About the Lesson

In this activity, students will identify whether points lie within a shaded region that is bounded by linear inequalities. The focus is on testing the points for truth in the inequality. Students will use a graph to verify their answers. As a result, students will:

- Visually determine the location of a point with regard to shading or the line itself (above, below, or on the line itself).
- Answer True or False as to whether a point satisfies multiple conditions established by linear inequalities.

Vocabulary

- addend
- additive inverse
- integer
- subtrahend

Teacher Preparation and Notes

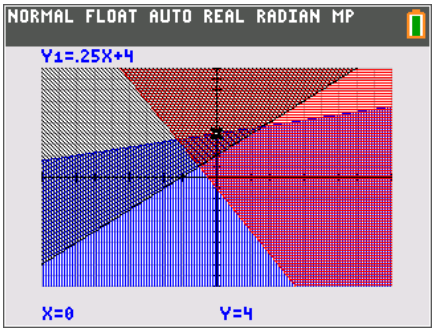
- Students will utilize a random number generator to create unique scenarios and answer questions about the points plotted as a result.
- Students will organize their thinking by using a table on the worksheet to answer True or False as to whether a point lies within a shaded region.
- Students will use the [test] menu to evaluate inequalities as true or false.

Activity Materials

- Compatible TI Technologies:

TI-84 Plus*
TI-84 Plus Silver Edition*
TI-84 Plus C Silver Edition
TI-84 Plus CE

** with the latest operating system (2.55MP) featuring MathPrint™ functionality.*



Tech Tips:

- This activity includes screen captures taken from the TI-84 Plus CE. It is also appropriate for use with the rest of the TI-84 Plus family. Slight variations to these directions may be required if using other calculator models.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials
- Any required calculator files can be distributed to students via handheld-to-handheld transfer.

Lesson Files:

- Testing_for_Truth_Student.pdf
- Testing_for_Truth_Student.doc

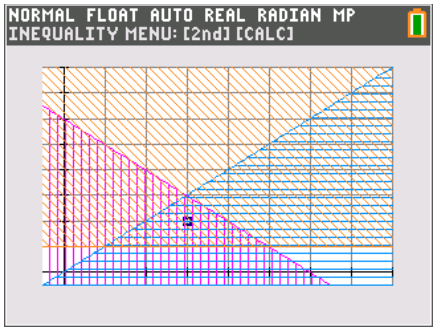
Problem 1 – The Pet-Sitting Business

Students begin this activity by considering opening a pet-sitting business.

Allow students to read through the problem and generate a discussion concerning the question presented at the end of the problem.

Suppose you and a friend want to start a pet-sitting business where you will watch your neighbors' cats and dogs while they are on vacation. You both agree that in a given day you can safely care for no more than six animals at a time. You also mutually agree that you should care for no more dogs than you do cats. Since you love cats so much, you feel that your business should always care for at least one of these cute, furry animals.

Would caring for 3 cats and 2 dogs meet the criteria of your business plan?

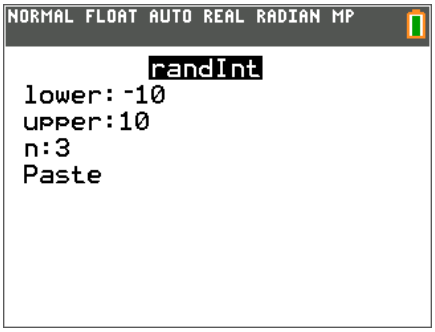


Students will then be asked to consider the graph of the linear inequalities that describes their business plan where *x* signifies the number of cats watched and *y* signifies the number of dogs watched.

They should notice that the ordered pair (3, 2) which represents the plan of caring for 3 cats and 2 dogs lies with the region shaded three times and therefore satisfies the three linear inequalities.

It may be important to point out to students that the focus of this application is not on how to write the inequalities and graph them, but instead how to determine if a point is a solution to the system of inequalities.

Problem 2 – Testing One Inequality

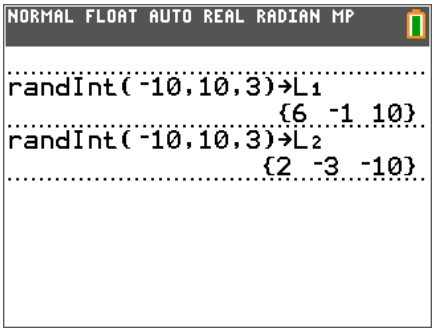


Students begin this activity by setting the random seed, so that students will not get the same sets of points throughout the activity. Instructions are given to use the last 4 digits of their phone numbers, but other numbers could be used, such as house or apartment number or birthday (in the form MMDD). Enter 1 2 3 4 sto→ math and arrow over to **PROB** and select **1:rand** and press enter and then enter again to confirm.

Students will then generate random numbers in **L1** and **L2** as *x*- and *y*-coordinates respectively. Press math and arrow over to **PROB** and choose **5:RandInt(**. They should enter the values –10, 10, and 3 afterwards as shown to the right and select **Paste** and press enter. Next, they should store those values into $\mathbf{L_1}$ by pressing sto→ 2nd 1 [L1].

Repeat the above process by replacing **L1** with **L2** to generate the *y*-coordinates.

Students will now be able to see their randomly generated values in a list by pressing [stat], choosing **1:Edit**, and pressing [enter].



The table on the student worksheet will make it easier for students to organize their thinking and to show their work.

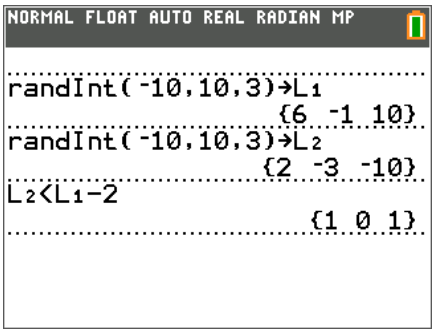
It may be helpful to discuss with students what they would write if the point lands on the line itself. On the line is not included in the shaded region for this example, because the inequality is $y > -x - 2$.

1. Using the table below, determine whether or not each point is a solution of the inequality.

Sample Answers:

Point *A* (*x*, *y*)	*y*	$-x - 2$	$y > -x - 2$	T or F
(2, 2)	2	–2 – 2	2 > –4	T
(6, 2)	2	–6 – 2	2 > –8	T
(–1, –3)	–3	1 – 2	–3 > –1	F
(10, –10)	–10	–10 – 2	–10 > –12	T

Students can also test the inequalities on the home screen to see if they are true or false. To test the given example, press [2nd] [2] [L_2] [2nd] [math] [test] option **5:<** [enter] [2nd] [1] [L_1] [−] [2]. The calculator will return either **1** for **True** or **0** for **False**. In this case, the first and third pair of coordinates satisfy the inequality but the second coordinate does not.



Problem 3 – Testing Two Inequalities

In this problem, students are given two inequalities, $y \leq 4$ and $y > -2$. Again, generate random numbers in **L1** (or *x*) and **L2** (or *y*). Remember, True is **1** and False is **0**.

2. Complete the table below. Generate coordinates until you find at least one solution to the inequality.

Sample Answers:

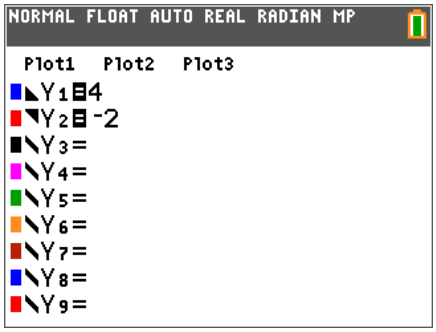
Point (*x*, *y*)	Test: $y \le 4$ (T or F)	Test: $y > -2$ (T or F)	Final answer? (T or F)
ex: (2, 0)	$0 \le 4$ T	$0 > -2$ T	T
(6, –2)	$-2 \le 4$ T	$-2 > -2$ F	F
(–3, 5)	$5 \le 4$ F	$5 > -2$ T	F
(8, 1)	$1 \le 4$ T	$1 > -2$ T	T

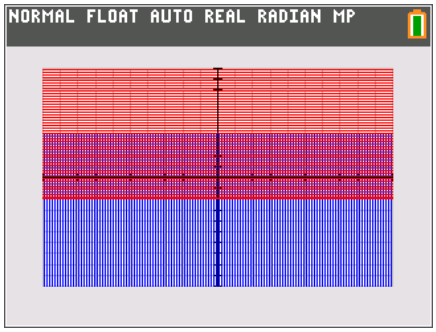
The emphasis here can be on dotted and solid lines, and <, ≤, >, ≥ symbols.

Again, have students generate random numbers and store to **L1** and **L2**. Students can use the home screen to test but they can also graph the inequalities and determine if a point is a solution graphically.

The equations should look like the screen at the right. To change the "style" of the graph, move the cursor to the left of **Y1=** and press Í. Arrow down to **Line:**, and then arrow left until you see either ◣ or ◥ .

Note: Before pressing s, make sure that all plots have been turned off, y o [stat plot] and select **4: PlotsOff**.





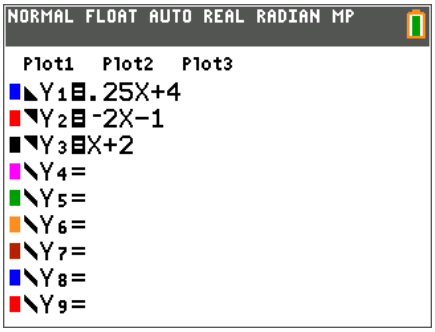
Problem 4 – Testing Three Inequalities

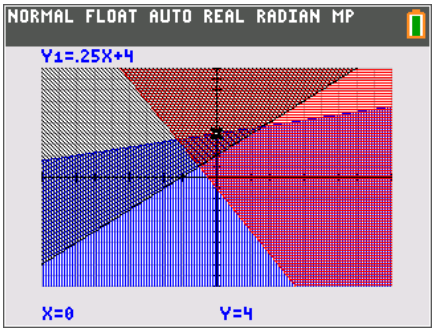
In this part, students must generate points until at least one lies within the triangle.

The students should use the table to record their answers on the student handout.

Encourage the students to continue generating ordered pairs if they cannot easily see the grid in order to record the correct numbers. If the students can't clearly determine whether the point lands on a line, or within or outside of the shaded region, don't use that point for simplicity of discussion.

Finally, students will fill in the chart below using their randomly generated coordinates.





3. Complete the table below. Generate coordinates until you find at least one solution to the inequality.

Sample Answers:

Point (x, y)	Test: $y \le 0.25x + 4$ (T or F)	Test: $y \ge -2x - 1$ (T or F)	Test: $y \ge x + 2$ (T or F)	Final answer? (T or F)
ex: (2, 0)	$0 \le 0.25(2) + 4$ $0 \le 0.5 + 4$ $0 \le 4.5$ T	$0 \ge -2(2) - 1$ $0 \ge -4 - 1$ $0 \ge -5$ T	$0 \ge 2 + 2$ $0 \ge 4$ F	F
(–4, 6)	$6 \le 0.25(-4) + 4$ $6 \le -1 + 4$ $6 \le 3$ F	$6 \ge -2(-4) - 1$ $6 \ge 8 - 1$ $6 \ge 7$ F	$6 \ge -4 + 2$ $6 \ge -2$ T	F
(5, 1)	$1 \le 0.25(5) + 4$ $1 \le 1.25 + 4$ $1 \le 5.25$ T	$1 \ge -2(5) - 1$ $1 \ge -10 - 1$ $1 \ge -11$ T	$1 \ge 5 + 2$ $1 \ge 7$ F	F
(–1, 3)	$3 \le 0.25(-1) + 4$ $3 \le -0.25 + 4$ $3 \le 3.75$ T	$3 \ge -2(-1) - 1$ $3 \ge 2 - 1$ $3 \ge 1$ T	$3 \ge -1 + 2$ $3 \ge 1$ T	T