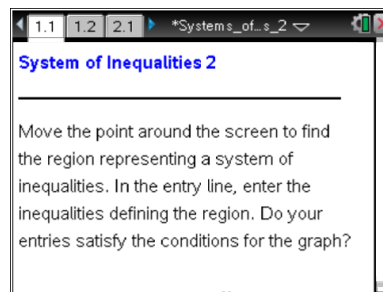## Math Objectives

- Students will identify points in a region of a system of linear inequalities in a graph.
- Students will identify the algebraic form of a system of inequalities from a graph representing points in the region.
- Students will use appropriate tools strategically (CCSS Mathematical Practice).

Vocabulary

- system of inequalities
- boundary line
- region

About the Lesson

- This lesson involves examining the graphical and algebraic representations of a system of inequalities.
- As a result, students will:
    - Determine whether points are in a region, on the boundary but not in the region, or not in the region of a system of inequalities.
    - Make a conjecture as to the definition of a system of inequalities in algebraic form.

TI-Nspire™ Navigator™ System

- Use Screen Capture to examine examples of systems of inequalities.
- Use Teacher Edition computer software or Live Presenter to review student documents and discuss examples as a class.
- Use Quick Poll to assess student understanding throughout the lesson.

TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point
- Graph inequalities
- Manipulate a slider

Tech Tips:

- Make sure the font size on your TI-Nspire handheld is set to Medium.
- Press ⌈ctrl⌉ ⌈G⌉ to either hide the entry line or access the entry line in a *Graphs* page.

Lesson Materials:
Student Activity

- Systems_of_Linear_ Inequalities_2_Student.pdf
- Systems_of_Linear_ Inequalities_2_Student.doc

TI-Nspire document

- System_of_Linear_ Inequalities_2.tns
- System_of_Linear_Inequaliti es_2_Answers.tns

Visit www.mathnspired.com for lesson updates and tech tip videos.

Discussion Points and Possible Answers

> **Tech Tip:** If students experience difficulty dragging a point, check to make sure that they have moved the cursor until it becomes a hand (🖐) getting ready to grab the point. Then press `ctrl` `✋` to grab the point and close the hand (✊). If students experience difficulty with the syntax of entering inequalities, use the computer software to demonstrate the correct syntax for the class. Students may edit their inequalities if necessary.

> **Tech Tip:** You can reset each graph page to eliminate the points that were created when you moved the labeled point. Just click up on the slider in the top left corner of the screen.

> **TI-Nspire Navigator Opportunity:** *Screen Capture and/or Live Presenter*
> **See Note 1 at the end of this lesson.**

Move to page 1.2.

1. Grab the point and move around the screen to determine the region representing a system of inequalities. Points will be marked in three ways. An "x" represents a point not in the region. An "o" represents a point on the boundary but not in the region. A "●" represents a point in the region.
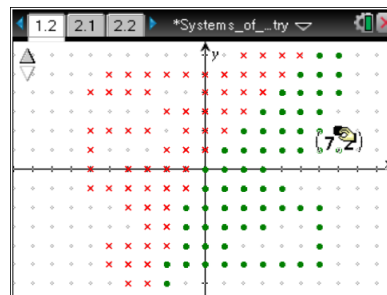
   a. When you have finished identifying the points in the region, make a conjecture as to the system of inequalities. In the entry line, enter the two inequalities that will define the region. If your conjecture is correct, the intersecting region should correspond with the classifications of the points.

   Press `ctrl` `G` to bring up the entry line. Press `del` to bring up a menu of inequality symbols. Use **2: <** or **4: >** for a dotted boundary line. Use **1: ≤** or **5: ≥** for a solid boundary line.

   > **Tech Tip:** In the entry line, when the equal sign is changed to a less than or greater than sign, the *f*(*x*) changes to a *y*.

b. Explain how you know whether or not the boundary line is included in your answer.

Answer: The boundary line will be included if the edge of the region has solid dots. It will not be included if the edge of the region has open dots.

c. Explain how you know in which direction the inequality sign goes.

Answer: If the shaded region is above the boundary line, then use > or $\geq$. If the shaded region is below the boundary line, then use < or $\leq$.

d. Write the system of inequalities represented on the graph.

**Answer:** $y \leq x$ and $y \leq 3x + 1$
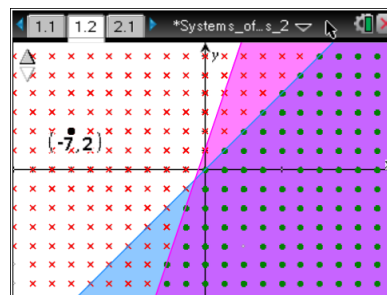
> **Teacher Tip:** Students may experience difficulty with finding the definition of the boundary line. A quick review of finding the slope and *y*-intercept from the graph may be necessary. The computer software could be used to go through the process with this first problem as a class. Encourage students to try to visualize a line going through 2 points.

TI-Nspire Navigator Opportunity: *Screen Capture and/or Live Presenter*
 See Note 2 at the end of this lesson.

Move to page 2.2.

2. Repeat question 1 for this new system of inequalities. Write the system of inequalities represented on the graph.

**Answer:** $y < 2x + 4$ and $y \geq \dfrac{1}{3}x - 1$
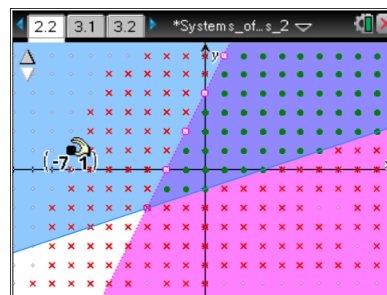
> **Tech Tip:** If students understand the concept, after a few problems, the teacher may want to revise the file by filling in the points for questions 3 and 4 and resaving it. Students would then proceed directly to finding the inequalities and entering them on the entry line.

> **Teacher Tip:** Point out to students that the boundary points only show in
> the intersected region (not necessarily all along the boundary).

Move to page 3.2.

3. Repeat question 1 for this new system of inequalities. Write
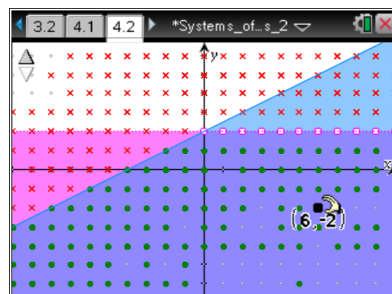   the system of inequalities represented on the graph.

   Answer: $y < -x + 2$ and $y > \dfrac{3}{2}x - 3$
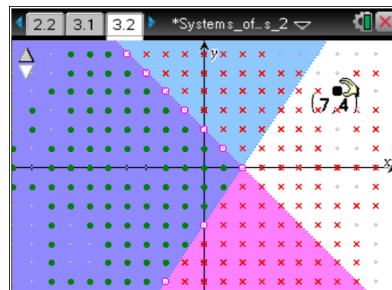
Move to page 4.2.

4. Repeat question 1 for this new system of inequalities. Write
   the system of inequalities represented on the graph.

   Answer: $y < 2$ and $y \le \dfrac{1}{2}x + 2$

> **TI-Nspire Navigator Opportunity:** *Quick Poll*
> **See Note 3 at the end of this lesson.**

Wrap Up

Upon completion of the discussion, the teacher should ensure that students understand:

- How to determine the boundary lines and whether or not they are included in the answer for a
  system of inequalities.

- How to determine the direction of the inequality sign.

- How to represent the different graphical representations of an inequality in algebraic form.

TI-Nspire Navigator

Note 1

Entire Document, *Screen Capture* **and** *Live Presenter***:** If students experience difficulty
with the syntax of entering inequalities, use Live Presenter with TI-Nspire Navigator to
demonstrate the correct syntax for the class. Students may edit their inequalities if
necessary.

Note 2

Question 1, *Screen Capture* and *Live Presenter:* Students may experience difficulty with finding the definition of the boundary line. A quick review of finding the slope and *y*-intercept from the graph may be necessary. The Screen Capture and Live Presenter could be used to go through the process with this first problem as a class.

Note 3

Question 4, *Quick Poll:* A Quick Poll can be given at the conclusion of the lesson. You can use the Review space at the start of the next class to discuss possible misunderstandings students may have.

The following are some sample questions you can use:

1. If the boundary of the shaded region is a solid line, then the inequality symbol is:
    a. < or >
    b. < or ≤
    c. > or ≥
    d. ≥ or ≤
    Answer: d

2. If the shaded region is below the boundary line, then the inequality symbol is:
    a. < or >
    b. < or ≤
    c. > or ≥
    d. ≥ or ≤
    Answer: b

3. True or False: Parallel boundary lines for a system of inequalities may result in no solution.
    Answer: True