Can I Graph You, Too?

About the Lesson

In this activity, students will explore absolute value inequalities, compound inequalities, disjunctions, and conjunctions graphically, numerically, and algebraically. As a result, students will:

- Rewrite absolute value inequalities as compound inequalities without absolute value and solve.

Vocabulary

- conjunction
- disjunction
- interval

Teacher Preparation and Notes

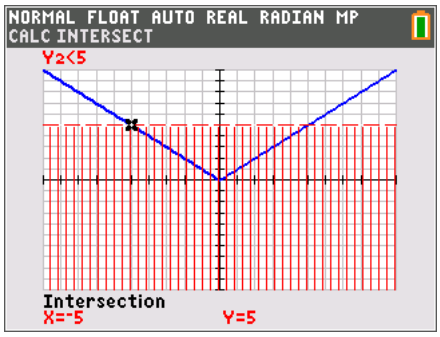
- Students should know how to graph linear inequalities by shading the appropriate half-plane. They should also know how to graph a linear absolute value function which produces a "v" shape.
- Teachers may want to give more guidance regarding isolating the absolute value expression on the left-hand side of the inequality before writing the disjunction or the conjunction.
- Students will be using the Inequality Graphing App (**Inequalz**) in this activity.

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:

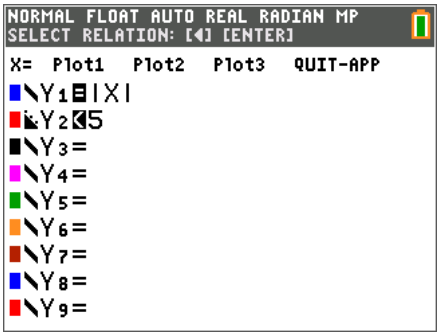
- Can_I_Graph_You_Too_Student.pdf
- Can_I_Graph_You_Too_Student.doc

©2015 Texas Instruments Incorporated

Tech Tip: If your students are using the TI-84 Plus CE, have them turn on the GridLine by pressing [2nd] [zoom] to change the [format] settings. If your students are using TI-84 Plus, they could use GridDot.

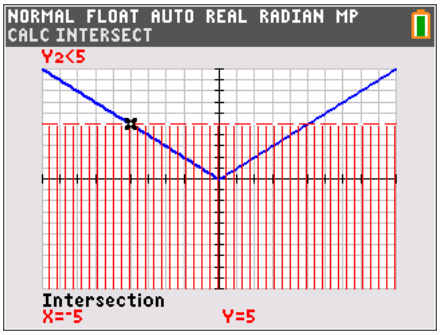
Introduction to Disjunction and Conjunction

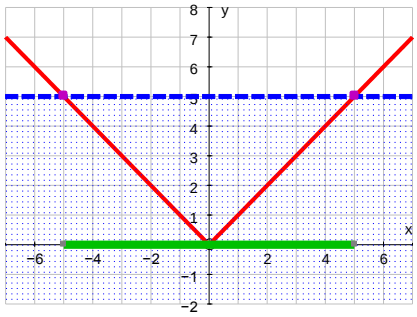
In this activity, students will explore absolute value inequalities graphically and numerically. **Example 1** describes how students would graphically solve the equation $|x| < 5$. This may be a different approach than your students have seen, but it helps them visualize what is going on.



Teaching Notes:

- You may want to further explain the terms conjunction and disjunction.
- Students should notice that the solution is an interval, not (*x*, *y*) points.
- When using the **Inequalz** app, students can select the symbol that they need by pressing **a** and then the key below where the symbol is shown. This will automatically shade the graph and display the horizontal line as dashed or solid.
- Challenge the students to graph the inequality on a piece of paper and to draw a segment on the *x*-axis representing the solution, like they would on a number line.
- Make sure that they understand that for a disjunction, the solution goes to negative and positive infinity.





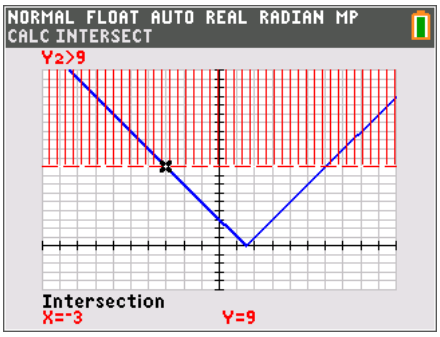
Application of Disjunction and Conjunction

Students will use what they've learned to solve inequalities graphically and algebraically. The absolute values are by themselves for the first two questions, but for the second two questions, students will need to get the absolute value by itself on the left hand side before writing as a conjunction or disjunction.

When confirming their answer by graphing, students should graph the left side and right side as they appear originally, not after getting the absolute value by itself.

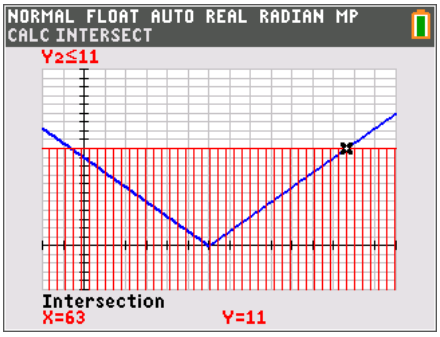
1. $|2x-3|>9$

Answer: $x < -3$ or $x > 6$



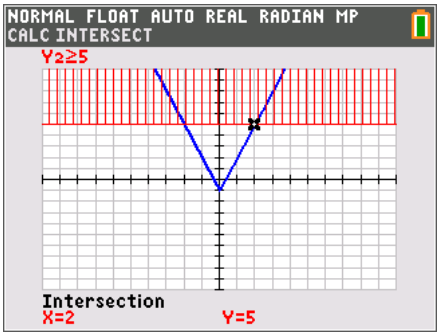
2. $\left|\frac{1}{3}x-10\right|\leq 11$

Answer: $-3 \leq x \leq 63$



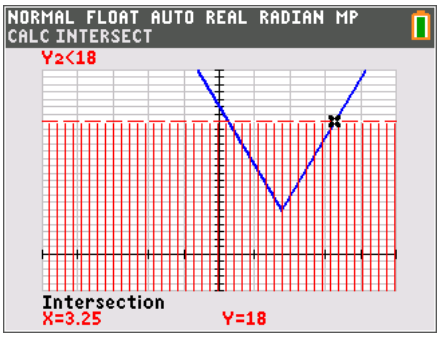
3. $|3x|-1\geq 5$

Answer: $x \leq -2$ or $x \geq 2$



4. $2|4x-7|+6<18$

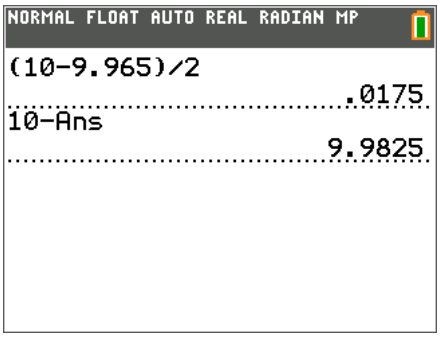
Answer: $0.25 < x < 3.25$

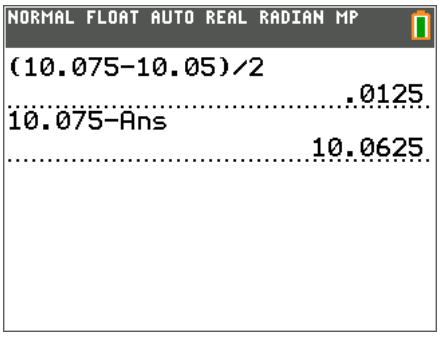


Real-World Application

Students are introduced to the idea of engineering tolerance and how absolute value inequalities are used to express this concept. They are asked to express the given bolt and hole tolerances as absolute value inequalities.

To write these inequalities, students will have to find the median of the two values and distance from the median to an end value.





5. One application of absolute value inequalities is engineering tolerance. Tolerance is the idea that an ideal measurement and an actual measurement can only differ within a certain range.

A bolt with a 10 mm diameter has a tolerance range of 9.965 mm to 10 mm, while the hole that it fits into has a tolerance range of 10.05 mm to 10.075 mm.

How can you express the tolerances of both the bolt and the hole in terms of an absolute value inequality?

Answer: bolt: $|x - 9.9825| \leq 0.0175$;
hole: $|x - 10.0625| \leq 0.0125$