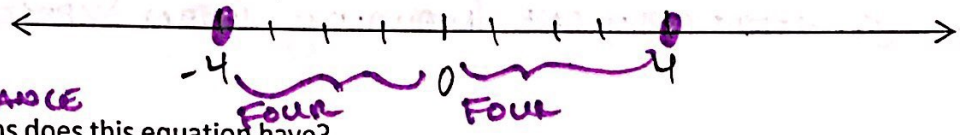
Lesson 4: Absolute Value Inequalities

Remember...

What does the equation $|x| = 4$ *mean*?

THE NUMBERS THAT HAVE A DISTANCE FROM ZERO OF FOUR.

On a number line, graph the solutions to $|x| = 4$.



How many solutions does this equation have?
Why?

2 - there are two numbers that are 4 units from zero.

Compare that equation to the inequality...

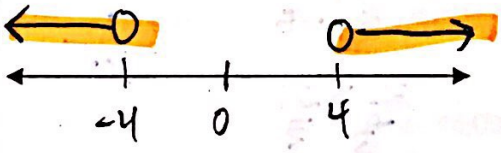
What does the inequality $|x| > 4$ *mean*?

THE SET OF NUMBERS THAT ARE MORE THAN 4 UNITS FROM ZERO.

What numbers are *more than* four units from zero?

A WHOLE LOT!

On a number line, graph the solutions to $|x| > 4$.
(plot the numbers that are more than 4 units from 0)



What kind of inequality does this look like?

AN OR COMPOUND INEQUALITY

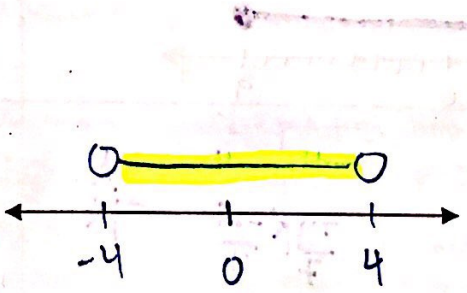
What does the inequality $|x| < 4$ *mean*?

THE SET OF NUMBERS THAT ARE LESS THAN 4 UNITS FROM ZERO.

What are some numbers are *less than* four units from zero?

A WHOLE LOT

On a number line, graph the solutions to $|x| < 4$.
(plot the numbers that are less than 4 units from 0)



What kind of inequality does this look like?

AN AND COMPOUND INEQUALITY

Why are there two different looking solution sets?

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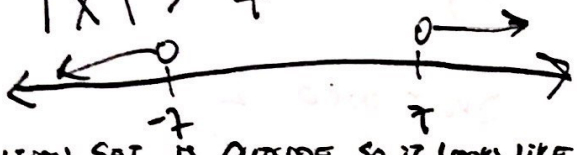
The RULE for absolute-value linear inequalities

If an absolute value inequality begins as "great**OR**"...

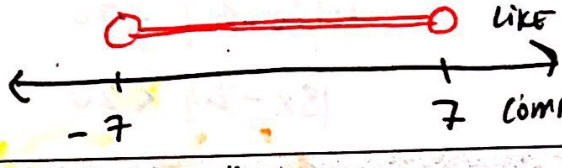
$|x| > 7$



THE SOLUTION SET IS OUTSIDE, SO IT LOOKS LIKE AN "OR"

If an absolute value inequality begins as "less th**AN**"...

$|x| < 7$



THE SOLUTION SET LOOKS LIKE AN "AND"

COMPOUND INEQ

How to solve a greatOR than absolute value inequality

Ex1: $\frac{2}{2}|3x+6| \geq \frac{24}{2}$

GET ABS. VALUE ALONE

$|3x+6| \geq 12$

$3x+6 \geq 12$

$-6 \quad -6$

$\frac{3x}{3} \geq \frac{6}{3}$

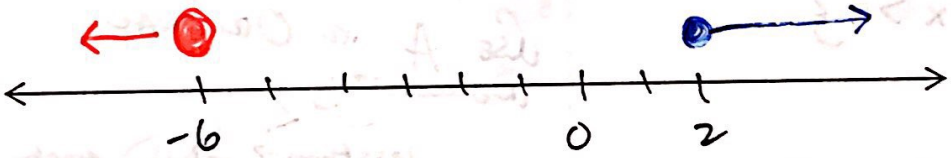
$x \geq 2$

$3x+6 \leq -12$

$-6 \quad -6$

$\frac{3x}{3} \leq \frac{-18}{3}$

$x \leq -6$



1. NOTICE: • ABSOLUTE VALUE
   • INEQUALITY SIGN: >
2. ONCE ABS. VALUE IS ALONE, SPLIT INTO 2 INEQUALITIES.
   - FLIP NEGATIVE VERSION'S INEQUALITY SIGN
3. SOLVE EACH.
4. PLOT SOLUTION SET ON THE NUMBER LINE.
5. GRAPH SHOULD MATCH GREATOR RULE.

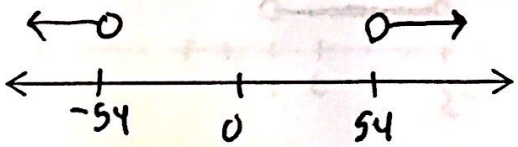
Examples to solve; express the solution in set notation and graph it on the number line.

a. $\left|\frac{d}{9}\right| > 6$

$\{d \mid d<-54 \text{ or } d>54\}$

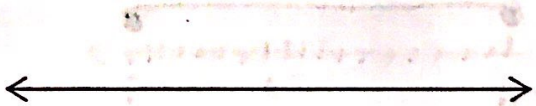
$(9)\frac{d}{9} > 6(9) \qquad (9)\frac{d}{9} < -6(9)$

$d > 54 \qquad d < -54$



b. $|10-m| \geq -2$

DISTANCE CAN'T BE NEGATIVE!



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How to solve a less thAND absolute value inequality

Ex 2: $4|2x-5|+1 < 21$

$-1 \quad -1$

$4|2x-5| < 20$

Less Than AND

$|8x-20| < 20$

$8x-20 < 20$ $\quad +20 \quad +20$

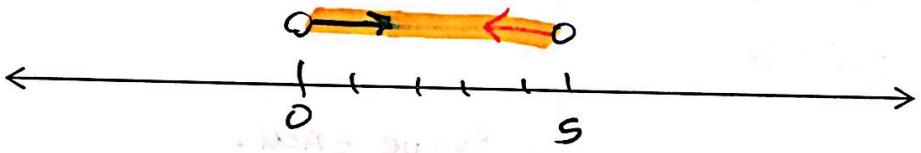
$\frac{8x}{8} < \frac{40}{8}$

$x < 5$

$8x-20 > -20$ $\quad +20 \quad +20$

$\frac{8x}{8} > \frac{0}{8}$

$x > 0$



$\{x \mid x < 5 \text{ and } x > 0\}$

1. Get Absolute Value By Itself.
2. Split into 2 inequalities - the negative boundary value should have a flipped inequality sign.
3. Solve each.
4. Plot Solution Set on Number Line & State in Set Notation.
5. Check with Original Inequality

less than → AND graph

Examples to solve; express the solution in set notation and graph it on the number line.

a. $|m+2|-3 \leq 6$

$+3 \quad +3$

$|m+2| \leq 9$

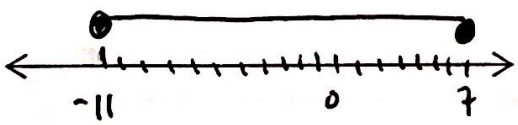
$m+2 \leq 9$ $\quad -2 \quad -2$

$m \leq 7$

$m+2 \geq -9$ $\quad -2 \quad -2$

$m \geq -11$

$\{m \mid m \geq -11 \text{ and } m \leq 7\}$



c. $3|d+1|-7 < -1$

$+7 \quad +7$

$\frac{3|d+1|}{3} < \frac{6}{3}$

$|d+1| < 2$

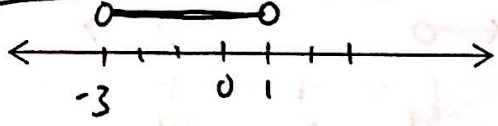
$d+1 < 2$ $\quad -1 \quad -1$

$d < 1$

$d+1 > -2$ $\quad -1 \quad -1$

$d > -3$

$\{d \mid d > -3 \text{ and } d < 1\}$



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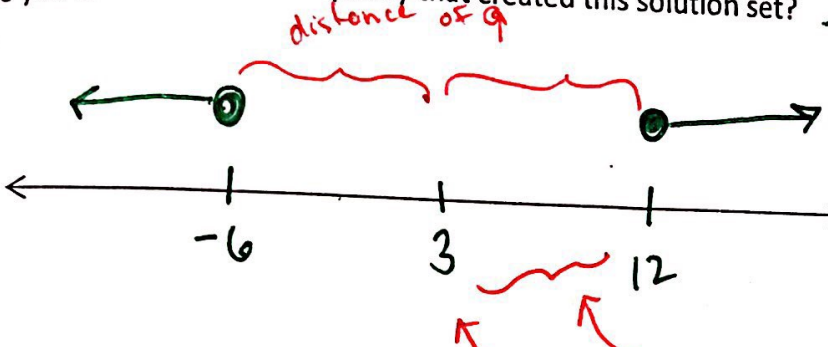
What do you know about the inequality that created this solution set?



THE NUMBERS THAT ARE MORE THAN 9 UNITS FROM 3.

$|x - 3|$

How would we write the inequality that created this solution set if the inequality was an absolute value?

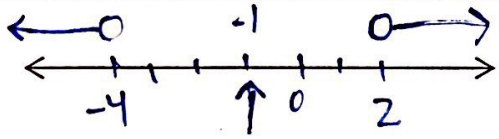
Remember: $|x -$ MIDPOINT $|$ $>$ / $<$ distance

FROM MIDPOINT TO EACH END POINT.

The symbol used should match the rule:

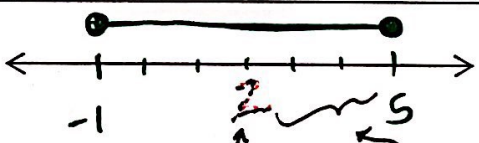
- If it looks like AND, then use $\leq$
- If it looks like an OR, then use $>$

Write an absolute value inequality that represents the graph:



$|x - -1| > 3$

$|x + 1| > 3$



$|x - 2| < 3$

Exit ticket: Why are absolute value inequalities split into two inequalities when solved?

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