

Linear Equations: Using Graphs & Tables

Student Worksheet

Overview

The **Overview** introduces the topics covered in **Observations** and **Activities**. Scroll through the **Overview** using (to review, if necessary). Read each screen carefully. Look for new terms, definitions, and concepts.

Observations

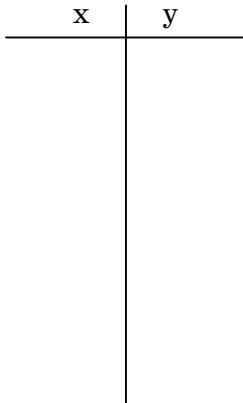
The **Observations** illustrate linear equation concepts relating to graphs and tables. Scroll through the **Observations** using (to review, if necessary). Read each screen carefully. When you come to a **Write an Observation** screen, stop and write the answers to the questions on your worksheet.



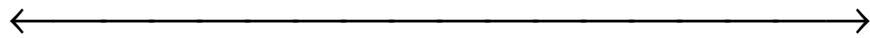
Observation 1

Using a table, find the solution of $-x - 6 = -3.5$.

First, find the solution by hand, making a table with at least five x and y values. You can start with any x value you want. Show your work.



Next, graph your solution on a number line. Be sure to label all points on the number line.



Activities

The **Activities** help you practice graphs and tables. You can select from two activities—**Beam Dale Up** or **Worksheet Activity**. Follow these steps to play the activity and complete your worksheet.

1. Make sure you are in the **Activities** for this section.
2. Highlight an activity using **◀** or **▶**, and press **[ENTER]**.



Scoring: You get two attempts to solve each problem. You earn 2 points for a correct answer on the first try, 1 point for a correct answer on the second try.

You can earn up to 10 points.

Beam Dale Up

1. Look at the problem on the space ship and determine how to solve the equation for x from the four choices given. The values are ordered as they are on a number line.
2. Press **◀** and **▶** to move Dale the Martian over the correct x value, and then press **[ENTER]**. If the x value you pick is correct, Dale is beamed up to his ship! If the answer is incorrect on the second attempt, the correct answer is displayed; press any key to resume play. As you play the activity, solve each equation in the space below. Show all steps and work.

3. What was your score? _____



Note: Press **◀** or **▶** to leave this screen.

Worksheet Activity

1. Look at the table of values of equations $Y_1=2X+4.5$ and $Y_2=7$.

X	Y ₁	Y ₂
0	4.5	?
.5	5.5	?
1	6.5	?
1.5	7.5	?
2	8.5	?
2.5	9.5	?
3	10.5	?

$Y_1 = 2X + 4.5$

2. When is $2X+4.5=7$ (or, when is $Y_1=Y_2$)? Look at the table carefully. The solution is between which two X values?

Try-It!™ on Your TI-83 Plus or TI-73

Use the table feature on your graphing calculator to search for the solution (when $Y_1=Y_2$).

To Do This	Press	Display (TI-83 Plus shown)																								
1. Exit the Topics in Algebra 1 application and clear the Home screen.	[2nd] [QUIT] ⟨EXIT⟩ [CLEAR]																									
2. First, enter $2X+4.5$ as Y_1 and 7 as Y_2 in the $Y=$ editor. Note: See Tip™ 3: <i>Graphing a Function in the Standard Window</i> for more information. Note: On the TI-73, use [x] rather than [X,T,Θ,n] .	[Y=] [CLEAR] 2 [X,T,Θ,n] + 4 . 5 7 [CLEAR]	Plot1 Plot2 Plot3 Y₁=2X+4.5 Y₂=7 Y₃= Y₄= Y₅= Y₆= Y₇=																								
3. Change the table settings to those used in the Worksheet Activity.	[2nd] [TBLSET] 0 .5 [ENTER] [ENTER]	TABLE SETUP TblStart=0 ΔTbl=.5 Indpt: Auto Ask Depend: Auto Ask																								
4. Display the table.	[2nd] [TABLE]	<table border="1"><thead><tr><th>X</th><th>Y₁</th><th>Y₂</th></tr></thead><tbody><tr><td>0</td><td>4.5</td><td>7</td></tr><tr><td>.5</td><td>5.5</td><td>7</td></tr><tr><td>1</td><td>6.5</td><td>7</td></tr><tr><td>1.5</td><td>7.5</td><td>7</td></tr><tr><td>2</td><td>8.5</td><td>7</td></tr><tr><td>2.5</td><td>9.5</td><td>7</td></tr><tr><td>3</td><td>10.5</td><td>7</td></tr></tbody></table> Y₁=2X+4.5	X	Y ₁	Y ₂	0	4.5	7	.5	5.5	7	1	6.5	7	1.5	7.5	7	2	8.5	7	2.5	9.5	7	3	10.5	7
X	Y ₁	Y ₂																								
0	4.5	7																								
.5	5.5	7																								
1	6.5	7																								
1.5	7.5	7																								
2	8.5	7																								
2.5	9.5	7																								
3	10.5	7																								
5. Change the table settings to focus on the range you found in the Worksheet Activity. Begin the table at the lower value and make the increments smaller.	[2nd] [TBLSET] 1 .1	TABLE SETUP TblStart=1 ΔTbl=.1 Indpt: Auto Ask Depend: Auto Ask																								
6. Display the table with the new settings.	[2nd] [TABLE]	<table border="1"><thead><tr><th>X</th><th>Y₁</th><th>Y₂</th></tr></thead><tbody><tr><td>1</td><td>6.5</td><td>7</td></tr><tr><td>1.1</td><td>6.7</td><td>7</td></tr><tr><td>1.2</td><td>6.9</td><td>7</td></tr><tr><td>1.3</td><td>7.1</td><td>7</td></tr><tr><td>1.4</td><td>7.3</td><td>7</td></tr><tr><td>1.5</td><td>7.5</td><td>7</td></tr><tr><td>1.6</td><td>7.7</td><td>7</td></tr></tbody></table> X=1	X	Y ₁	Y ₂	1	6.5	7	1.1	6.7	7	1.2	6.9	7	1.3	7.1	7	1.4	7.3	7	1.5	7.5	7	1.6	7.7	7
X	Y ₁	Y ₂																								
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1.3	7.1	7																								
1.4	7.3	7																								
1.5	7.5	7																								
1.6	7.7	7																								

7. The table still does not display the exact solution. What table settings would you choose in order to display the exact solution?

TblStart= _____

ΔTbl= _____

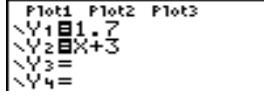
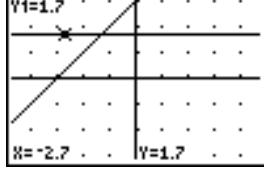
8. What is the solution (when is $Y_1=Y_2$)? _____

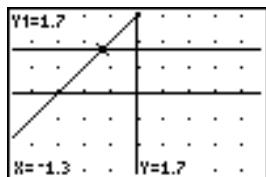
9. How do you know this is the solution? _____

Try-It!™ on Your TI-83 Plus or TI-73 (continued)

Solution Search Using X-Y Graphs: Find the solution for the equation $X+3=1.7$. First, use your number sense to estimate the solution for $X+3=1.7$. Record your estimate here. _____

Use the table feature on your graphing calculator to search for the solution (when $Y_1=Y_2$).

To Do This	Press	Display (TI-83 Plus shown)
1. Exit the Topics in Algebra 1 application and clear the Home screen.	[2nd] [QUIT] ⟨EXIT⟩ [CLEAR]	
2. Set the window format as shown. Note: See TIp™ 2: <i>Adjusting Your Graphing Calculator Settings</i> for more information. Screens are shown for the TI-83 Plus. There are slight differences on the TI-73.	[2nd] [FORMAT]	
3. Enter both sides of the equation into the Y= editor as shown. Note: See TIp™ 3: <i>Graphing a Function in the Standard Window</i> for more information. Note: On the TI-73, use [X] rather than [X,T,θ,n] .	[Y=] [CLEAR] 1 [X] 7 [CLEAR] [X,T,θ,n] [+] 3	
4. Select ZDecimal to set the viewing window and automatically graph the functions.	TI-83 Plus: ZOOM 4:ZDecimal TI-73: ZOOM 8:ZDecimal	
5. Trace $Y_1=1.7$. 6. Trace $Y_2=X+3$. Note: The function displays in the upper left corner of the screen; the X and Y values are displayed on the bottom of the screen.	TRACE [←] or [→] to trace a function [▲] and [▼] to move between functions	
7. Find where $X+3=1.7$. What is the solution? _____		
8. How do you know? _____		
9. Did you notice that the value of $X+3$ is 1.7 when $X=-1.3$?		



 **Try-It!™ on Your TI-83 Plus or TI-73 (continued)**

Solution Search: Write the solution and explain how you found the solution using graphs and tables for each of the problems below.

For each problem:

- Before you start, estimate the solution so you have an idea of where the solution is located.
- Search for the solution of the equation on the graphing calculator using graphs and table.

Note: See  TIp™ 4: *Creating a Table* for additional help with the graphing calculator.

- Remember to change your viewing window or your table setting to do your search.

Note: See  TIp™ 5: *Adjusting the Viewing Window* for additional help with the graphing calculator.

- Explain how you found the solution.

Graphing Calculator Fact: The graphing calculator only uses the variables **X** and **Y** for graphs and tables. If an equation uses letters other than **X**, you will have to enter the letter for the unknown variable as **X** in the graphing calculator in order to make the graphs and tables for your solution search.

1. $p + 3 = 1$

2. $3x - 2 = 1.6$

3. $\frac{1}{2}x + \frac{5}{8} = \frac{7}{8}$

4. $4 + 0.5C = 7$

Graphing Calculator Hint: Use **ZStandard** to change the graph window so that: $-10 \leq X \leq 10$ and $-10 \leq Y \leq 10$.

Linear Equations: Using Graphs & Tables

Teacher Notes

Objectives

- To illustrate how to locate the real number solution of a linear equation using tables.
- To illustrate how to locate the real number solution of a linear equation using a graphical method on a Cartesian (x-y) graph.

Math Highlights

In the table of values method, students see a table of values for the left and right side of the equation. They see that the x value, which makes the two sides of the equation equal, is the solution. They also see that they may need to refine the table of values to search for the solution.

In the x-y graphical method, students graph both sides of the equation and find the intersection of the lines. If students have not graphed lines, they can first make a table of values and then plot the points to graph the lines. The x coordinate of the intersection of the lines is the solution.

Common Student Errors

- Using graphs and tables can mislead a student to think that they can always find the exact solution using these methods. Although they often will find exact solutions using these methods, using algebra will give exact answers for these equations. Have students try to search for the solution to $x + \sqrt{2} = \sqrt{7}$. The exact answer is $x = \sqrt{7} - \sqrt{2} = 1.2315377\dots$.
- At times, introducing the algebraic solution of equations gives students just the mechanics of doing a problem. Algebraic methods alone usually do not invite the student to reason out the solution using number sense. The graphs and tables method gives students the opportunity to see the values of each side of the equation so they can see when the right side and left side of the equation are equal.

Visual learners benefit by seeing the numbers and graphs first, and then by using these as the tool to find the solution.

- Some students are able to see the solution to an equation using their number sense and may have difficulty taking the time to show their work. This may also be an issue in Chapter 2: Linear Equations, Section 2: Using Algebra. Encourage the use of written mathematics and drawing graphs and tables as a communication tool. Have students look in newspapers for graphs and tables of information to show real examples for the need for this communication skill.

Student Worksheet Notes with Answers

Overview

Tell students:

1. How to find the **Overview** or tell them to review the instructions on the worksheet.
2. How to navigate the application, if they are not yet familiar with the application.
3. To scroll through the **Overview** on the graphing calculator. Point out new terms, definitions, and concepts, and tell students to look for them as they go through the **Overview**.

Observations

The **Observations** help students understand linear equation concepts relating to graphs and tables.

If necessary, tell students how to find the **Observations** section for this section.



Observation 1

Using a table, find the solution of $-x-6 = -3.5$.

First, find the solution by hand, making a table with at least five x and y values. The students can start with any x value they want. Students show their work.

Next, they graph the solution on a number line. Remind them to label all points on the number line.

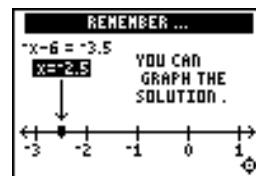
Students make a table by hand on the worksheet to search for the solution of $-x - 6 = -3.5$. Then they transfer these x and y values to a number line. Look for correct labeling.

Students see the table and graph screens as they finish viewing the observation.

DID YOU OBSERVE ...

x	$-x-6$	-3.5
-3.5	-2.5	-3.5
-3	-3	-3.5
-2.5	-3.5	-3.5
-2	-4	-3.5

$x = -2.5$



Activities



Scoring: Students get two attempts to solve each problem. They earn 2 points for a correct answer on the first try, 1 point for a correct answer on the second try.

Students can earn up to 10 points.

Beam Dale Up

Tell students to:

1. Look at the problem on the space ship and determine how to solve the equation for x from the four choices given. The values are ordered as they are on a number line.
2. Press \leftarrow and \rightarrow to move Dale the Martian over the correct x value, and then press **ENTER**. If the x value they pick is correct, Dale is beamed up to his ship! As they play the activity, students record the solution to each equation, showing all steps and work. If the answer is incorrect on the second attempt, the correct answer is displayed; press any key to resume play.
3. Record their scores.



Note: Press \leftarrow or \rightarrow to leave this screen.

Worksheet Activity

Tell students to:

1. Look at the table of values of the expressions, $Y_1=2X+4.5$ and $Y_2=7$.
2. Answer the questions: When is $2X+4.5=7$ (or, when is $Y_1=Y_2$)? The solution is between which two X values?

The solution for $2X+4.5=7$ is found between 1 and 1.5.

Students will continue to search for the solution in the Try-It! section.

Try-It!™ on Your TI-83 Plus or TI-73

Tell students to:

- Follow the steps exactly on the graphing calculator, using the table feature to find the solution. Example screen pictures are displayed on the worksheet for students to compare with the graphing calculator screen. This keystroke exercise lets students define $Y_1=2X+4.5$ and $Y_2=7$.
- Determine what the table settings should be for an exact solution and record them on their worksheet.

Answer: $\Delta Tbl=0.25$ and $TblStart=1$.

<pre>TABLE SETUP TblStart=1 △Tbl=.25 Indpt: Auto Ask Depend: Auto Ask</pre>	<table border="1" style="width: 100px; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; padding: 2px;">X</th> <th style="text-align: center; padding: 2px;">Y₁</th> <th style="text-align: center; padding: 2px;">Y₂</th> </tr> </thead> <tbody> <tr><td style="text-align: center; padding: 2px;">1</td><td style="text-align: center; padding: 2px;">6.5</td><td style="text-align: center; padding: 2px;">?</td></tr> <tr><td style="text-align: center; padding: 2px;">1.25</td><td style="text-align: center; padding: 2px;">7</td><td style="text-align: center; padding: 2px;">?</td></tr> <tr><td style="text-align: center; padding: 2px;">1.5</td><td style="text-align: center; padding: 2px;">7.5</td><td style="text-align: center; padding: 2px;">?</td></tr> <tr><td style="text-align: center; padding: 2px;">1.75</td><td style="text-align: center; padding: 2px;">8</td><td style="text-align: center; padding: 2px;">?</td></tr> <tr><td style="text-align: center; padding: 2px;">2</td><td style="text-align: center; padding: 2px;">8.5</td><td style="text-align: center; padding: 2px;">?</td></tr> <tr><td style="text-align: center; padding: 2px;">2.25</td><td style="text-align: center; padding: 2px;">9</td><td style="text-align: center; padding: 2px;">?</td></tr> <tr><td style="text-align: center; padding: 2px;">2.5</td><td style="text-align: center; padding: 2px;">9.5</td><td style="text-align: center; padding: 2px;">?</td></tr> </tbody> </table> <p style="margin-top: 5px;">$X=1.25$</p>	X	Y ₁	Y ₂	1	6.5	?	1.25	7	?	1.5	7.5	?	1.75	8	?	2	8.5	?	2.25	9	?	2.5	9.5	?
X	Y ₁	Y ₂																							
1	6.5	?																							
1.25	7	?																							
1.5	7.5	?																							
1.75	8	?																							
2	8.5	?																							
2.25	9	?																							
2.5	9.5	?																							

- Find the solution and record it. *Answer: $Y_1=Y_2$ when $X=1.25$.*

Solution Search Using X-Y Graphs: Find the solution for the equation $X+3=1.7$.

Tell students to:

- Estimate the solution and record it on their worksheets.
- Follow the steps exactly on the graphing calculator. Example screen pictures are displayed on the worksheet for students to compare with the graphing calculator screen. This keystroke exercise lets students find the solution where $X+3=1.7$.
- Record the solution and explain their answers on the worksheet after step 6.
Answers will vary. Student estimates using number sense should be close to the answer -1.3. They see that the two lines intersect at $x=-1.3$.

Note: See the *TI-83 Plus Guidebook*, for information on the TI-83 Plus automatic feature “Intersection,” which is not covered in this section. This feature is not on the TI-73.

Solution Search: Students write the solution and explain how they found the solution using graphs and tables for each of the problems below.

Tell students to:

- Review how to use the graphing features of the graphing calculator to search for a solution.
- Find the intersection of the lines by tracing the graph. Remind students that the viewing window must be set appropriately to find the intersection, and finding the exact solution is not guaranteed; they must combine the two methods to find the solutions.
- Use number sense to complete the search.

1. $p + 3 = 1 \quad \text{when } p = -2$

2. $3x - 2 = 1.6 \quad \text{when } x = 1.2$

3. $\frac{1}{2}x + \frac{5}{8} = \frac{7}{8} \quad \text{when } x = \frac{1}{2}$

4. $4 + 0.5C = 7 \quad \text{when } C = 6$