# Solving Systems by Graphing

## MATH NSPIRED

## Math Objectives

- Students will visualize a solution to a system of equations.
- Students will explore a system that intersects in one point and identify the ordered pair that represents the solution.
- Students will use appropriate tools strategically. (CCSS Mathematical Practice)

## Vocabulary

- solution
- system of equations
- linear equations

## About the Lesson

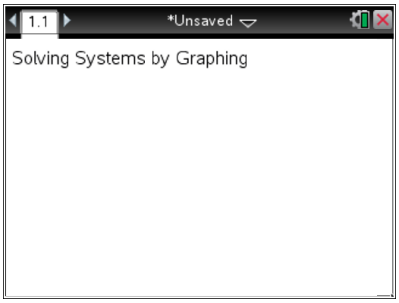
- In this activity, students will explore the solution to a system of linear equations. They will move a point on the x-axis to change the x-coordinate of a point on each of the lines. They will determine when the point on each line is a solution to the system of equations. This method could provide visual cues to help students determine if their algebraic solution is reasonable.

## TI-Nspire™ Navigator™

- Use Class Capture to observe students' work as they proceed through the activity.
- Use Live Presenter to have a student illustrate how he/she moved the point on the *x*-axis.

## Activity Materials

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




**Tech Tips:**

- This activity includes screen captures 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*

- Solving_Systems_by_Graphing.pdf
- Solving_Systems_by_Graphing.doc

*TI-Nspire document*

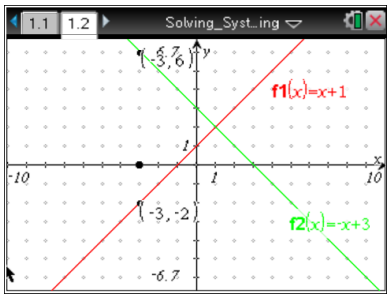
- Solving_Systems_by_Graphing.tns

## Discussion Points and Possible Answers

**Tech Tip:** If students have 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 or tab.

**Teacher Tip:** Instructions for creating the TI-Nspire document, *Solving_Systems_by_Graphing.tns,* are available at mathnspired.com.

**Move to page 1.2.**




Questions 1–3 refer to the system of equations graphed in the TI-Nspire document: **f1**(x) = x + 1
**f2**(x) = -x + 3

Move the point that is on the *x*-axis to the left or right as needed.

1. Move the point so that *x* = -2 in both sets of coordinates. Is either of these ordered pairs a solution to the given system of equations? Justify your answer.

   **Answer:** When *x* = -2, the value of the function **f**1 is -1. When *x* = -2, the value of the function **f**2 is 5. Since the function values are not equal, this is not a solution to the system of equations.

2. Move the point so that *x* = 3 in both sets of coordinates. Is either of these ordered pairs a solution to the given system of equations? Justify your answer.

   **Answer:** When *x* = 3, the value of the function **f**1 is 4. When *x* = 3 the value of the function **f**2 is 0. Since the function values are not equal, this is not a solution to the system of equations

3. What is the solution to the system pictured? Explain how you know.

   **Answer:** The solution to the system pictured is (1, 2). These are the coordinates of the point that is the intersection of the two lines. That is, when *x* = 1, the *y*-coordinate on each line is 2.

**Tech Tip:** Students can change the equation of the lines graphed by moving the cursor on top of the label for the equation and clicking twice to make edits to the equation. Students could also add the new functions introduced, **f**3(x) and **f**4(x), in the function entry line.

**Tech Tip:** To add new functions for **f**3(x) and **f**4(x), students can show the function entry line by double-tapping the page.

4. Jean told the class that she knew of another system that had the same solution as the system pictured in the graph. Her system is

   **f**1(x) = x + 1

   **f**3(x) = 4x – 2

   Bryan argued that he thought that the system with the same solution as the system pictured in the graph was the following:

   **f**2(x) = -x + 3

   **f**4(x) = 2x

   Who is right? Explain your reasoning.

   **Answer:** Both students are correct. The solution to both systems is the ordered pair (1, 2). A graph would show that **f**1(x) and **f**3(x) intersect at the point (1, 2) and **f**2(x) and **f**4(x) also intersect at (1, 2).

5. Find the solution to the following system graphically. Show the necessary work to check the solution.

   **f**1(x) = x + 1

   **f**2(x) = -x – 3

   **Answer:** The solution to the system is (-2, -1). These are the coordinates of the point that is the intersection of the two lines. That is, when $x = -2$, the $y$-coordinate of each line is -1.

6. Find the solution to the following system graphically. Show the necessary work to check the solution.

   **f**1(x) = -x + 3

   **f**2(x) = -x – 3

   **Answer:** This system has no solution. The lines do not intersect. The equations have the same slope and a different y-intercept. Consequently, the graphs of these lines are parallel. They do not have any points in common.

7. How does the solution to the system in problem 6 compare to the solution of the system in the previous problems? Justify your answer.

   **Answer:** This system does not have a solution, whereas the other systems had one solution, a point of intersection.

## Wrap Up

Upon completion of the discussion, ensure that students understand:

- What is meant by the reference to an ordered pair as a solution to a system of linear equations.
- The point of intersection of two lines is the solution to that system of linear equations.

## Assessment

Solve the system that follows graphically. Explain why the ordered pair you give as the answer is the solution to the system.

$y = 2x - 1$

$y = -x + 5$

**Answer:** When $x = 2$, $y$ is equal to 3 in each equation. (2, 3) is the point of intersection of the graphs of the two equations.