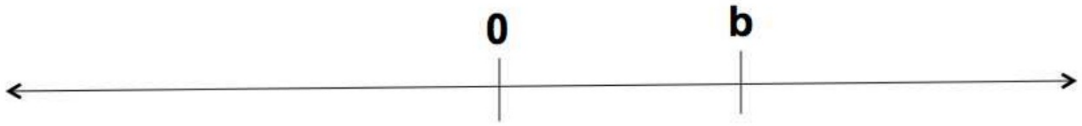
Objectives

- **Solve absolute value inequalities** and categorize solutions as 'and' or 'or' inequalities using a graphic organizer.
- Success Criteria
  - Understand why there is a case 1 and case 2 for absolute value inequalities
  - Graph solutions on a number line using test points
  - Rewrite in inequality and interval notation
- Vocabulary: absolute value, test points

Case 1

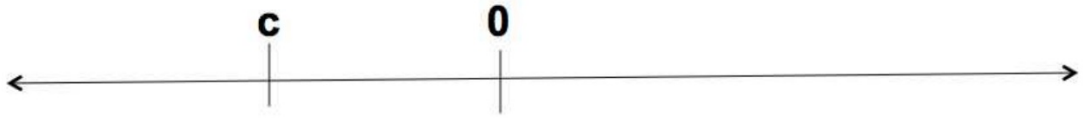
- Consider the following number, b



- b $>$ 0
- |b| = b

Case 2

- Consider the following number, c



- c $<$ 0
- $|c| = -c$

AND Absolute Value Inequalities

$$|?| < \#$$

$$|?| \leq \#$$

$$\# > |?|$$

$$\# \geq |?|$$

AM:Solve Absolute Value Linear Inequalities

- This question is asking you to solve an **AND** inequality!
- We want to find all real numbers such that if you subtract 1 and apply the absolute value the result will be less then five.

Solve: $|x-1|<5$

$A) -4 < x < 6$ $\quad$ $B) x < -4$ or $x > 6$

$C) x \le -4$ or $x \ge 6$ $\quad$ $D) -4 \le x \le 6$

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How to Solve Absolute Value Problems

- There are two cases for absolute values
- WHY?
  - x-1 could be positive (case 1)
  - x-1 could be negative and mapped to a positive number through the || (case 2)

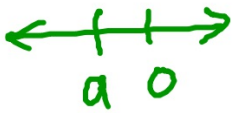
$a = x-1$

- Case 1:
  - $x-1 < 5$
    $+1 \quad +1$
    $x < 6$

$a > 0$

$|a| = a$

- Case 2: $a = x-1$



  - $-(x-1) < 5$
    $-x+1 < 5$
    $-1 \quad -1$
    $-x < 4$
    $\frac{-x}{-1} < \frac{4}{-1}$
    $x > -4$

$a < 0$

$|a| = -a$

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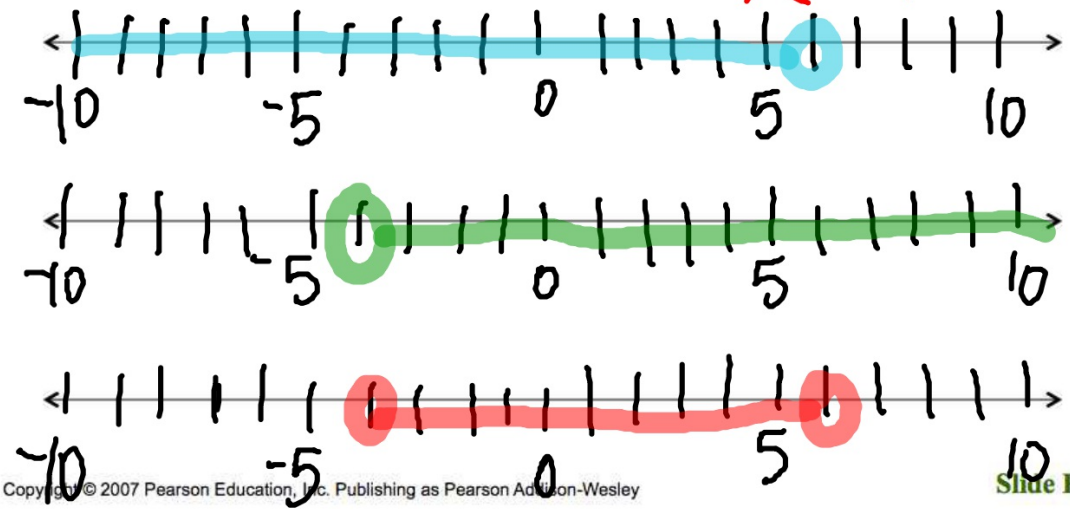
Using a graph to solve

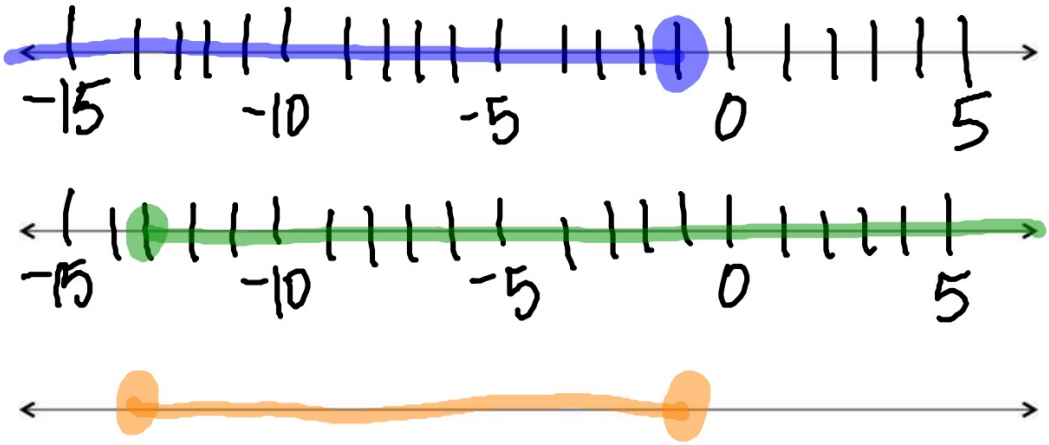
$x < 6$ AND $x > -4$

$-4 < x < 6$, $(-4, 6)$



Using a graph to solve

$x \leq -1$ AND $x \geq 13$



AM:Solve Absolute Value Linear Inequalities

- This question is asking you to solve an **AND** inequality!
- We want to find all real numbers such that if you add seven and apply the absolute value the result will be less than or equal to six.

Solve: $|x+7| \leq 6$

$A) -13 < x < -1$ $\quad$ $B) x \leq -13 \text{ or } x \geq -1$

$C) -13 \leq x \leq -1$ $\quad$ $D) x < -13 \text{ or } x > -1$

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OR Absolute Value Inequalities

$$|?| > \#$$

$$|?| \geq \#$$

$$\# < |?|$$

$$\# \leq |?|$$

Solve Absolute Value Linear Inequalities

- This question is asking you to solve an **OR** inequality!

- We want to find all real numbers such that if you multiply the number by two add three and apply the absolute value to the quantity the result will be greater then thirteen. This requires you to stretch you imagination.

Solve: $|2x + 3| > 13$

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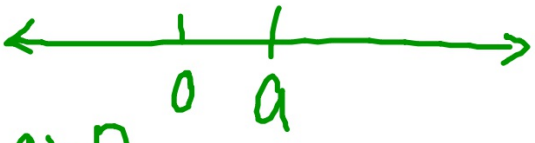
$$|2x+3|>13$$

Case 1 $a = 2x+3$



$a > 0$

$|a| = a$

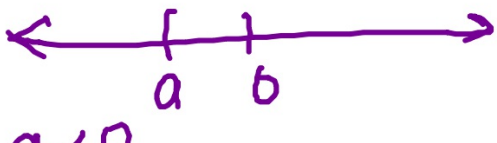
$2x+3 > 13$

$-3 \quad -3$

$\frac{2x}{2} > \frac{10}{2}$

$x > 5$

Case 2: $a = 2x+3$



$a < 0$

$|a| = -a$

$-(2x+3) > 13$

$-2x-3 > 13$

$+3 \quad +3$

$\frac{-2x}{-2} > \frac{16}{-2}$

$x < -8$

$|2x+3|>13$ $|2(0)+3|>13$ $|2(7)+3|>13$

$|2(-10)+3|>13$ $|3|>13$ $|17|>13$

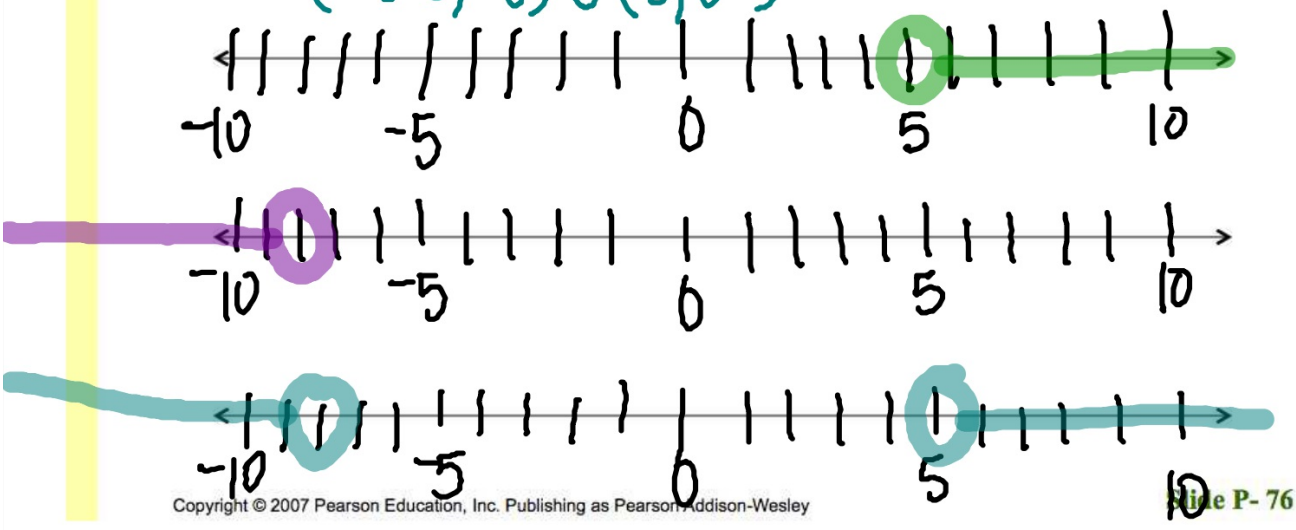
$|-17|>13$ $17>13$

Using a graph to solve

$|7>13$

$x>5$ OR $x<-8$

$(-\infty,-8)\cup(5,\infty)$



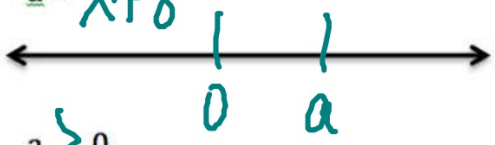
AM: Solve absolute value inequalities

3. $|x+8| \le 8$

[A] $x \le -16$ or $x \ge 0$ [B] $-16 \le x \le 0$ [C] $x = -8$ [D] no solution

Case 1 (non-negative)

a = $x+8$



$a \ge 0$

$|a| = a$

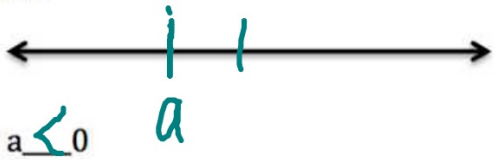
$x+8 \le 8$

$-8 \quad -8$

$x \le 0$

Case 2 (negative)

a =



$a \le 0$

$|a| = -a$

$-(x+8) \le 8$

$-x-8 \le 8$

$+8 \quad +8$

$\frac{-x}{-1} \le \frac{16}{-1}$

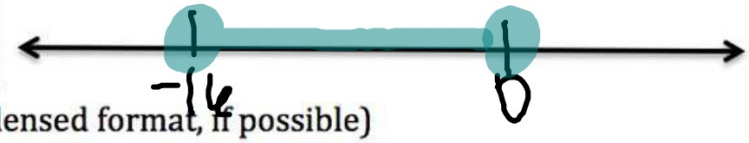
$x \ge -16$

Graph

Case 1 $x \le 0$

Case 2 $x \ge -16$

Solution $-16 \le x \le 0$



Final Solution (rewrite in condensed format, if possible)

$[-16, 0]$

AM: Graph absolute value inequalities (number line)

Graph:

Case 1: $x \geq 3$

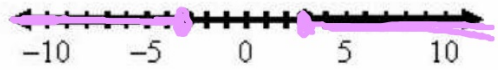
Case 2: $-x \geq 3$

$-1 \quad -1$

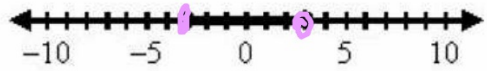
$x \leq -3$

1. $|x| \geq 3$

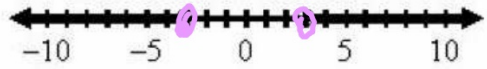
[A]



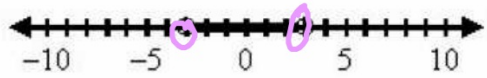
[B]



[C]



[D]



$|3x+4| \leq -1$

not possible

$|x+3| \leq 0$

$\boxed{x=-3}$