below compares linear and nonlinear functions.

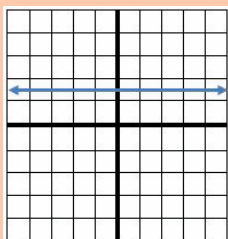
Linear Functions

- $y = mx + b$

- A line is formed when it is graphed.



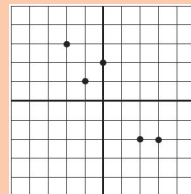
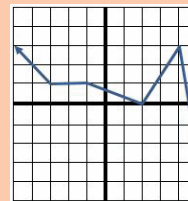
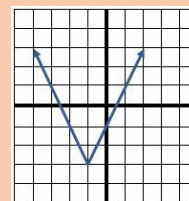
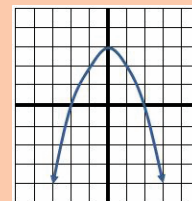
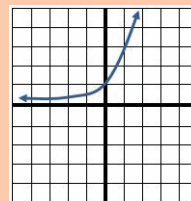
- These can also be of the form $y = \text{number}$.



Nonlinear Functions

- Any equation as long as it ***isn't*** of the form $y = mx + b$

- The graph is a curve, set of segments or rays, a combination of both, or a set of discrete data.



- All of these can be graphed.
- All must pass the Vertical Line Test.

NAME: _____ PERIOD: _____ DATE: _____

Homework Problem Set

Determine if the table in each problem can represent a linear function. Explain your thinking.

1.

x	y
0	7
2	9
4	11
6	13

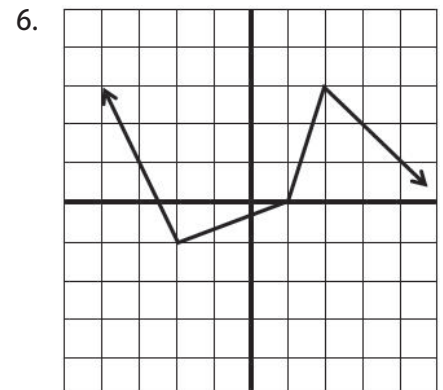
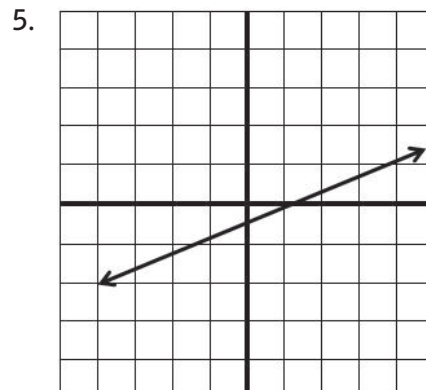
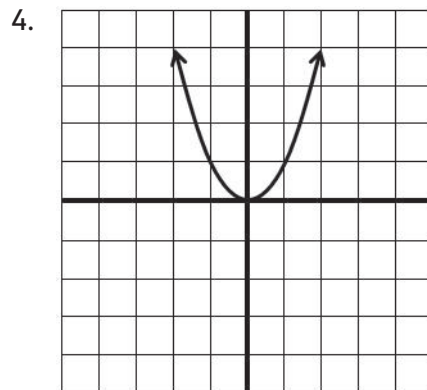
2.

x	y
1	3
2	6
3	9
4	12

3.

x	y
0	0
1	1
2	4
3	9

Determine if the graph in each problem is representing a linear or a nonlinear function.



Determine if the equation in each problem is representing a linear or a nonlinear function.

7. $f(x) = 2x - 1$

8. $f(x) = 2x^2 - 1$

9. $f(x) = -3 + 4x$

Choose the Best Option

Two equipment rental companies have different penalty policies for returning a piece of equipment late.

Company 1: On day 1, the penalty is \$5. On day 2, the penalty is \$10. On day 3, the penalty is \$15. On day 4, the penalty is \$20, and so on, increasing by \$5 each day the equipment is late.

Company 2: On day 1, the penalty is \$0.01. On day 2, the penalty is \$0.02. On day 3, the penalty is \$0.04. On day 4, the penalty is \$0.08, and so on, doubling in amount each additional day late.



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Jim rented a digger from Company 2 because he thought it had the better late return policy. The job he was doing with the digger took longer than he expected, but it did not concern him because the late penalty seemed so reasonable. When he returned the digger 15 days late, he was shocked by the penalty fee.

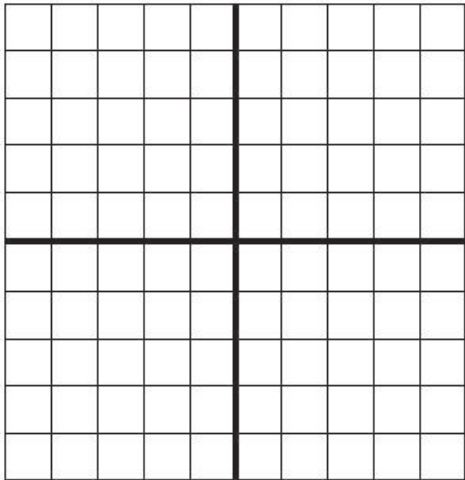
10. Why is Company 2 a more expensive option for Jim?

11. Use the table below to see the charges over the 15 late days.

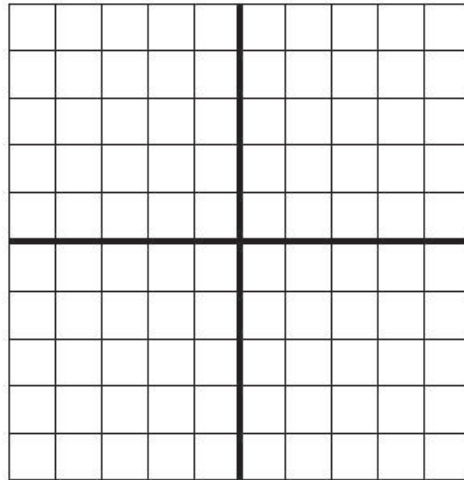
Company 1	
Day	Penalty
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Company 2	
Day	Penalty
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

18. Sketch a graph of a linear function.



19. Sketch a graph of a nonlinear function.



Spiral REVIEW—Evaluating Functions

Determine the value of $f(2)$ and $f(-2)$ for each equation below.

20. $f(x) = 2x - 1$

21. $f(x) = 2x^2 - 1$

22. $f(x) = -3 + 4x$

23. $f(x) = |2x - 1|$

24. $f(x) = |2x^2 - 1|$

25. $f(x) = |-3 + 4x|$

26. $f(x) = |2x| - 1$

27. $f(x) = |2x^2| - 1$

28. $f(x) = -3 + |4x|$