LESSON 29

Describing Functions

LEARNING OBJECTIVES

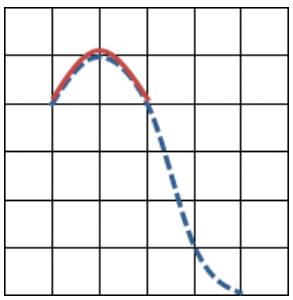
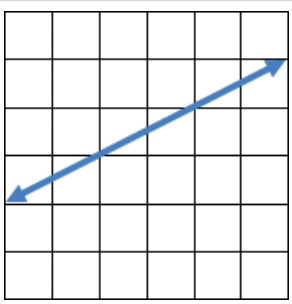
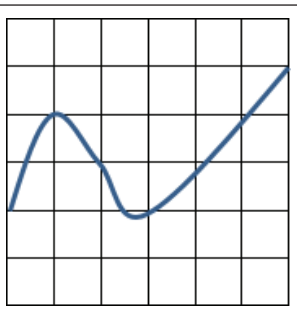
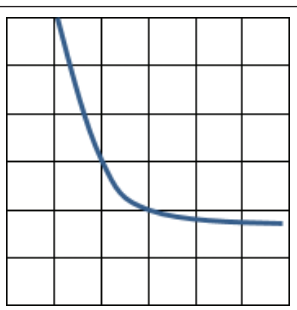
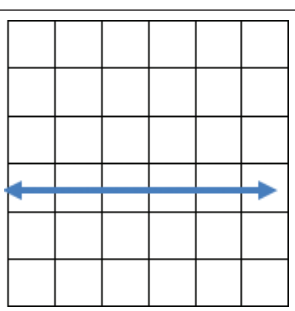
- Today I am: using Desmos to examine intervals on graphs.
- So that I can: write a description of the graph using mathematical language.
- I'll know I have it when I can: sketch a graph based on descriptions.

Opening Exercise

You will need: a Chromebook and a class code for *#__Describing Function Intervals__#* on Desmos

1. Use the class code _____ to begin the Desmos activity on describing function intervals.

2. Match the vocabulary word to the correct definition and example.

Vocabulary Term	Definition	Example
A. linear 5, ii, v	1. A function where the y-value increases as the x-value increases	i. 
B. nonlinear 3, i, iii, iv	2. The set of real numbers such that any number that lies between the two endpoints is part of the set	ii. 
C. interval 2	3. A curve or a set of discrete data points	iii. 
D. increasing 1, ii	4. A function where the y-value decreases as the x-value increases	iv. 
E. decreasing 4, iv	5. A function with a constant slope value	v. 

Exploration 1—Describing Graphs

Let's look at describing a different graph before we examine our world population graph. Use the graph of $f(x)$, on the right, to answer the following questions.

3. What is $f(-1)$?

1

4. What is $f(2)$?

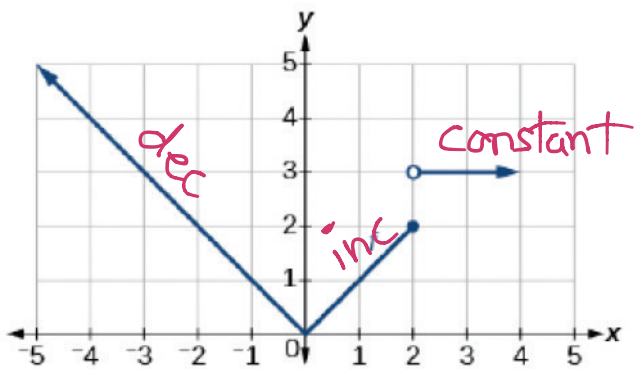
2

5. What is the domain of this function?

$(-\infty, \infty)$

6. What is the range of this function?

$[0, \infty)$

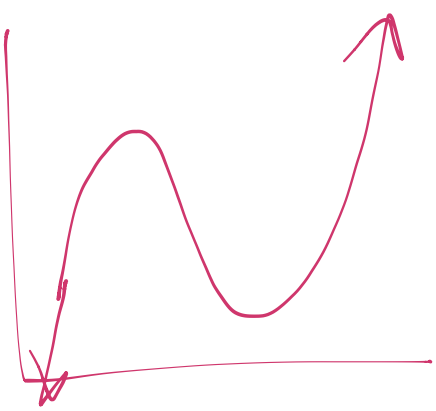


7. At what numbers is $f(x) = 1$?

$x = 1, -1$

8. At what numbers is $f(x) = 3$?

$(2, \infty)$, -3



9. For what intervals is the function increasing?

$(0, 2)$

10. For what intervals is the function decreasing?

$(-\infty, 0)$

11. For what intervals is the function constant?

$(2, \infty)$

12. Is there a relative ~~maximum~~ or minimum on this graph? Where is it?

relative minimum at $x = 0 \rightarrow (0, 0)$

13. Can you determine $f(4)$? If so, what is it and how did you find it?

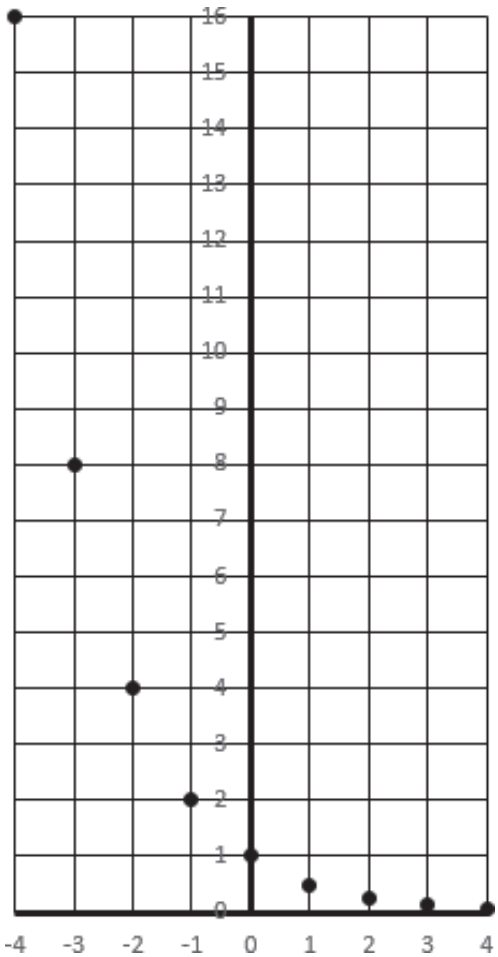
3

14. Can you determine $f(-6)$? If so, what is it and how did you find it?

6

Exploration 2—Describing Discrete Data

Use the graph of $g(x)$, on the right, to answer the following questions.



15. What is $g(-1)$?

16. What is $g(2)$?

17. What is the domain of this function?

18. What is the range of this function?

19. At what numbers is $g(x) = 1$?

20. At what numbers is $g(x) = 4$?

21. Can you determine $g(3)$? If so, what is it and how did you find it?

22. Can you determine $g(-6)$? If so, what is it and how did you find it?

Describing Data

Science Buddies at https://www.sciencebuddies.org/science-fair-projects/competitions/data-analysis-for-advanced-science-projects explains why data analysis is so important in science.

23. **Read** over the excerpt and **highlight two** important ideas that you never considered before.

Without careful data analysis to back up your conclusions, the results of your scientific research won't be taken seriously by other scientists.

Three common mistakes among young scientists are assuming that:

- Data analysis occurs only after you are done collecting all your data.
- Data analysis is quick—you pick your analysis methods, apply them in a "plug-in" fashion, and then you are done.
- Data can stand alone without additional context.

None of these things could be further from the truth. Data analysis is an ongoing process in a research project.

Although it might be tempting to quickly plug your data into a spreadsheet, create a graph, print out the basic corresponding statistics, and celebrate your project as "finished," this methodology might lead you to miss relevant information. Instead, you should plan to spend a good chunk of time "playing" with your data. The more variables you test, the longer this "playing" takes. By looking at the data from various perspectives, trying different ways of organizing the data and representing it visually and mathematically, you might stumble upon connections or trends of which you were unaware when starting the project.

Lastly, it is always important to not just have your data stand alone, but to put it into context. Simply put, expressing your data relative to other data is much more enlightening.

Generally speaking, scientific data analysis usually involves one or more of following three tasks:

- Generating tables,
- Converting data into graphs or other visual displays, and/or
- Using statistical tests.

You might think of graphs as the primary way to present your data to others; although graphs *are* excellent ways of doing that, they're also a good analytical mechanism. Seeing your data in different graphical formats might highlight new conclusions, new questions, or the need to go and gather additional data.

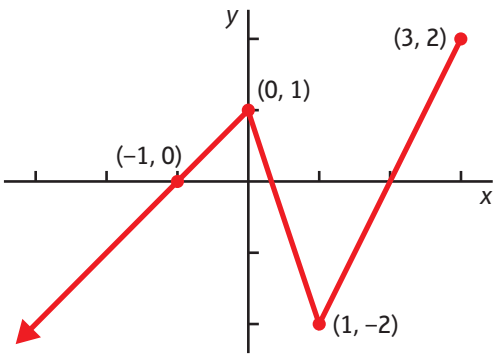
NAME: _____ PERIOD: _____ DATE: _____

Homework Problem Set

Use the graph of $g(x)$, on the right, to answer the following questions.

1. What is $g(-1)$?

2. What is $g(3)$?



3. What is the domain of this function?

4. What is the range of this function?

5. At what numbers is $g(x) = 0$?

6. For what intervals is the function increasing?

7. For what intervals is the function decreasing?

8. For what intervals is the function constant?

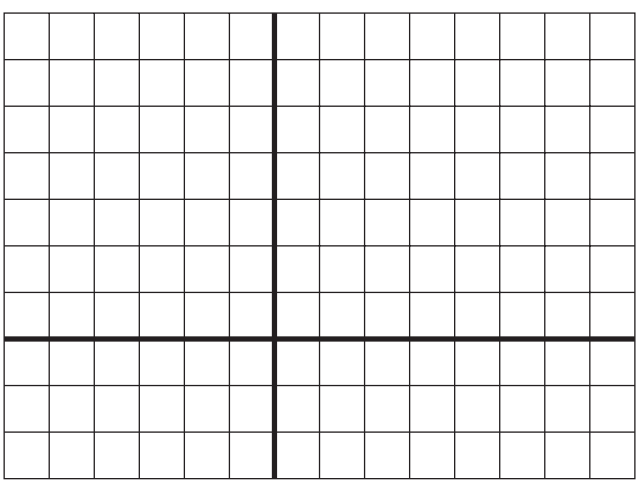
9. Is there a relative maximum or minimum on this graph? Where are they?

10. Can you determine $g(4)$? If so, what is it and how did you find it?

11. Can you determine $g(-6)$? If so, what is it and how did you find it?

12. **Open Ended** Sketch a function that follows all the descriptions given.

- ☐ The function is increasing from $(-1, 3)$.
- ☐ The function is decreasing from $(-5, -1)$.
- ☐ The function is constant from $(3, 7)$.
- ☐ The function is linear from $(-1, 3)$.
- ☐ The function is nonlinear on the interval $(-5, -1)$.
- ☐ The function is continuous, meaning there are no breaks.
- ☐ $(-5, 4)$ is a point on the function.
- ☐ The domain is $[-5, 7]$.
- ☐ The range is $[-2, 4]$.



13. Which descriptions in Problem 12 were the most difficult to sketch? Why?

14. Which clues did you use first? Why?