All On The Line

ID: 11929

Time required
30 minutes

Activity Overview

Students will encounter the three different cases for linear systems: one point of intersection, no points of intersection, and infinitely many points of intersection. Then they will enter points into a spreadsheet and graph equation to help solve linear systems.

Topic: Linear Systems

- *Points of intersection*
- *Parallel lines*
- *Slope and y-intercept*

Teacher Preparation and Notes

- *Students must have a foundational understanding of slope and slope-intercept form. The terms system, parallel, infinite, and intersecting will be used with the expectation that students understand them already.*
- *Before beginning the activity, students should clear all lists and turn off functions. To clear the lists, press* 2nd [MEM] *and scroll down until the arrow is in front of* ***ClrAllLists****. Press enter twice. To clear any functions, press* Y= *and then press* CLEAR *when the cursor is next to each Y= equation.*
- *Students should be familiar with graphing equations and finding intersection points.*
- ***To download the student worksheet, go to education.ti.com/exchange and enter "11929" in the keyword search box.***

Associated Materials

- *AllOnTheLine_Student.doc*

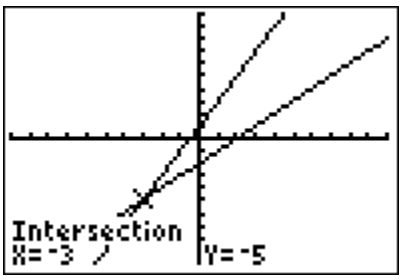
Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *How Many Solutions (TI-84 Plus family) — 9283*
- *System Solutions (TI-84 Plus family with TI-Navigator) — 5750*
- *Linear Systems: Using Graphs and Tables (TI-84 Plus family) — 4423*

Problem 1 – Intersecting Lines

After previously studying slope and slope-intercept form, students are asked to apply their knowledge to linear systems. On the worksheet, students are asked to write down the slopes of the two lines. Students are asked to graph the equations and find the intersection point.



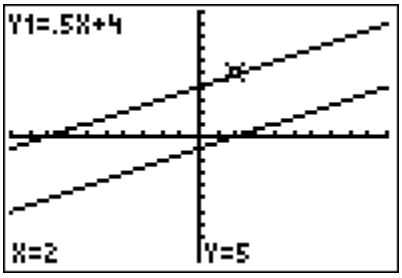
Students will use the **Intersect** command ([2nd] [CALC]) to find the intersection point. When the display asks for **Curve 1?**, students will need to press [ENTER] on one of the equations. When asked for **Curve 2?**, they will need to make sure the second equation is selected. Then, they will be asked for a **Guess?**. They should use the cursor keys to move close to the intersection point before pressing [ENTER].

Students should understand that the intersection point is the solution to the set of equations and that to check to see if the point is actually a solution, they can substitute the values in for *x* and *y* to see if each side of the equation is the same value.

Problem 2 – Parallel Lines

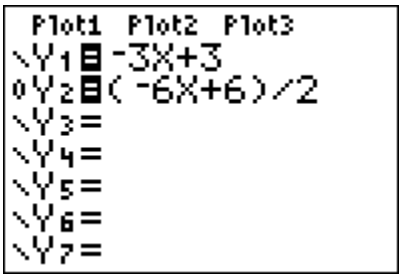
In this problem, the students will see pairs of parallel lines. They should notice the same slopes, and record them on the student worksheet.

In Questions 10 and 11 students are asked to determine if the lines are parallel or not. Work space is provided on the student worksheet for them to solve for *y* in order to make a decision.



Problem 3 – Same Lines, Infinite solutions

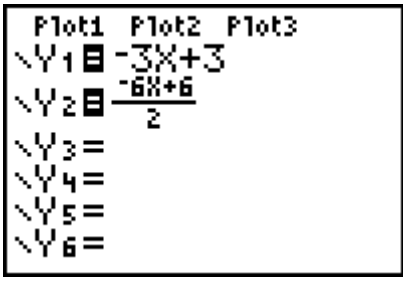
Lines that are the same have infinitely many points of intersection. You may wish to introduce some notation for how to write the solution set (many use {(*x*, *y*): *x* + *y* = 3}). Explain that if one line undergoes a scale change by either multiplication or division, it yields a different form of the same equation, and the graph will be the same line.



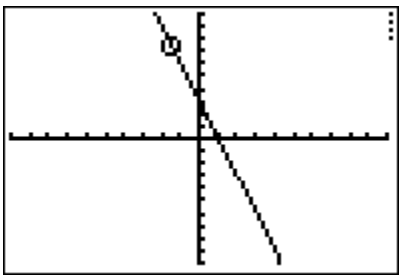
If using Mathprint OS:

Students can display the function as a fraction in the [Y=] screen. To do this, press [Y=] and to the right of Y2= press [ALPHA] [F1] and select **n/d**. Then enter the value of the numerator, press [▼] and enter the expression for the denominator and press [ENTER].

Note: Parentheses are not needed in the numerator.



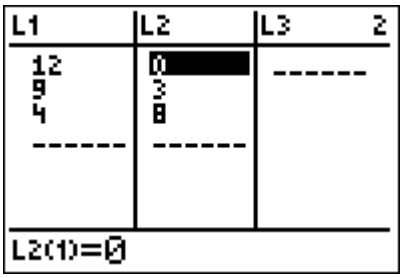
For students to determine if the linear equations given in Question 15 are the same, they may require some guidance, perhaps, with regard to solving for *y*. In the screenshots at the right, the style for Y2 has been changed to a circle. Students will see that the second graph follows the path of the first graph.



Homework – Word problems

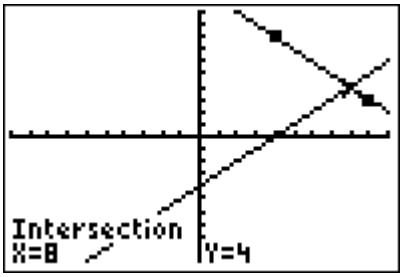
Problem 4

The sum of two numbers is 12. The difference between the numbers is 4.



Help the students to write the equations for this problem and solve for *y*. First, students are expected to enter at least three ordered pairs into **L1** and **L2**. Remind them to focus on just numbers that add up to 12. These ordered pairs will appear as a scatter plot on the graph on the next page.

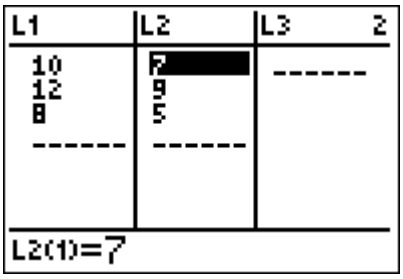
Students must enter their equations into **Y1** and **Y2**. They will see that one line will go through the plotted data points. One of those points should be the intersection point of the two lines. Students can use the **Trace** tool or the **Intersect** tool to see the coordinates of the points and determine which point is the solution.



If you would like the students to differentiate between the two functions, you can have them change the style of one function to bold (or dotted). Move the cursor to the ╲ symbol to the left of the equation and press ENTER to change it to ┓ (thick) or ⋱ (dotted) and then graph.

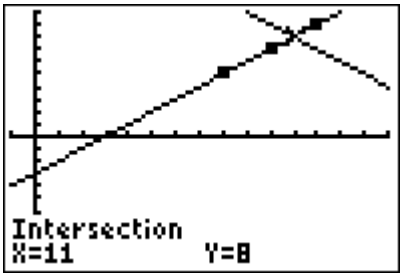
Problem 5

The "age problem"…How old is Zohan anyway? Ferdie is 3 years older than Zohan. Together, the total of their ages is 19. How old is each person?



Students are to repeat the procedure completed for Problem 4. Encourage students to use *x* and *y* for their variables. (Students like to use letters like *F* and *Z* to remind them which variable represents which person.)

Students should enter ages in **L1** and **L2** for Ferdie and Zohan in which Ferdie is 3 years older than Zohan. Students are expected to solve for *y* in order to graph the linear system. Again, if the **Stat Plot** is turned on, the plotted points will be revealed, and one line will go through those points.



Solutions – student worksheet

Problems 1, 2, and 3

1. Slopes are 2 and 1.
2. (–3, –5)
3. Slopes are $\frac{2}{3}$ and –1.
4. (3, 3)
5. Always
6. $\frac{1}{2}; \frac{1}{2}$
7. Equations will vary but should all have a slope of $\frac{1}{2}$.
8. False
9. $\frac{1}{3}; -\frac{1}{3}$
10. False
11. $y = 4$ is a horizontal line; $x = 4$ is a vertical line
12. They are also perpendicular lines.
13. –1; –1
14. The two lines are equal.
15. Yes because they have the same slope.
16. True

Homework/Extension

1. $x + y = 12$; $x - y = 4$
2. Answers will vary. Sample: (10, 2), (8, 4), (7, 5)
3. (8, 4)
4. $x = y + 3$; $x + y = 19$
5. Answers will vary. Sample: (7, 4), (9, 6), (12, 9)
6. (11, 8)