Four Ways to Get There

ID: 13460

Time required
45 minutes

Activity Overview

In this activity, students will use a variety of features of the TI-73 Explorer to represent problem situations. Students will look at problems algebraically, graphically, verbally, and numerically.

Topic: Numbers

- *Translating verbal sentences into mathematical equations*
- *Unit analysis*
- *Function zeros*
- *Solutions to systems of equations*

Teacher Preparation and Notes

- *Students will work with graphing equations, changing window settings, setting up a table, and using the equation solver.*
- *TI-Navigator is not required for this activity, but an extension is given for those teachers that would like to use it.*
- ***To download the student worksheet and TI-Navigator files, go to education.ti.com/exchange and enter "13460" in the quick search box.***

Associated Materials

- *MGAct13_FourWays_worksheet_TI73.doc*
- *MGAct13_FourWays_Nav_TI73.act*

Suggested Related Activities

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

- *Linear Equations: Using Graphs and Tables (TI-73 Explorer) — 4415*
- *Table that Equation (TI-73 Explorer) — 8461*
- *Getting Started with TI-Navigator: Linear Equations (TI-73 Explorer & TI-Navigator) — 5611*
- *River of Life (TI-73 Explorer & TI-Navigator) — 5601*

Problem 1 – Draining a Water Tank

The Rule of Four emphasizes that problem situations can be represented in four different ways. These multiple representations are: 1) verbal, 2) numerical, 3) analytic (algebraically), and 4) geometric (graphically).

Questions 1–3

In this problem, a water tank is being drained by two pipes. Use the following information to set up one way to solve this particular problem.

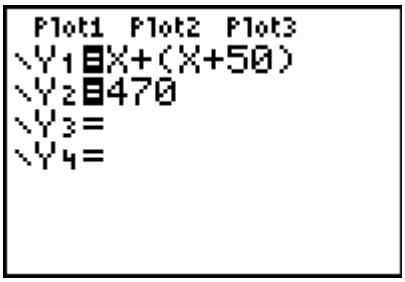
> *One pipe drains at a rate of 50 l/min faster than the other pipe. If they release 4,700 liters in 10 minutes, what is the drainage rate?*

Students are first asked to translate the problem into a verbal sentence using variables.

- If the first pipe drains at x l/min, then the second drains at $x + 50$ l/min.
- Together the pipes drain 4700 l/10 min = 470 l/min.
- So, $x + (x + 50) = 470$.

Students are to enter the expression for the drainage rate of both pipes working together in **Y1** and the unit rate in **Y2**.

Note: To enter X, press [x].



Questions 4–6

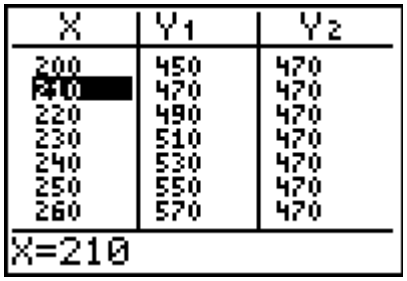
Students are to put together the expressions to form an equation and solve for x, algebraically.

$$x + (x + 50) = 470$$
$$2x + 50 = 470$$
$$2x = 420$$
$$x = 210$$

Next, students will set up the table to find the value where both equations are equal. To access the table setup, press [2nd] [WINDOW]. Change the settings as shown at the right and then press [2nd] [GRAPH] to view the actual table.

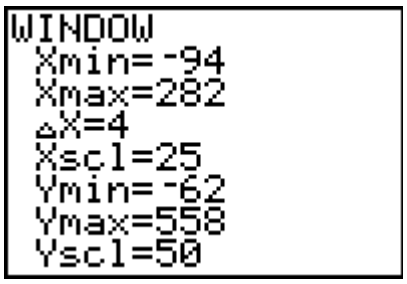
As students scroll down, they will notice that they "skip" 470 when x goes from 200 to 250. Engage them in a discussion about how you could include the numbers between 200 and 250 in the table.

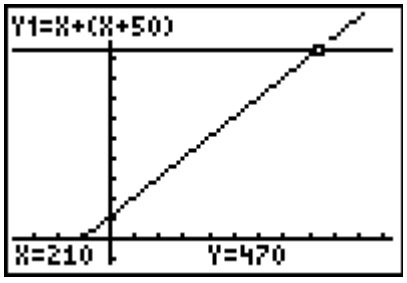
Direct students to return to the table setup and adjust Δ**Tbl** to be 10 instead of 50 and have them look at the table again. They should now find an exact match between Y1 and Y2 for 470 is at X = 210.



Problem 2 – Solving by Different Methods

Next, students will explore the same problem graphically and numerically.





Questions 9–10

Have students check that their two equations are still in the [Y=] editor.

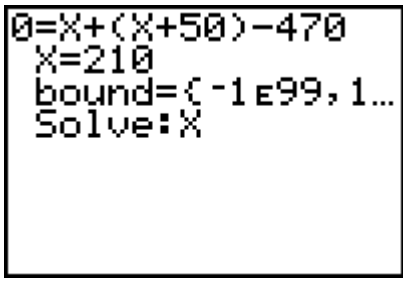
Students may need to adjust the window in order to actually see the graphs and the intersection of the graphs. Have them discuss what values might be appropriate for the window.

To adjust the window, press [WINDOW]. A suggested window is shown at the right.

Note: ΔX will automatically update when Xmin and Xmax are changed. Students should not change the ΔX value.

Questions 11–12

Finally, students will find the solution to the equation using the **Solver**. To access the solver, press [MATH] [6]. The equation should come up empty but if it does not, simply press [CLEAR] to remove any previous information.



Students will need to enter the equation set equal to 0. This can be accomplished by subtracting 470 from both sides.

Once the equation is entered, use the [▼] to move to the line that says **Solve: X** and press [ENTER]. The solution will appear next to the **X=** line above.

Students should quickly see that the same solution is obtained using this method as well.

Extension – TI-Navigator™

1. For Questions 9 and 10, load the activity settings file ***MGAct13_FourWays_Nav_TI73.act*** into Activity center. Start the activity and have students enter the two equations on their calculators. Once students have submitted the equations, they will be able to see the intersection point.

   After looking at the graph and discussing the intersection point, click on the **Equation** tab. Select **Y_1** in the second column. Select **Y_2** in the third column. This replicates the table solution method shown earlier in the activity. Scroll through the table until you find where the second and third columns are equal (470) and look at the *x*-value. Students will see that again, the *x*-value is 210.

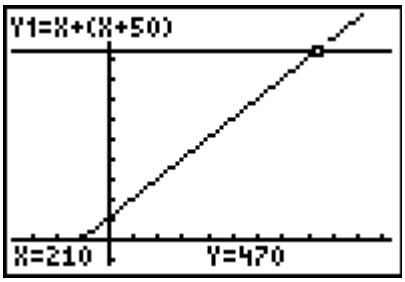
2. Use **Screen Capture** or **Quick Poll** to monitor student activity throughout the lesson.

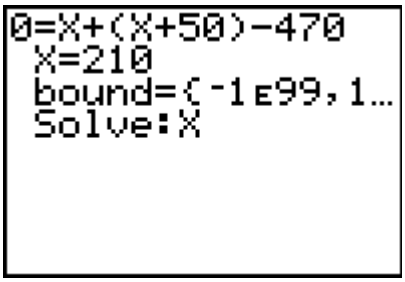
Solutions – student worksheet

Problem 1

1. If the first pipe drains at x l/min, then the second drains at $x + 50$ l/min. Together the pipes drain 4700 l/10 min = 470 l/min. So, $x + (x + 50) = 470$.
2. 470 l/min
3. $Y_1 = x + (x + 50)$; $Y_2 = 470$
4. $x + (x + 50) = 470$
5. 210
6. Students should observe that with the initial window settings, they "skip" past the point where 470 would appear in both lists. They need to make the changes in the table step smalled to find where 470 appears in both lists.
7. 210
8. 210, 260

Problem 2

9. (210, 470); Yes, the exact intersection can be found.
10. 

11. 

12. 210
13. It is the same.
14. It is the same.
15. Answers will vary. Students should see that there could be limitations with finding an "exact" intersection on a graph. This is not the "best" method of solving an equation but it can give you a visual idea of where the intersection is. Students may also conclude that the table could have the same limitation.