



Math Objectives

- Students will understand the definition of *function* and use it to identify whether or not an input-output pairing represents a function.
- Students will determine if a graph represents a function by using a moving vertical line.
- Students will determine if a table of x - and y -values represents a function.
- Students will use clear definitions in discussion and reasoning (CCSS Mathematical Practice).

Vocabulary

- function

About the Lesson

- A function associates exactly one output value y with each possible input value x . If more than one output value y is associated with a single input value x , that process does not describe a function.
- In this lesson, students are presented with graphs and tables and asked to determine which represent functions and which do not.

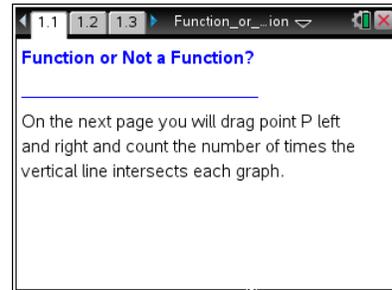


TI-Nspire™ Navigator™

- Use Quick Poll to check student understanding.
- Use Class Capture to examine patterns that emerge.
- Use Live Presenter to engage and focus students.
- Use Teacher Edition computer software to review student documents.

Activity Materials

- Compatible TI Technologies:  TI-Nspire™ CX Handhelds,  TI-Nspire™ Apps for iPad®,  TI-Nspire™ Software



Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

Lesson Files:

Student Activity

- Function_or_Not_a_Function_Student.PDF
- Function_or_Not_a_Function_Student.DOC

TI-Nspire document

- Function_or_Not_a_Function.tns



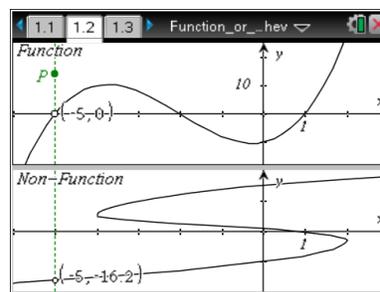
Discussion Points and Possible Answers



Tech Tip: If students experience difficulty dragging a point, check to make sure that they have moved the arrow until it becomes a hand () getting ready to grab the point. Also, be sure that the word *point* appears. Then press **ctrl** to grab the point and close the hand (). When finished moving the point, press **esc** to release the point. Once a function has been graphed, the entry line can be shown by pressing **ctrl** **G**.

Move to page 1.2.

1. Grab point *P* to move the vertical line across the graphs. Move point *P* back and forth to observe the number of times the vertical line intersects each graph at different parts of the graph.
 - a. Does the vertical line ever intersect the graph labeled **Function** at more than one point?



Answer: No.

- b. Does the vertical line ever intersect the graph labeled **Non-Function** at more than one point?

Answer: Yes.

2. Based on your observations in question 1:
 - a. A vertical line intersects the graph of the **Function** at more than one point:

Answer: NEVER

- b. A vertical line intersects the graph of the **Non-Function** at more than one point:

Answer: SOMETIMES

3. Move the vertical line so that it intersects the **Non-Function** graph at more than one point.
 - a. What do the coordinates of these points have in common?

Answer: The points have the same value for the *x*-coordinates.



b. What is different about the coordinates of these points?

Answer: The points have different values for the y -coordinates.



TI-Nspire Navigator Opportunity: **Class Capture**

See Note 1 at the end of this lesson.

Move to page 1.3.

4. The tables display the ordered pairs from a function and a non-function.

a. How are the tables the same?

Answer: They both display pairings of x - and y -values.

b. How are the tables different?

Answer: The *Non-Function* table has some of the x -values repeated with different y -values.

Function		Non-Function	
x	y	x	y
-1	7	-1	7
0	2	0	2
1	-2	0	-1
2	-1	1	-2
3	7	2	-1
		2	2
		3	7

5. A **function** is a relation for which every possible input value x has only one output value y .

a. Explain why the *graph* labeled **Non-Function** on page 1.2 does not represent a function.

Answer: The graph does not represent a function because some x -values can be graphed with more than one y -value.

b. Explain why the *table* labeled **Non-Function** on page 1.3 does not represent a function.

Answer: The table does not represent a function because it contains x -values that are paired with multiple y -values.

Teacher Tip: The critical issue is whether there are any repeated x -values with different y -values. If students have difficulty recognizing this, instruct them to always look first at the x -values. If no x -values repeat, then the table does represent a function, since you can't have multiple y -values paired with any one x -value if each x -value occurs only once.



TI-Nspire Navigator Opportunity: **Quick Poll**

See Note 2 at the end of this lesson.

While students are working on pages 2.1, 3.1, 4.1, and 5.1 in the TNS file:



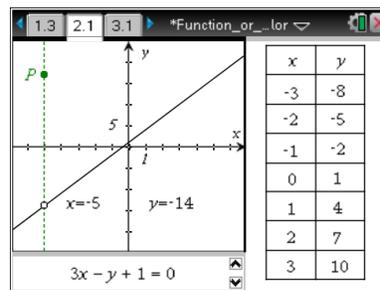
TI-Nspire Navigator Opportunity: **Live Presenter and Class Capture**

See Note 3 at the end of this lesson.

Move to page 2.1.

- Examine the graph and table. Grab point P , and drag the vertical line back and forth to explore the graph of the equation $3x - y + 1 = 0$. Is $3x - y + 1 = 0$ a function? Why or why not?

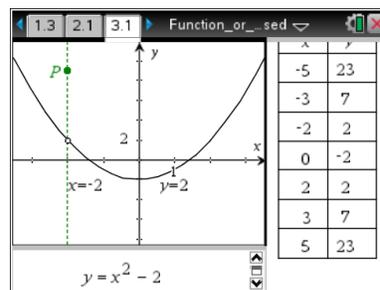
Answer: Yes, this is a function. On the graph and in the table, each x -value has only one y -value.



Move to page 3.1.

- Examine the graph and table. Grab point P , and drag the vertical line back and forth to explore the graph of the equation $y = x^2 - 2$. Is $y = x^2 - 2$ a function? Why or why not?

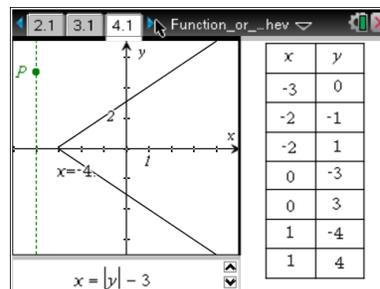
Answer: Yes, this is a function. On the graph and in the table, each x -value has only one y -value.



Move to page 4.1.

- Examine the graph and table. Grab point P , and drag the vertical line back and forth to explore the graph of the equation $x = |y| - 3$. Is $x = |y| - 3$ a function? Why or why not?

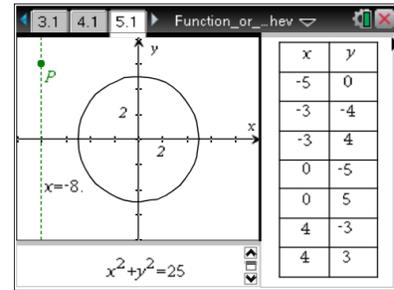
Answer: No, this is not a function. A vertical line can intersect the graph at more than one point. This means that there are points that have the same x -value, but different y -values. The table contains x -values that repeat and are paired with different y -values.





Move to page 5.1.

9. Examine the graph and table. Grab point P , and drag the vertical line back and forth to explore the graph of the equation $x^2 + y^2 = 25$. Is $x^2 + y^2 = 25$ a function? Why or why not?



Answer: No, this is not a function. A vertical line can intersect the graph at more than one point. This means that there are points that have the same x -value, but different y -values. The table contains x -values that repeat and are paired with different y -values.

10. How do you determine whether or not you have a function if you are given:
- a graph?

Answer: A vertical line will never intersect the graph of a function at more than one point. If it is possible for a vertical line to intersect the graph at more than one point, the graph does not represent a function because that would mean that it contains x -values that are paired with multiple y -values.

- a table of values?

Answer: When a table has x -values that repeat and are associated with different y -values, then it does not represent a function.



TI-Nspire Navigator Opportunity: Quick Poll

See Note 4 at the end of this lesson.

Wrap Up

Upon completion of the discussion, the teacher should ensure that students are able to understand:

- A **function** is a relation for which every possible input value x has only one output value y .
- How to evaluate an expression.
- A vertical line will never intersect the graph of a function at more than one point. If it is possible for a vertical line to intersect the graph at more than one point, the graph does not represent a function because that would mean that it contains x -values that are paired with multiple y -values.
- When a table has x -values that repeat and are associated with different y -values, then it does not represent a function.



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Note 1

Class Capture: For questions 1–3, take Class Captures to see how the students are progressing.

Note 2

Quick Poll: Using the Open Response option on Quick Poll, ask this question aloud: “What is the greatest number of times that a vertical line can intersect the graph of a function?” Have students type their answers using a number, not in words. The correct answer is 1.

Note 3

Class Capture: While students are doing these pages, use Class Capture to see which students understand the activity and which do not. For those who do, have them become Live Presenters to show the entire class how they answered the questions. For those who experience difficulty, work with their group to help the students to understand. It is a good idea to have different Live Presenters for each page: 2.1, 3.1, 4.1, and 5.1.

Note 4

Quick Poll: Make a quick sketch of a graph of a function on the board. Then, using the “Yes No” option, ask aloud if this graph represents a function. Once you collect the responses, have the students discuss why it is a function. Then make a quick sketch on the board of the graph of a relation that is not a function. Using the “Yes No” option, ask aloud if this graph represents a function. Once you collect the responses, have the students discuss why it is not a function. Repeat this activity as needed.