Introduction to Disjunction and Conjunction

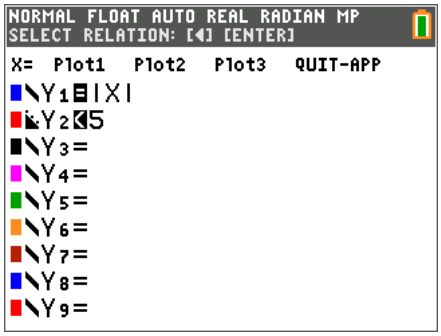
Consider the equation $|x| = 5$. To solve, you would graph both sides of the equation as functions ($y = |x|$ and $y = 5$) and mark the solution as the area where the graphs intersect.

The same method can be applied to inequalities.

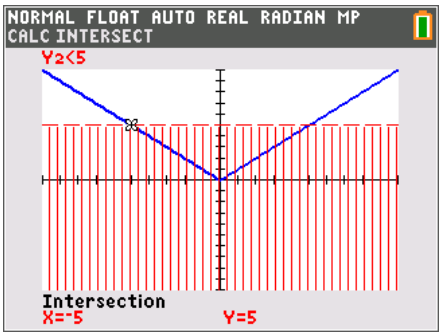
Press [apps] and select the **Inequalz** app. Press any key to begin.

Example 1: $|x| < 5$

- Using **Y1=** graph the left side as $y = |x|$. The absolute value function is located by pressing [math] [▶] and selecting **abs(**.
- Using **Y2=** graph the right side as $y < 5$. On the equals sign, press [enter] and arrow down to **Y**. Arrow to the right to select the < sign and arrow to **Select** and press [enter]. Press [zoom] and select **ZoomStandard**.



- Find the intersection points by pressing [2nd] [trace] and selecting **intersect**. Now just move the cursor to the intersection point and press [enter] three times. The solution is where the shading overlaps the graph of the absolute value function.



In this case, the solution is **–5 < *x* < 5**.

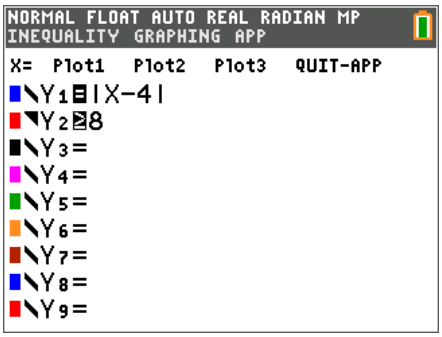
When an absolute value is less than a number, it is a conjunction because the solution is just one part of the graph.

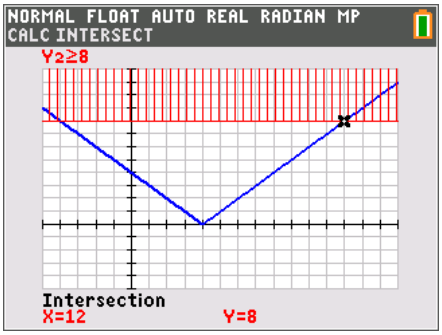
$|ax + b| < c \quad \rightarrow \quad -c < ax + b < c$.

Example 2: $|x-4| \geq 8$

- Using **Y1=** graph the left side as $y = |x-4|$.
- Using **Y2=** graph the right side as $y \geq 8$. On the equals sign, press alpha [f5] for the ≥ sign. Press window to choose appropriate window settings.
- Find the intersection points.

In this case, the solution is ***x* ≤ –4 or *x* ≥ 12**.





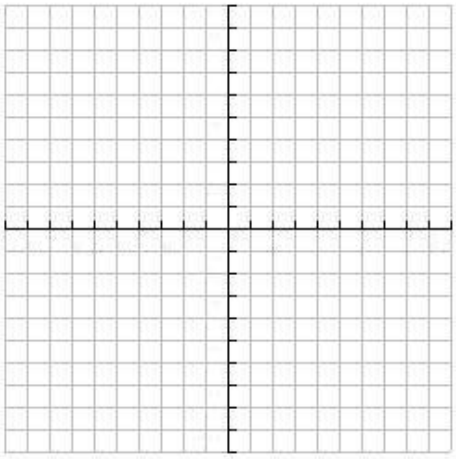
When an absolute value is greater than a number, it is a **disjunction** because the solution is two separate parts of the graph.

$$|ax+b| > c \quad \rightarrow \quad ax + b < -c \text{ or } ax + b > c.$$

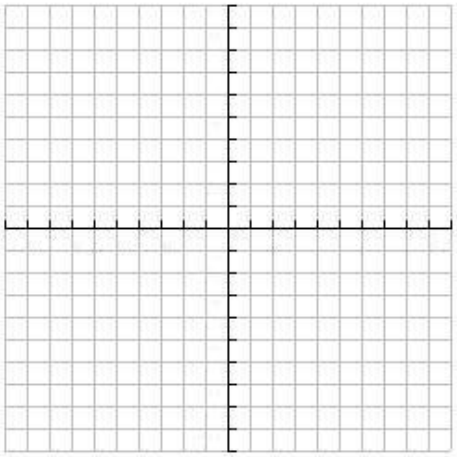
Application of Disjunction and Conjunction

For the problems below, write the inequalities as either a conjunction or disjunction, then solve for *x*. Check your solution by graphing using the method described in Examples 1 and 2. Please use your graphing calculator to check your results.

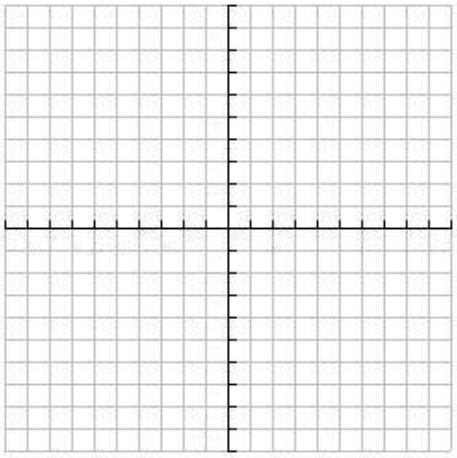
1. $|2x-3| > 9$



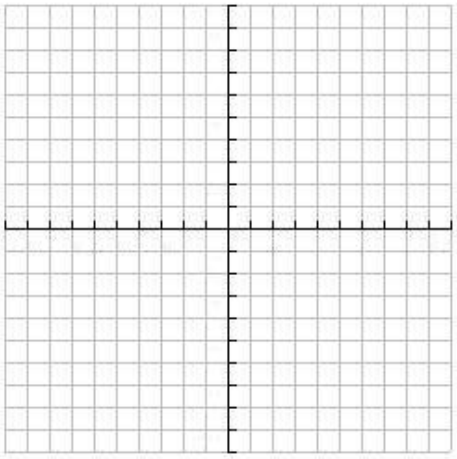
2. $\left|\frac{1}{3}x - 10\right| \leq 11$



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



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



Real-World Application

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?