ExploreLearning

Lesson Plan
Lecture Edition

Linear Inequalities

Objectives

Students will:

- Discover how to graph a linear inequality.
- Determine if a point is in the solution set.
- Solve linear inequality application problems.

Prerequisite Knowledge

Students are able to:

- Graph linear equations.
- Solve linear equations for a given variable.

Resources

- This lesson assumes that your classroom has only one computer, from which you can lecture. If your classroom has enough computers for all your students, either working individually or in small groups, see the lab version of this lesson.
- Rulers, pencil, paper
- Access to http://www.explorelearning.com/
- Copies of the worksheet for each student (optional)

Lesson Preparation

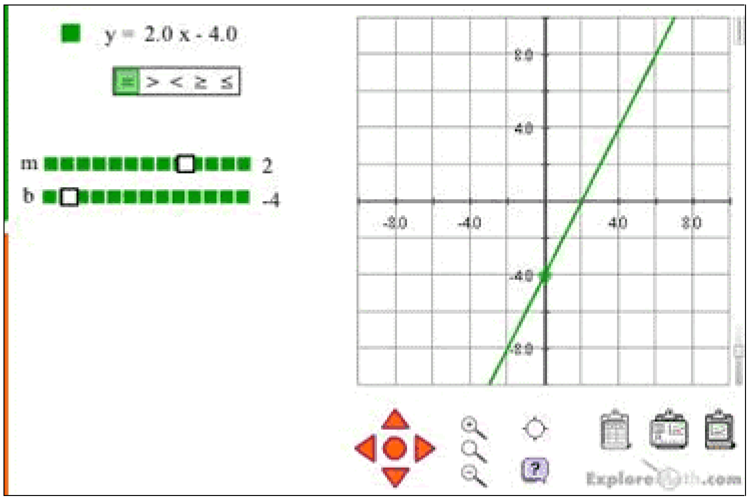
Before conducting this lesson, be sure to read through it thoroughly, and familiarize yourself with the Linear inequalities activities at ExploreLearning.com. You may want to bookmark the activity page for your students. If you like, make copies of the worksheet for each student.

Lesson

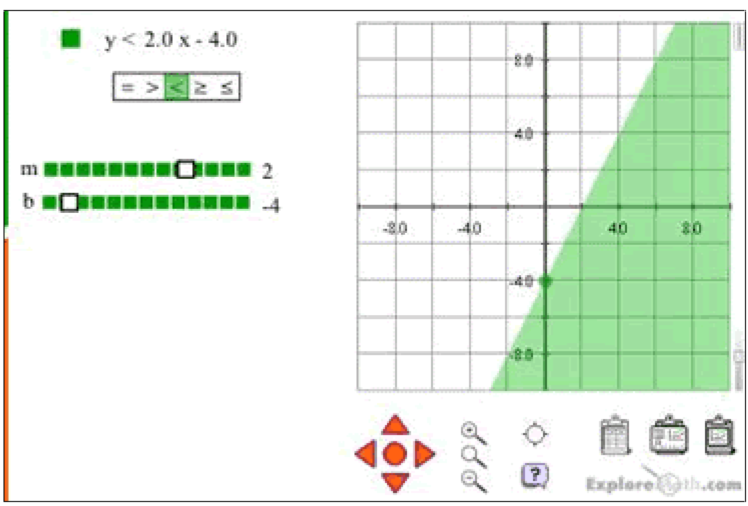
Motivation:
Students need to imagine that they own a sneaker company. Ask students how they would know if their company made a profit. Ask students how to determine the number of sneakers of each type they need to sell in order to “break even.”

Tell students that we will explore the answers to these questions later in the lesson.

Go to the Linear inequalities activity at ExploreLearning.com. Graph **y** = **2x** – **4**. This can be accomplished by typing a **2** next to the m slide bar and a –**4** next to the b slide bar.



Ask students how the graph of **y** < **2x** –**4** would differ from the graph of **y** = **2x** – **4**. Go over answers then select the > symbol. Show students the resulting graph.



Ask students why the “lower” section of this graph is shaded. Try to lead students towards answers that involve “solution sets.” Explain to the students that the shaded area represents all the coordinates that satisfies the equation **y** < **2x** – **4**. Ask students how points could be tested to determine if they are in the solution set. Have a student pick a point from the shaded area to test.

Example: Testing the point **(3, -4)**

$$\mathbf{Y < 2x - 4}$$
$$\mathbf{-4 < 2(3) - 4}$$
$$\mathbf{-4 < 6 - 4}$$

$\mathbf{-4 < 2}$ which is a true statement, therefore **(3, -4)** is in the solution set.

Now have a student pick a point from the non-shaded area to test.

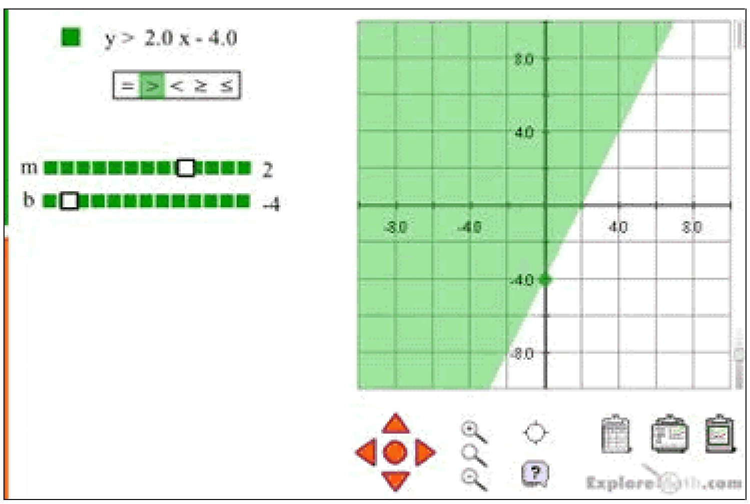
Example: Testing the point **(-2,4)**

$$\mathbf{Y < 2x - 4}$$
$$\mathbf{4 < 2(-2) - 4}$$
$$\mathbf{4 < -4 - 4}$$

$\mathbf{4 < -8}$ which is not a true statement, therefore **(-2, 4)** is not in the solution set.

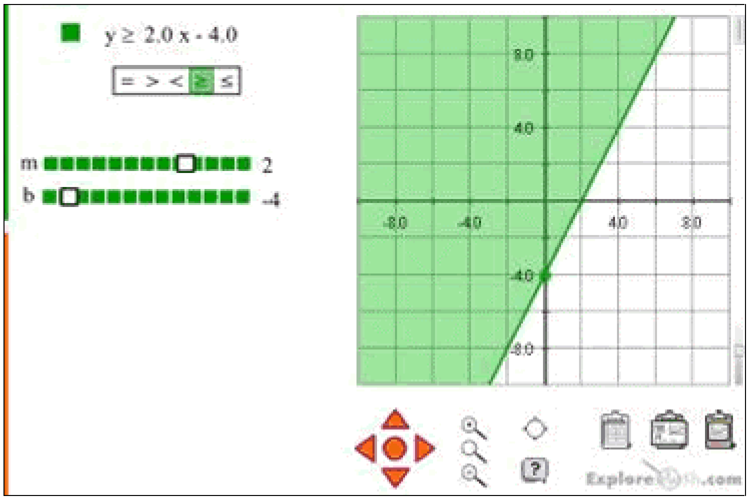
Ask students if more than one point needs to be tested in order to determine which side of the line needs to be shaded. Go over responses.

Ask students how the graph of $\mathbf{y > 2x - 4}$ would differ from the other two graphs. Go over responses, and then show students the graph.



Ask students to compare the solution sets of $\mathbf{y > 2x - 4}$ and $\mathbf{y < 2x - 4}$.
Have students make conjectures about when the solution set is "above" the line and when the solution set is "below" the line. Test their conjectures by graphing several different inequalities.

Now ask students how the graph of $\mathbf{y \leq 2x - 4}$ differs from $\mathbf{y < 2x - 4}$.



Ask students what is the significance of the solid green line. Plug the point **(2,0)** into $y \le 2x - 4$ and $y < 2x - 4$. Solve these equations side-by-side.

$y \le 2x - 4$	$y < 2x - 4$
$0 \le 2(2) - 4$	$0 < 2(2) - 4$
$0 \le 4 - 4$	$0 < 4 - 4$
$0 \le 0$	$0 < 0$
True statement	False statement

Students should see that one equation contains “boundary points” in its solution set, and the other equation does not.

Ask students how the graph of $y \ge 2x - 4$ differs from $y > 2x - 4$; from $y \le 2x - 4$. Go over responses.

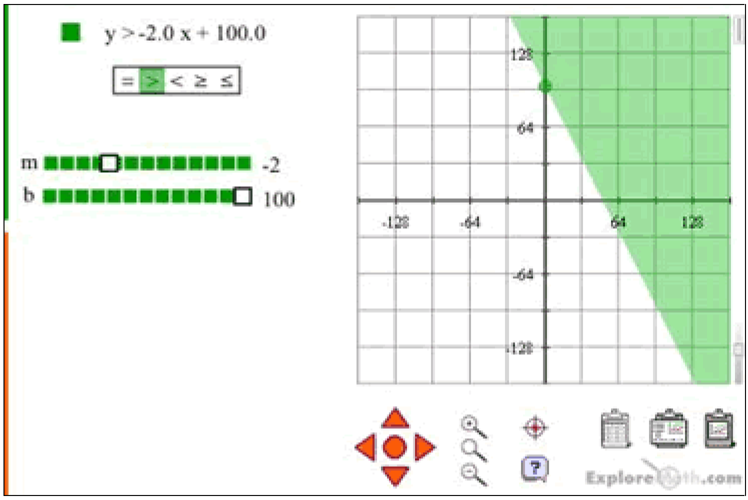
Have students graph several linear inequalities of each type. Also pick points and have students determine if the points are members of the solution set. (Pick points close to the boundary and very large points. The “crosshair” utility is helpful for picking points.)

Profit/Loss Application

Remind students of the questions asked at the beginning of class about the sneaker company. Assume that there are two types of sneakers to sell, brand **x** and brand **y**. The sell of brand ‘**x**’ yields $2/sneaker and brand ‘**y**’ yields $1/sneaker. Ask students to come up with some cost associated with selling sneakers. Make a table similar to the one below. Keep values $\le$ **100** in order to graph inequalities on the computer.

Fixed Cost/Day	Revenue/Sneaker
Rent $18	$2/X
Utilities $20	$1/Y
Labor $62	
Total $100	

Using this model, students should see to make a profit, at least $100 needs to be made per day. This leads to the inequality **2x** + **1y** > **100**, which can be written as **y** > **-2x** + **100**
When graphed the inequality looks like this:



Ask students how the shaded area relates to our application. Ask students why the shaded areas in quadrants **2** and **4** should be disregarded. Ask students how the intercepts relate to the application. Ask students how much profit selling **40** pairs of **x** and **65** pairs of **y** makes. Ask students how many pairs of **x** needs to be sold to break even if **54** pairs of y were sold.

Conclusion

Linear inequalities come in four different types, <, >, ≤, and ≥. The graph of each inequality involves shading a portion of the plane. The shaded areas represent all the points that are in the solution set of the inequality. The graphs of ≤ and ≥ have solid boundary lines to indicate that boundary points are included in the solution set. To test a point for inclusion in the solution set, plug the point into the inequality. If the answer turns out to be a true statement, the point is in the solution set. If the answer turns out to be a false statement, the point is not in the solution set.