Name ______________________________

Date ______________________________

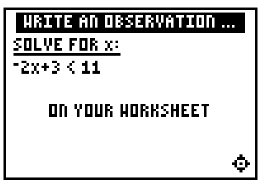
Linear Inequalities: Using Algebra — Student Worksheet

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 mathematical concepts relating to using algebra in linear inequalities. 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

Solve the inequality. Show your work.

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Draw the solution set on the number line.

Name ______________________________

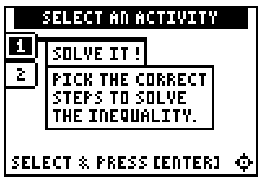
Date ______________________________

Activities

The **Activities** help you practice using algebra to solve inequalities. You can select from two different activities—**Solve It!** and **Free Fall**. 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 pick the step. You earn 2 points for a correct answer on the first try, 1 point for a correct answer on the second try. You get an additional 2 points for the correct solution.

The total number of points available varies.

Solve It!

1. Highlight a level (silver = less difficult; gold = more difficult), and press [ENTER] to select it.

2. Look at the algebraic expression at the top of the screen and decide what must be done to solve the inequality for **x**.

3. Press [▼] or [▲] to cycle through steps to choose from, and then press [ENTER] to select the correct step (some problems require two steps). If your second choice is incorrect, the correct step is displayed; press any key to continue play. If the activity prompts you to select the correct result, highlight it with [▶] or [◀], and then press [ENTER] to select it. As you play the activity, write each inequality. What was your strategy for finding the solution?

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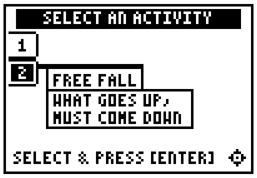
4. What level did you play? ______________________________

5. What was your score? ______________________________

Activities (continued)



Scoring: Points are based on how quickly you solve each equation.

Unless you specify point or time limits for this activity, students can play the activity when four missed equations stack up, the game is over.or they press 〈**QUIT**〉 to stop. There is no time limit.

Free Fall

1. Highlight a level (silver = less difficult; gold = more difficult), and press [ENTER] to select it.
2. When you are ready to start, press any key.
3. Watch the equation as it falls, and quickly solve for **x**. Enter the solution (press [(-)] for negative numbers), and press [ENTER] before the equation hits bottom. If you give an incorrect answer, the correct answer is displayed; press any key to resume play. The incorrect equation stacks up at the bottom of the screen, giving you less time to solve the next equation.
4. Follow your teacher's instructions for how long to play the activity.
5. What level did you play? ____________
6. What was your score? ____________

Additional Problems

Solve the following inequalities. Show your work.

1. $6.4x > 16$
2. $\frac{1}{2}x - 2 \le {}^{-}2$
3. $2x - 2.1 < {}^{-}3.5$
4. A cell phone company charges a flat fee of $15 per month to use the phone. They also charge 25 cents for each phone call you make no matter how long you are on the phone. Your budget allows you to spend at most $30 per month for the phone. How many phone calls will you be able to make each month? (Tax is included in the prices.) Show your work. Write a short paragraph explaining why would you choose this company or why not.

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Name ______________________________
Date ______________________________

Try-It!™ on Your TI-83 Plus or TI-73

Testing points and graphing solution sets: If **X=3**, is **2X+4>7** true or false? Try it by hand first. Show your work below.

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. From the Home screen, the graphing calculator can tell you if a sentence is TRUE or FALSE (**1**=TRUE and **0**=FALSE). First, determine the value that is currently stored in **X**. **Note**: On the TI-73, use [x] rather than [X,T,Θ,n].	[X,T,Θ,n] [ENTER]	

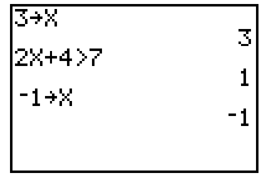
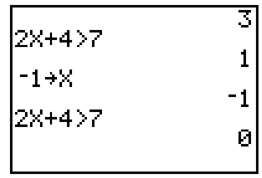
What is the value of **X** stored in your graphing calculator? ________

Check around the class. Most likely, there are many different values of **X**.

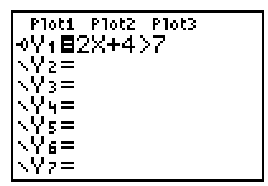
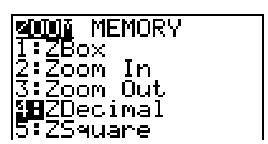
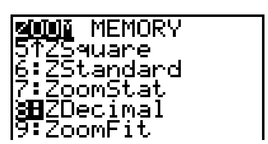
1. If you want to find out if **2X+4 > 7** is true or false when **X=3**, you must tell the graphing calculator that **X=3**, which is called storing a value in **X**. **Note**: On the TI-73, use [x] rather than [X,T,Θ,n].	[CLEAR] **3** [STO▸] [X,T,Θ,n] [ENTER]	3→X 3
2. Next, input the number sentence **2X+4>7.** This takes two steps. **Note**: On the TI-73, use [x] rather than [X,T,Θ,n].	**2** [X,T,Θ,n] [+] **4**	3→X 3 2X+4
3. You can find the **>** (greater than) sign in the catalog ([2nd] [CATALOG]). **Shortcuts:** On the TI-83 Plus, press [2nd] [TEST] **3**. On the TI-73, press [2nd] [TEXT] [▼] [▼] [▼] [▶] [▶] [ENTER] to select **>** and [▼] [ENTER] to select **Done**.	[2nd] [CATALOG] [▲] until the cursor is next to **>** [ENTER]	CATALOG = ≠ < ▸> ≤ ≥ ▫
4. Now, complete the sentence and see the result! Remember, **1**=TRUE and **0**=FALSE. If you substitute **X=3**, you get **10>7** which is TRUE.	**7** [ENTER]	3→X 3 2X+4>7 1

Name ______________________________
Date ______________________________

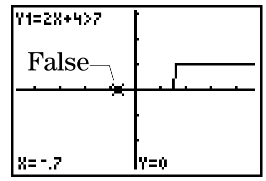
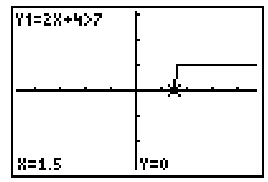
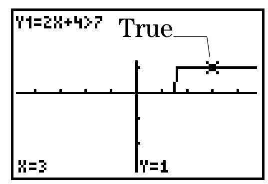
Try-It!™ on Your TI-83 Plus or TI-73 (continued)

To Do This	Press	Display (TI-83 Plus shown)
5. Test another point! (Try ⁻**1**.) **Note**: On the TI-73, use x rather than X,T,Θ,n.	(–) **1** STO▶ X,T,Θ,n ENTER	
6. You do not have to type in the number sentence **2X+4>7** again. **Note:** You also can edit an expression after it is pasted to the line. Since **1**=TRUE and **0**=FALSE, **2X+4>7** is FALSE when **X=⁻1**.	TI-83 Plus: 2nd [ENTRY] 2nd [ENTRY] ENTER TI-73: ▲ ▲ ▲ ▲ to highlight expression ENTER to copy ENTER	

Graph the inequality **2X + 4 > 7**.

To Do This	Press	Display (TI-83 Plus shown)
1. Graph this solution set. **Note**: On the TI-73, use x rather than X,T,Θ,n.	Y= CLEAR **2** X,T,Θ,n + **4** 2nd [CATALOG] ▲ until the cursor is next to **>** ENTER **7**	
2. Set the graph style to the animate graph style, which lets you see the graph as it is being plotted, even when it is on the axis at **Y=0**.	◀ until the cursor is in the left column ENTER until the ⸸ style is indicated	
3. Set the viewing window and graph the inequality by selecting **ZDecimal**.	TI-83 Plus: ZOOM **4:ZDecimal** TI-73: ZOOM **8:ZDecimal**	 

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

To Do This	Press	Display (TI-83 Plus shown)
4. Trace the function. Notice that where the graph is FALSE, **$Y_1=0$**; where the graph is TRUE, **$Y_1=1$**.	[TRACE] ◄ or ► to trace the function	
5. Notice that **$Y_1=0$** (FALSE) up through **X=1.5** (when **X≤1.5**).	◄ or ► to trace the function	
6. Keep tracing and you see that the graph jumps to **$Y_1=1$** (TRUE) when **X>1.5**. Find the exact set using algebra. Solve **2X+4>7**. Does your answer agree with this graph?	◄ or ► to trace the function	

Additional Problems

Above, you solved the following inequalities using algebra. Now, graph the solution set of these inequalities using your graphing calculator. Compare the graph to your calculated answers above.

1. **6.4X>16**

2. **$\frac{1}{2}$X−2≤⁻2**

3. **2X−2.1<⁻3.5**

Linear Inequalities: Using Algebra Teacher Notes

Objectives

- To review one-step and two-step linear inequalities.
- To review the Properties of Inequalities.

Math Highlights

This section opens with examples of solving linear inequalities of the forms, $x + a < b$, $ax < b$, and $ax + b < c$ for any relation $<$, $\leq$, $>$, and $\geq$. Word problems about an amusement park are included for students to solve. The students also see the need to interpret the answers obtained using the appropriate number set. For example, they find that they have to knock down at least 9 3/8 bottles to earn enough points for the best prize. They see that they need to interpret this answer as at least 10 bottles in order to win the prize.

The inequality properties of addition, subtraction, multiplication and division are given. When multiplying or dividing by a negative number, students are reminded about the reversal of the inequality sign. They also are reminded of how to translate phrases such as “at least” and “at most” to the appropriate relation in the **Observations** subsection.

Common Student Errors

- Students may have a hard time deciding which steps to follow to solve the inequality. They should connect this work back to the methods of solving linear equations. Students might make sign errors as they add or subtract from both sides of the inequality or reverse the inequality when multiplying or dividing by a negative number.
- Students may have difficulty making the connection that $C > 0$ means C is positive and $C < 0$ means C is negative.
- Although this section deals with the mechanical way of finding the solution set, students should be reminded that they should check to see if the solution set is reasonable. They need to keep using number sense.
- Many students are able to find the answer using number sense without the written work. Learning how to write mathematics correctly is part of the communication skill and needs to be encouraged. This can cause frustration for students who find the problems easy to solve “in their heads.”
- Some students have difficulty remembering the meaning of the symbols, $<$, $\leq$, $>$, and $\geq$. They also have trouble translating the phrases such as “at least” and “at most.”

Student Worksheet Notes with Answers

Overview

Tell students:

1. How to find the **Overview**, or tell them to review the instructions on the worksheet.

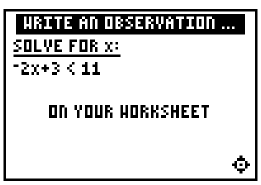
2. How to navigate the application, if they are not yet familiar with the application.

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** give students an opportunity to practice finding the solution set to given inequalities. They are reminded about reversing the inequality sign when multiplying or dividing an inequality by a negative number. They also see a reminder of how to translate a phrase such as *more than* to the symbol >.

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

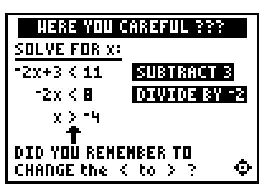


Observation 1

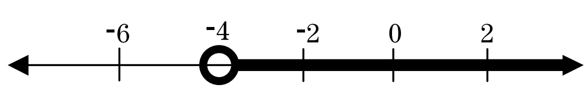
Solve for **x**:
$^-2x+3 < 11$

$x > {}^-4$.

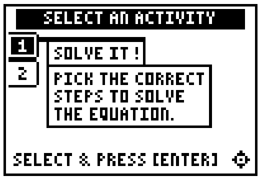
Students will see the answers on the next screen. Students' work may vary with the step order shown on the screen.



Students label the result on a number line. A possible number line looks like this:



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. They get an additional 2 points for the correct solution.

The total number of points available varies.

Solve It!

Tell students to:

1. Highlight a level (silver = less difficult; gold = more difficult), and press $\boxed{\text{ENTER}}$ to select it.
2. Look at the algebraic expression at the top of the screen and decide what must be done to solve the inequality for **x**. Students must select from the choices offered; this activity presents only one sequence of steps (to first isolate **x** and then change the coefficient of **x** to 1), although other sequences may be correct.
3. Press $\boxed{\blacktriangledown}$ or $\boxed{\blacktriangle}$ to cycle through steps to choose from, and then press $\boxed{\text{ENTER}}$ to select the correct step (some problems require two steps). If their second choice is incorrect, the correct step is displayed; press any key to continue play. If the activity prompts them to select the correct result, highlight it with $\boxed{\blacktriangleright}$ or $\boxed{\blacktriangleleft}$, and then press $\boxed{\text{ENTER}}$ to select it. As they play the activity, write each inequality and their strategy for finding the solution.
4. Record the level they played.
5. Record their scores.

Scoring: Points are based on how quickly students solve each equation. If they give an incorrect answer, the equation stacks up at the bottom of the screen, giving them less time to solve the next equation.

Unless you specify point or time limits for this activity, students can play the activity when four missed equations stack up, the game is over.or they press 〈**QUIT**〉 to stop. There is no time limit.

Free Fall

Tell students to:

1. Highlight a level (silver = less difficult; gold = more difficult), and press $\boxed{\text{ENTER}}$ to select it.
2. When they are ready to start, press any key.
3. Watch the equation as it falls, and quickly solve for **x**. Enter the solution (press $\boxed{(-)}$ for negative numbers), and press $\boxed{\text{ENTER}}$ before the equation hits bottom. If they give an incorrect answer, the correct answer is displayed; press any key to resume play.
4. Follow your instructions. For example, students can play:
   - Until they have answered incorrectly four times (no time limit).
   - Until a certain amount of time has expired (highest score with the fewest misses wins).
   - Until a certain score has been reached (first student to reach the score with the fewest misses wins).
   - Repeatedly over a period of time (days, weeks, etc.) for tracking improvement of high scores.
5. Record the level they played.
6. Record their scores.

Activities (continued)

Additional Problems

1. $6.4x > 16$ *when* $x>2.5$

2. $\frac{1}{2}x - 2 \le -2$ *when* $x \le 0$

3. $2x - 2.1 < -3.5$ *when* $x < -0.7$

4. Let C = the number of phone calls per month. Therefore, $15 + 0.25C \le 30$. The solution is $C \le 60$. Students could discuss that this is about 2 calls per day. They should write whether or not this phone plan would be adequate for them.

Try-It!™ on Your TI-83 Plus or TI-73

This keystroke exercise lets students learn about the logic functionality built in the graphing calculator. They see how to store a variable, test an inequality and finally graph a TRUE(**1**)/FALSE(**0**) graph. By graphing the solution set using the graphing calculator's logic, they can verify their algebraic work on the inequalities.

Students first solve the problem by hand. They should show all their work.

If **X=3**, is **2X+4>7** true or false?

Answer: $2(3) + 4 > 7$

$6 + 4 > 7$

$10 > 7$

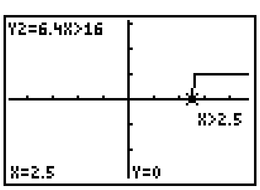
Therefore, the statement is true.

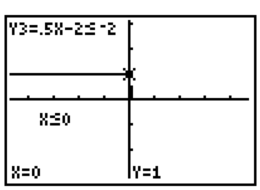
Tell students to follow the steps exactly on the graphing calculators. Example screens are displayed on the worksheets for students to compare with the graphing calculator screens.

Additional Problems

Tell students to do the following calculation by hand, and then check the answers using the graphing calculator. They should show all their work.

The graphs are shown below using **ZDecimal** ([ZOOM]) window values. Students should discuss how they determine the endpoint of the solution set. Remind them that using algebra gives the exact answer. The graph helps them see where the solution is approximately located.

1. 

2. 

3.