Border Patrol
ID: 11603

Activity Overview
In this activity, students will graph one linear inequality and then graph a system of linear inequalities as they apply to an area of land. Students will practice graphing systems of inequalities and determining if a points lies in the solution. In the extension, students are challenged to write a system of inequalities that describe the area of Mississippi.

Topic: Linear Systems
- *Linear inequalities in two variables*
- *Solution sets*

Teacher Preparation and Notes
- *This activity can be used without the worksheet, though one has been provided.*
- *The teacher should introduce and practice graphing an inequality before using the activity.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "11603" in the keyword search box.***

Associated Materials
- *BorderPatrol_Student.doc*
- *BorderPatrol.tns*
- *BorderPatrol_Soln.tns*

Suggested Related Activities
To download any activity listed, go to <u>education.ti.com/exchange</u> and enter the number in the keyword search box.
- *Solving Linear Equations and Inequalities (TI-Nspire technology) — 8992*
- *Winning Inequalities Part 1 (TI-84 Plus family) — 4283*
- *The Impossible Task (TI-84 Plus family) — 9316*

Problem 1 – Graphing one inequality

Students are to graph an inequality that represents United States territory along the US/Mexico border. Directions for graphing the inequality are provided on page 1.2.

To answer the questions on pages 1.4 – 1.6, students can use the **Text** tool to label the sides of the graph as United States or Mexico. They will need to use the **Point** tool and the **Coordinates and Equations** tool to place a point in either side. To change the coordinates, double click on the *x*-value or *y*-value. The window will need to be adjusted.

Discussion Questions:

- Why does line appear dotted?

- How can one determine if the calculator has shaded the plane correctly?

- Can a town lie on the border and be considered in US territory?
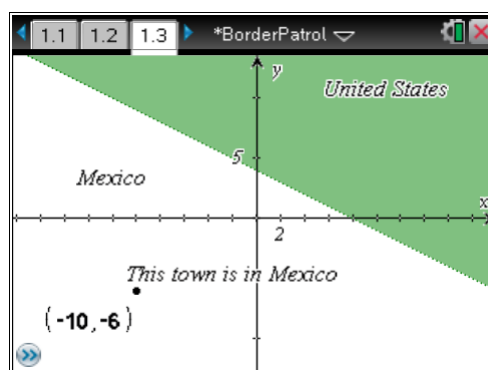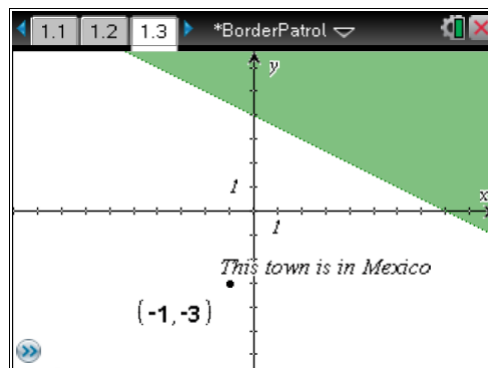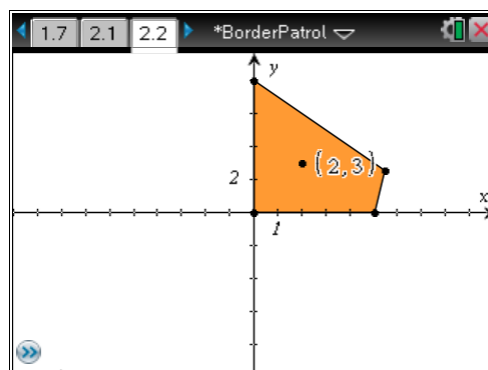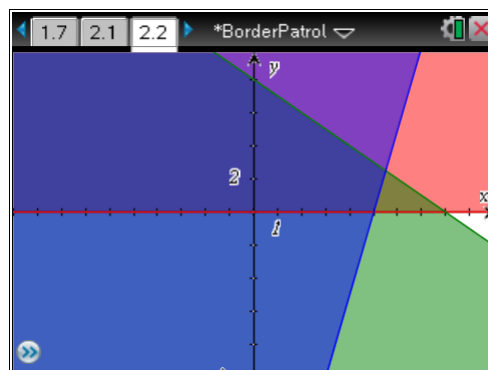
Problem 2 – Graphing a system of linear inequalities

Students are given a system of inequalities that represent a fenced-in yard. They will be able to graph all of the inequalities except $x \geq 0$. Explain to students that this inequality would shade everything to the right of the *y*-axis. When entering the other inequalities students can press [ctrl] [=] and select the desired inequality

Students should see that the lines are solid because the fence is the owner's property and the inequality symbols are $\leq$ and $\geq$.

To verify that students understand the solution of the system of inequalities, they are to use the **Polygon** tool (**MENU > Shapes > Polygon**) to show the area of the fenced-in yard. Then they can use the **Hide/Show** tool to hide the inequalities.

They will need to use the **Point** and **Coordinates and Equations** tools to find a point within the yard for the bird-feeder.

Problem 3 – Practice graphing systems of inequalities

Students will graph systems of linear inequalities given at the top of each Graphs page. They are to graph the systems and then determine if the points given on the *Question* page are in the solution set.

> Note: If students have the TI-Nspire CX technology, they can color code the inequalities to match their respective inequality. To color code the graphed inequalities, students can select the inequality and then press ⌨ctrl⌨ ⌨menu⌨ and select **color**.

To determine if the points are in the solution set, students can drag the plotted point to the desired location, or they can insert a *Calculator* page and determine if the point satisfies both inequalities.
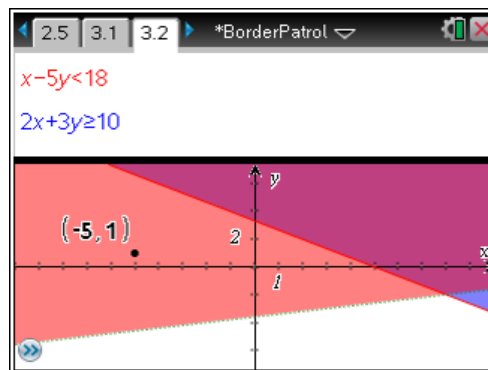
Discussion Questions:

- How can we determine the solution set by examining the graph?

- Is there a way to describe the solution set using non-graphical notation?

Extension – Writing a system of linear inequalities

In the first extension, students are given a graph of the shape of the state of Mississippi. They are to determine the system of linear inequalities that describe the area of the state. The can use the **Point On** tool to place two points on a line and then calculate the slope. The inequalities should have < or > because the borders are imaginary.

In the second extension, students are given a word problem from which they will write a system of linear inequalities. They can graph the system on page 4.4. One of the constraints is $x > 2$. Students can add a vertical line at $x = 2$ and place text on the screen notifying that there is that constraint.

Students must then determine which of the combinations of juniors and seniors listed on page 4.4 are possible solutions to the problem.