



### Math Objectives

- Students will represent real-world applications with linear inequalities using two variables.
- Students will understand the difference between a dashed boundary line and a solid boundary line.
- Students will understand the graphical differences for each of the inequality symbols.
- Students will be able to select test points to verify the solution set.

### Vocabulary

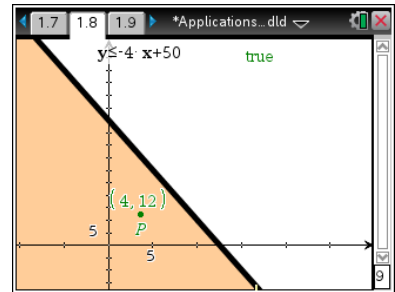
- linear inequality
- boundary line

### About the Lesson

- This lesson is a follow-up lesson to the activity *Linear Inequalities in Two Variables*.
- This lesson involves students representing real-world applications with linear inequalities in two variables. Students will use the graphs of inequalities in two variables to visualize solution sets. Students will also use test points to verify solutions sets and make adjustments to solution sets based on the context of the application.

### Related Lessons

- Prior to this lesson: Linear Inequalities in Two Variables



### TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point
- Use a slider

### Tech Tips:

Make sure the font size on the TI-Nspire handheld is set to medium.

### Lesson Materials:

#### Student Activity


- Applications\_of\_Linear\_Inequalities\_Student.doc
- Applications\_of\_Linear\_Inequalities\_Student.pdf

#### TI-Nspire document

- Applications\_of\_Linear\_Inequalities.tns



### Discussion Points and Possible Answers

**Tech Tip:** If students experience difficulty dragging a point, check to make sure that they have moved the cursor (arrow) until it becomes a hand (☞) getting ready to grab the point. Also, be sure that the word point appears. Then press **ctrl**  to grab the point and close the hand (☞). When finished moving the point, press **esc** to release.

Move to pages 1.2 – 1.7.

1. When writing an inequality to represent the problem, which inequality symbol would be used? How can you tell?

**Answer:** The sentence “The company does not allow employees to work more than 50 hours each week” indicates that employees can work up to and including 50 hours in a week. Therefore, the less-than-or-equal-to symbol should be used.

**Teacher Tip:** This answer assumes the number of hours is placed on the right side of the inequality. If not, then the greater-than-or-equal-to sign would be correct.

2. Using the variable  $x$  to represent the number of bikes assembled and  $y$  to represent the number of bikes that are road tested, write an inequality to represent the problem.

**Answer:**  $4x + y \leq 50$

3. Solve the inequality from Question 2 for  $y$ . Show your work below.

**Answer:**

$$\begin{array}{r} 4x + y \leq 50 \\ -4x \quad -4x \\ \hline y \leq -4x + 50 \end{array}$$

4. To graph the inequality from Question 3, would the boundary line be graphed as a solid or dashed line? Explain.

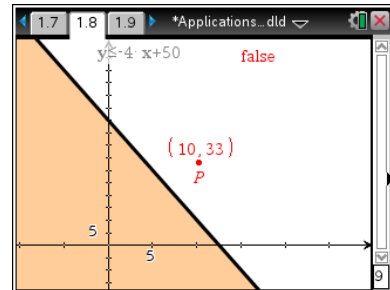
**Answer:** The boundary line would be solid since it is included in the solution set, as indicated by the “or equal to” part of the inequality symbol.



### Move to page 1.8.

5. Page 1.8 shows the graph of the inequality that represents the problem on page 1.2. How does this inequality compare to your result from Questions 2 and 3?

**Answer:** Answers may vary and are dependent on student responses to Questions 2 and 3.



### Move to pages 1.9 – 1.13.

On page 1.8, suppose the  $x$ -coordinate of point  $P$  represents the number of bikes assembled and the  $y$ -coordinate represents the number of bikes that are road tested.

6. Grab and move point  $P$  around the graph. Notice the word *true* or *false* appears on the screen depending on the position of the point. What does this mean? Explain.

**Answer:** *True* indicates the point satisfies the inequality and is part of the solution set. *False* indicates the point does not satisfy the inequality and is not part of the solution set.

7. Which solutions graphed on page 1.8 make sense in the context of the problem? Explain.

**Answer:** Solutions located in the first quadrant (including positive portions of the  $x$ -axis and  $y$ -axis) make sense in the context of the problem. Negative numbers would not make sense, since  $x$  represents the number of bikes assembled and  $y$  represents the number of bikes road tested.

8. Choose three different coordinates for point  $P$  by dragging the point above the boundary line, on the boundary line, and below the boundary line. Record the three you chose in the table below. Complete the table by testing each point in the inequality and showing your work.

### Sample Answers:

	Above the boundary line	On the boundary line	Below the boundary line
Coordinates $(x, y)$ of the Point	(9, 39)	(5, 30)	(3, 16)
Verify by substituting the coordinates into the equation or inequality	$y \leq -4x + 50$ $39 \leq -4(9) + 50$ $39 \leq -36 + 50$ $39 \leq 14$ <b>false</b>	$y \leq -4x + 50$ $30 \leq -4(5) + 50$ $30 \leq -20 + 50$ $30 \leq 30$ <b>true</b>	$y \leq -4x + 50$ $16 \leq -4(3) + 50$ $16 \leq -12 + 50$ $16 \leq 38$ <b>true</b>

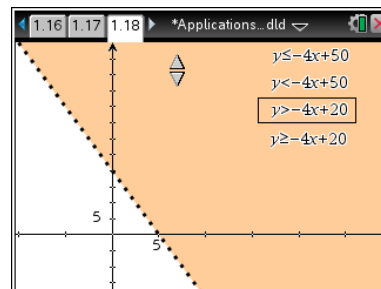


**Tech Tip:** It is possible that a value on the boundary line will show as a false result. In cases such as these, have students change the attributes of the x-coordinate (**MENU > Actions > Attributes**) to display one decimal.

Move to pages 1.14 – 1.18.

### Extension Questions

The following questions and answers are provided as an extension/continuation of the activity. Depending on time, you may or may not choose to have students complete this portion. If you choose not to have students complete it, you can delete the questions from the student worksheet and tns file or have them ignore them.



9. Suppose the company policy states that employees must work less than 50 hours per week. How would this change the graph? Explain.

**Answers:** The boundary line would no longer be part of the solution set, since the inequality would change to less than. Therefore, the boundary line would be dashed instead of solid.

10. Suppose the company policy states that employees must work more than 20 hours per week. How would this change the graph? Explain.

**Answer:** The boundary line would not be included in the solution set, since the inequality would be greater than. Therefore, the boundary line would be dashed instead of solid. Also, the y-intercept would change from 50 to 20, and the shading would be above the line instead of below.

11. Suppose the company policy states that employees must work at least 20 hours per week. How would this change the graph? Explain.

**Answer:** The y-intercept would change from 50 to 20, and the shading would be above the line instead of below.

### Wrap Up:

Upon completion of the discussion, the teacher should ensure that students are able to:

- Understand how linear inequalities using two variables can be used to represent real-world problems.
- Understand the difference between a dashed boundary line and a solid boundary line.
- Understand the graphical difference for each of the inequality symbols.
- Verify test points as part of the solution set.
- Understand solutions in the context of real-world problems.