

## How Many Solutions?

ID: 9284

Time required  
60 minutes

## Activity Overview

*In this activity, students graph systems of linear functions to determine the number of solutions. Once acquainted with each of the three possibilities—one solution, zero solutions and infinitely many solutions—they use their experience with the graphs to investigate the relationship between the coefficients of a pair of linear equations and the number of solutions. In the investigation, students are given one line and challenged to draw a second line that creates a system with a particular number of solutions. By repeating this experiment and recording the equations of the line, students gather data that they use to write rules about the number of solutions of a linear system based on its coefficients.*

## Topic: Linear Systems

- *Graph a system of linear equations to determine whether they have no solutions, one or infinitely many.*
- *Examine the coefficients of a pair of linear equations to determine how many solutions for the system.*

## Teacher Preparation and Notes

- *This activity is appropriate for students in Algebra 1. It is assumed that students are familiar with linear functions, their graphs, and have solved linear systems algebraically.*
- *Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter “9284” in the keyword search box.***

## Associated Materials

- *HowManySolutions\_Student.doc*
- *HowManySolutions.tns*
- *HowManySolutions\_Soln.tns*

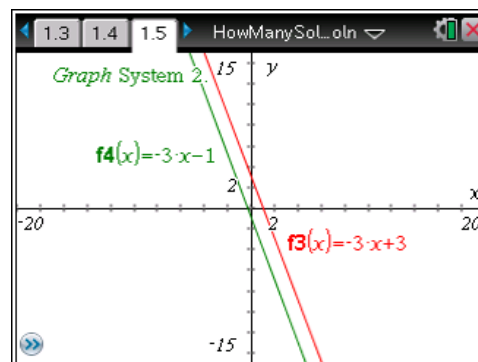
## Suggested Related Activities

*To download any activity listed, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter the number in the keyword search box.*

- *System Solutions (TI-84 Plus family with TI-Navigator) — 5750*
- *Linear Systems: Using Graphs and Tables (TI-84 Plus family) — 9083*

**Problem 1 – Graphing systems of linear equations**

Students are prompted to graph three different linear systems on three different screens and state how many solutions each have. This introduces all the possible numbers of solutions and connects them to the graphs of the systems. Help students connect what they see in the graphs with their experiences solving systems by asking them to find the points that represent solutions and write their coordinates.

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

See Note 1 at the end of this lesson.

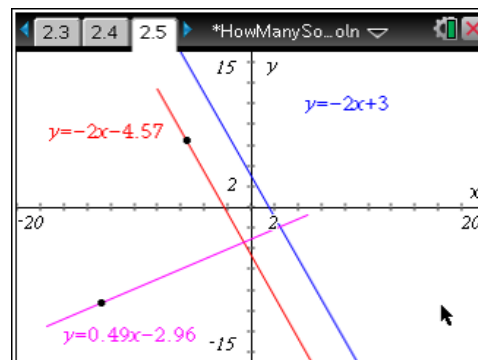
**Problem 2 – Create your own system**

In this problem, students are given a line and challenged to draw additional lines to form linear systems with particular numbers of solutions. They then use the **Coordinates and Equations** tool to find the equation of the lines they drew.

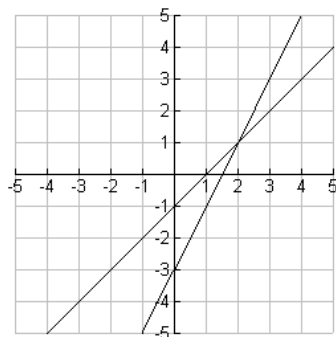
**If using TI-Nspire CX technology:**

In order to differentiate the lines, students can change the colors of the lines by right-clicking the line (or hovering over the line and pressing **ctrl** + **menu**), then selecting **Color > Line Color**, and selecting a new color.

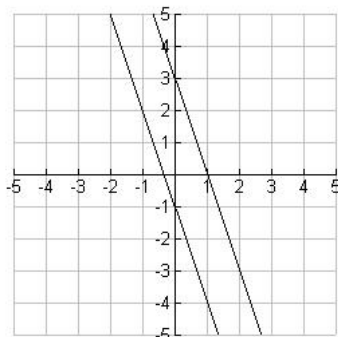
These equations are recorded in a table on their worksheet. This data is used to answer a series of questions, guiding the student to state rules that for the number of solutions of a linear system can be determined by the coefficients of the equations. Finally, these rules are applied to determine the number of solutions of a system without graphing.

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

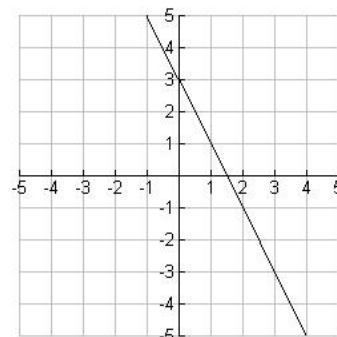
See Note 2 at the end of this lesson.

**Solutions****1.**

one solution

**2.**

no solutions

**3.**

infinitely many solutions

4. The equations that form systems with no solutions or infinitely many solutions have the same slope.
5. The equations that form systems with infinitely many solutions have the same  $y$ -intercept.
6. The equations that form systems with infinitely many solutions are equivalent.
7. Sometimes equations are written differently although they are equivalent. One equation may have been multiplied by a constant on both sides or terms moved around. For example,  $\begin{cases} 4x + 2y = 6 \\ y = -2x + 3 \end{cases}$ .
8. A linear system has no solution if both equations have the same slope but different  $y$ -intercepts.  
A linear system has infinitely many solutions if both equations have the same slope and same  $y$ -intercepts.  
A linear system has one solution if the two equations have different slopes and different  $y$ -intercepts.
9. one solution
10. one solution
11. no solution
12. infinitely many solutions

**TI-Nspire Navigator Opportunities****Note 1****Problem 1, *Screen Capture***

This would be a good place to do a screen capture to verify students are entering the correct equations on each page and answering the questions correctly.

**Note 2****Problem 2, *Screen Capture***

You may want to use screen capture to compare student results. Students can see other solutions to show that there is more than one correct answer.