All On The Line

ID: 11928

Time required
30 minutes

Activity Overview

In this activity, 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.*
- *Students need to know how to answer multiple choice questions by clicking on the choices, as well as how to enter text into an answer box in the Open Response form of a question.*
- *The Lists & Spreadsheet application is used, but students are not expected to know how to use it to create the scatter plot. The scatter plot is already set up to produce a graph of the ordered pairs entered in by the student.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "11928" in the quick search box.***

Associated Materials

- *AllOnTheLine_Student.doc*
- *AllOnTheLine.tns*
- *AllOnTheLine_Soln.tns*

Suggested Related Activities

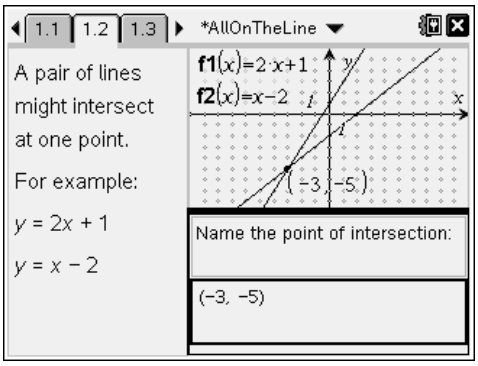
To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *How Many Solutions (TI-Nspire technology) — 9284*
- *Solving Systems of Linear Equations from Four Perspectives (TI-Nspire technology) — 9210*
- *Intersections (TI-Nspire technology) — 9083*
- *Waitress and the Cook – Solving a System of Linear Equations (TI-Nspire technology)— 9050*

Problem 1 – Intersecting Lines

After previously studying slope and slope-intercept form, students apply their knowledge to linear systems. On the worksheet, students are asked to write down the slopes of the two lines. The grid is in the background of the graph so that students can more easily locate the ordered pair where the two lines meet.

A similar problem is presented on the next page, but without the grid.

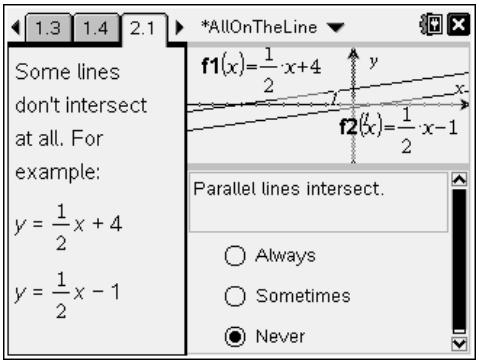


Students may check their answers using the **Intersection Point(s)** tool (**MENU > Points & Lines > Intersection Point(s)**). When they select both lines, the intersection point and its coordinates will appear. Page 1.4 asks students if two lines with different slopes will *always, sometimes, or never* intersect in one point.

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.

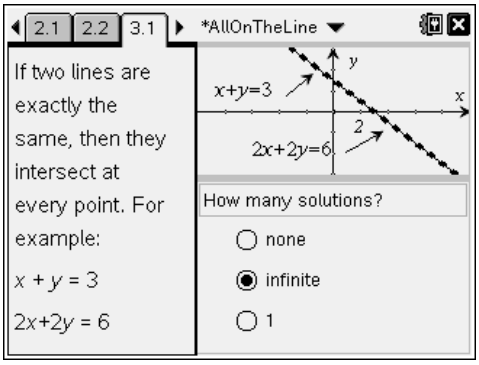
On page 2.2, two examples are given, and students are asked to determine if the lines are parallel or not. Work space is provided on the student worksheet for them to solve for *y* in order to make a decision.



Problem 3 – Same Lines, Infinite solutions

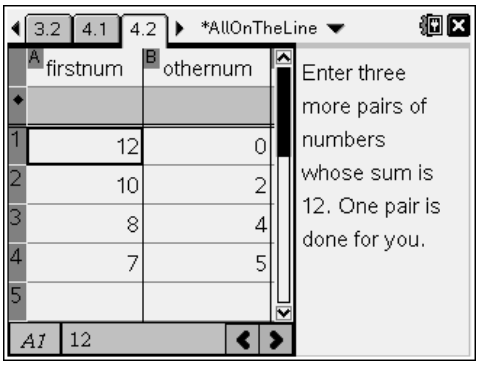
Lines that are the same have infinitely many points of intersection. You may wish to introduce to students some notation for how to write the solution set (many use {(*x*, *y*): *x* + *y* = 3}). Explain that if one line undergoes a scale change by either multiplication or division, it yields a different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

For students to determine if the linear equation given on page 3.2 are the same, they may require some guidance, perhaps, with regard to solving for *y*.



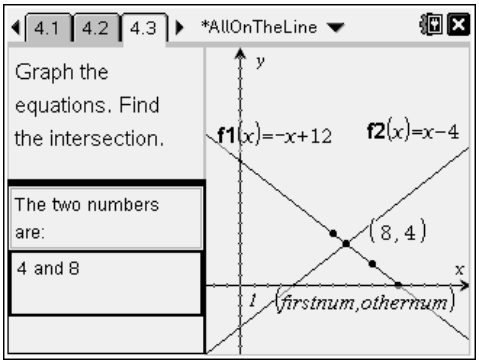
Extensions/Homework – Problems 4 and 5

Students are given the following problem:
The sum of two numbers is 12. The difference between the numbers is 4.



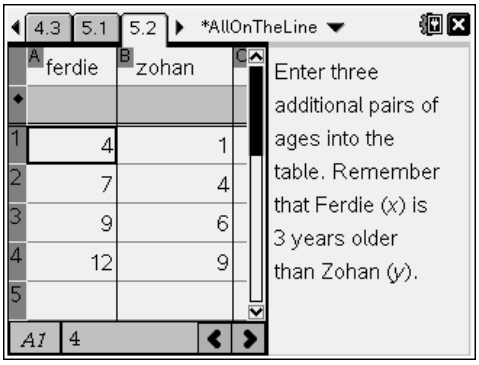
Help the students to write the equations for this problem and solve for *y*. This will assist the students in entering the equations into the *Graphs* page soon. First though, students are expected to enter at least three ordered pairs into the table on page 4.2. Remind them to focus on just numbers that add up to 12. These ordered pairs will appear as a scatter plot on the graph on the next page.

On page 4.3, the students must enter their equations into **f1(*x*)** and **f2(*x*)**. They will see that one line will go through the plotted data points. Depending on the pairs entered in the spreadsheet, one of those points may be the intersection point of the two lines. Students can use the **Graph Trace** tool or the **Intersection Point(s)** tool to see the coordinates of the points and determine which point is the solution.



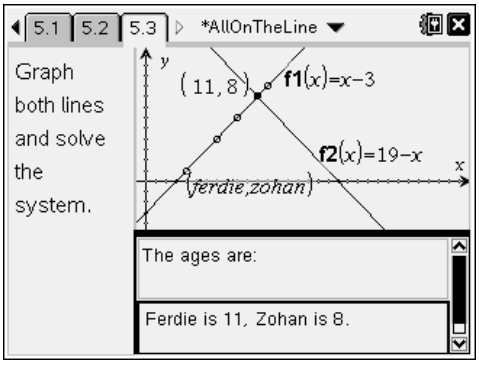
Students can enter the ordered pair of numbers that fulfill the problem description in the bottom left answer box.

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, as suggested in the problem. (Often, students like to use letters like *F* and *Z* to remind them of which variable represents which person.)

On page 5.2, another spreadsheet is provided for students to enter in ages 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 on page 5.3. Again, the plotted points will be revealed, and one line will go through those points. The answer box is provided in the bottom right corner.



Solutions – Student Worksheet

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. False
8. $\frac{1}{3}; -\frac{1}{3}$
9. False
10. $y = 4$ is a horizontal line; $x = 4$ is a vertical line
11. They are also perpendicular lines.
12. –1; –1
13. The two lines are equal.
14. Yes because they have the same slope.
15. True
16. $x + y = 12$; $x - y = 4$
17. Answers will vary. Sample: (10, 2), (8, 4), (7, 5)
18. (8, 4)
19. $x = y + 3$; $x + y = 19$
20. Answers will vary. Sample: (7, 4), (9, 6), (12, 9)
21. (11, 8)