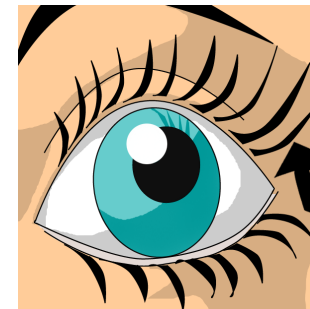
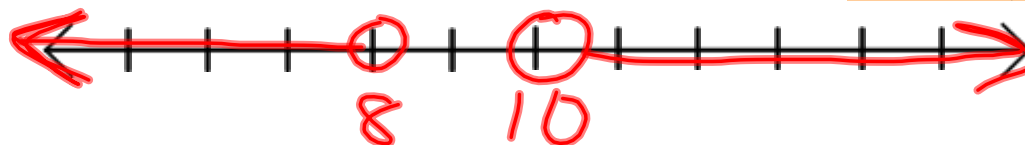


Eye Opener

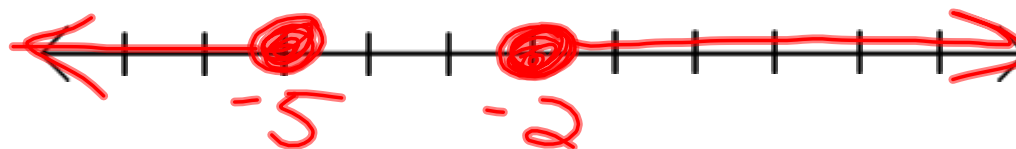


Graph each pair of inequalities on one number line

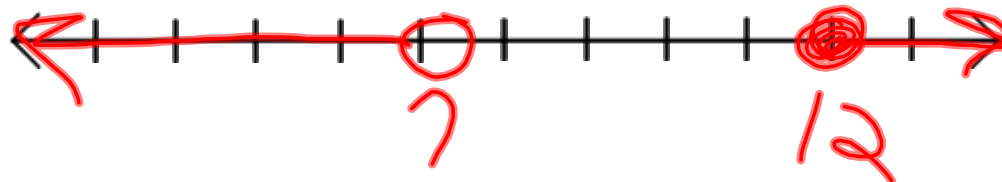
$$c < 8; c > 10$$



$$t \geq -2; t \leq -5$$



$$m < 7; m \geq 12$$



3-6: Compound Inequalities

Essential Understanding:

A compound inequality is two inequalities joined by the word "AND" or "OR".

You find the solutions of a compound inequality either by identifying where the solution sets intersect or by uniting the solution sets to form a larger solution set.

The graph of a compound inequality with the word "AND" contains an "INTERSECTION" of the graphs of the two inequalities.

The graph of a compound inequality with the word "OR" contains the "UNION" of the graphs of the two inequalities.



Examples of Compound Inequalities:

$$x > -5 \text{ AND } x < 7 \quad \text{also written} \quad -5 < x < 7$$

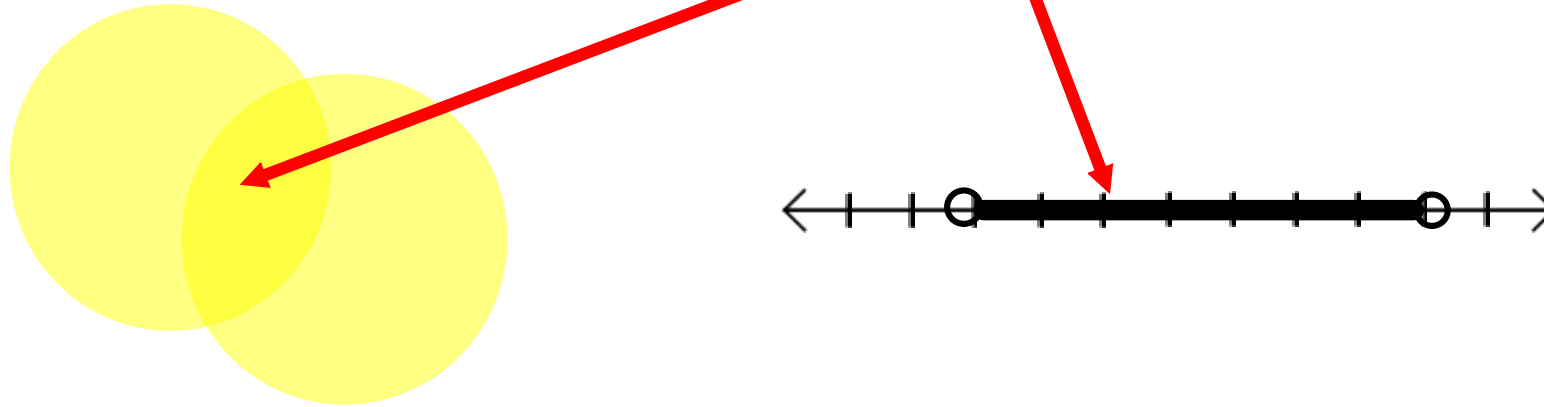
$$x < -3 \text{ OR } x > 9$$

Difference between AND and OR

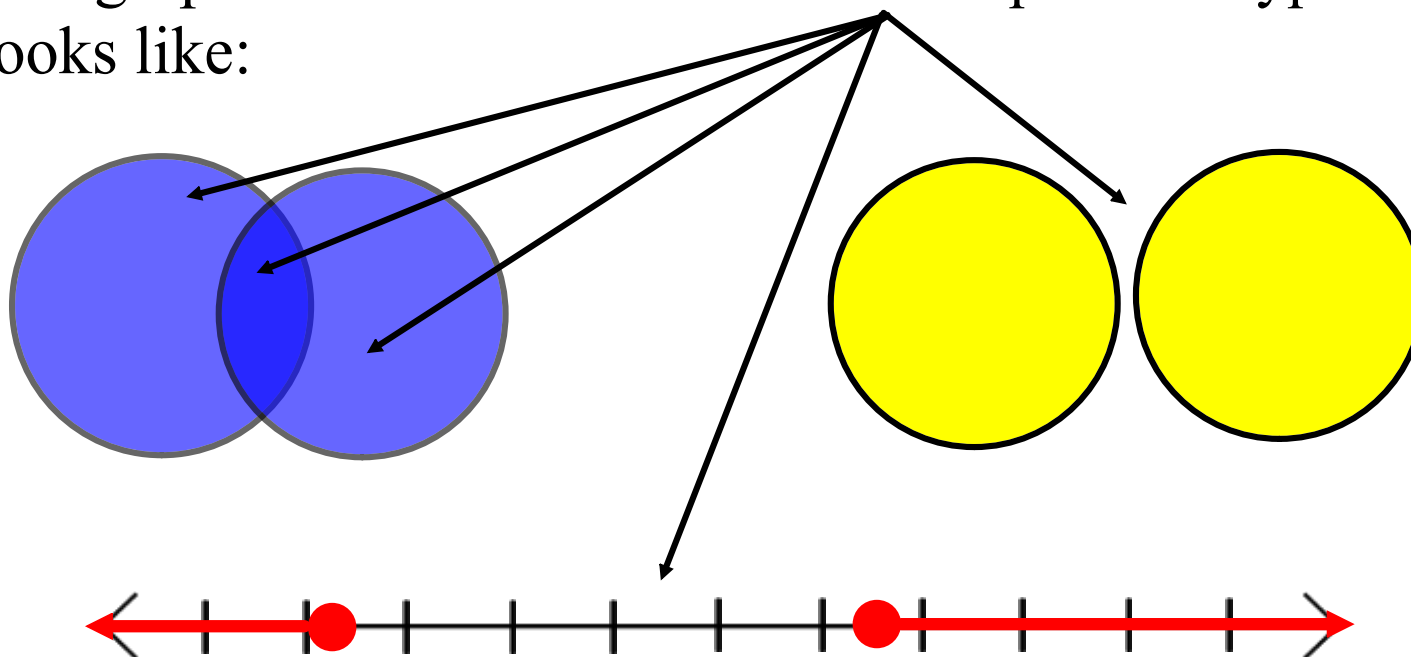
"AND" means the **intersection** of the two sets of solutions for the inequalities; **only** what they share in common; it is **more restrictive**

"OR" means the **union** of the two sets of solutions for the inequalities; **everything** they have combined; it is **less restrictive**

The graph of the solution to an "**AND**" problem typically looks like:



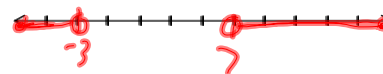
The graph of the solution to an "**OR**" problem typically looks like:



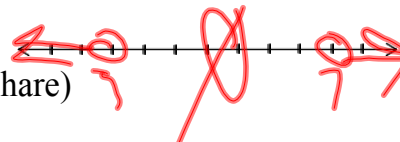
Graphing Compound Inequalities

Tip: Graph each individual inequality then determine what to keep, & shade it a different color.

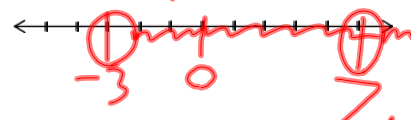
a) $x < -3$ **OR** $x > 7$
(keep everything)



b) $x < -3$ **AND** $x > 7$
(keep only what they share)



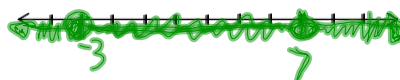
c) $x > -3$ **OR** $x > 7$
(keep everything)



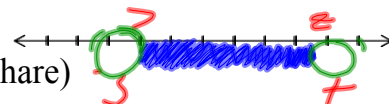
d) $x > -3$ **AND** $x > 7$
(keep only what they share)



e) $x > -3$ **OR** $x < 7$
(keep everything)



f) $x > -3$ **AND** $x < 7$
(keep only what they share)



Solving Compound Inequalities with "AND"

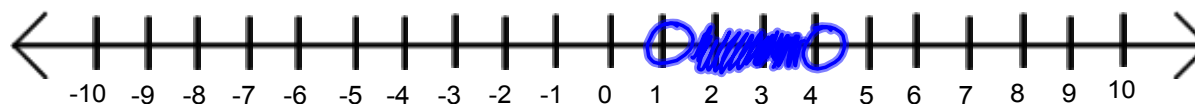
$$-4 < x - 5 < -1 \text{ implies } -4 < x - 5 \text{ AND } x - 5 < -1$$

$$\begin{array}{r} +5 \quad +5 \quad +5 \\ \hline 1 < x < 4 \end{array}$$

$$\begin{array}{r} +5 \quad +5 \\ \hline 1 < x \end{array}$$

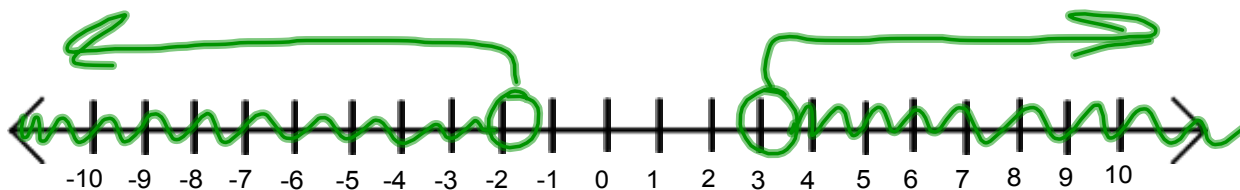
$$\begin{array}{r} +5 \quad +5 \\ \hline x < 4 \end{array}$$

$$x > 1 \quad x < 4$$



Solving Compound Inequalities with "OR"

$$\begin{array}{l} 4x + 3 < -5 \\ \underline{4} \quad \underline{-3} \quad \underline{+3} \\ \quad \quad \underline{-8} \\ \quad \quad \underline{\underline{4}} \\ x < -2 \end{array} \quad \text{OR} \quad \begin{array}{l} -2x + 7 < 1 \\ \underline{-2} \quad \underline{-7} \quad \underline{-7} \\ \quad \quad \underline{-6} \\ \quad \quad \underline{\underline{-2}} \\ x > 3 \end{array}$$



Writing and Solving a Compound Inequality

The acidity of the water in a swimming pool is considered normal if the average of three pH readings is between 7.2 and 7.8. The first two readings taken that day are 7.4 and 7.9. What possible values for the third reading will make the average pH normal?

- What is "x"? *x = 3rd reading*
- What is the formula I need to know? *Avg = $\frac{\text{sum of values}}{\text{\# items in sum}}$*
- Write a compound inequality
- Solve the compound inequality
- Graph the solution
- Check the solution

$$7.2 \leq \text{Avg} \leq 7.8$$

$$7.2 \leq \frac{7.4 + 7.9 + x}{3} \leq 7.8$$

$$\begin{array}{r} \times 3 \\ \hline 21.6 \leq 7.4 + 7.9 + x \leq 23.4 \\ -7.4 \quad -7.4 - 7.9 \quad -7.4 \\ -7.9 \quad \quad -7.9 \quad \quad -7.9 \\ \hline 6.3 \leq x \leq 8.1 \end{array}$$

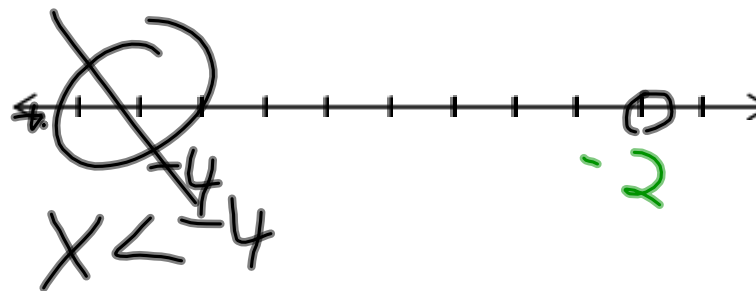


You try:

a) $-6 < 3x < 15$
 $\frac{-6}{3} < \frac{3x}{3} < \frac{15}{3}$
 $-2 < x < 5$



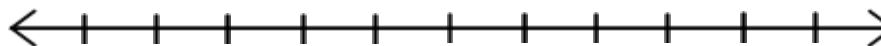
b) $7 > -3x + 1$ **and** $-3x + 1 > 13$
 $\frac{7}{-3} > \frac{-3x + 1}{-3}$ $\frac{-6}{-3} > \frac{-3x + 1}{-3}$
 $\frac{6}{-3} > -x + \frac{1}{-3}$ $\frac{6}{-3} > -x + \frac{1}{-3}$
 $-2 < x - \frac{1}{3}$ $-2 < x - \frac{1}{3}$
 $x < -4$



c) $-2x + 7 > 3$ **or** $3x - 4 > 5$
 $x < 2$ $x > 3$
 $\frac{-2x + 7}{-2} > \frac{3}{-2}$ $\frac{3x - 4}{3} > \frac{5}{3}$
 $\frac{-2x}{-2} + \frac{7}{-2} > \frac{3}{-2}$ $\frac{3x}{3} - \frac{4}{3} > \frac{5}{3}$
 $x - \frac{7}{2} > -\frac{3}{2}$ $x - \frac{4}{3} > \frac{5}{3}$
 $x > -\frac{3}{2} + \frac{7}{2}$ $x > \frac{5}{3} + \frac{4}{3}$
 $x > 2$ $x > 3$



d) $-3 < 2x - 1$ **or** $3x + 5 < 12$



e) Find three consecutive even integers whose sum is between 48 and 60.

38. **Sports** In a survey of students about favorite sports, the results include ~~22 who like tennis, 25 who like football, 9 who like tennis and football, 17 who like tennis and baseball, 20 who like football and baseball, 6 who like all three sports, and 4 who like none of the sports.~~ How many students like only tennis and football?

11

How many students like only tennis and baseball? How many students like only baseball and football? 14

3

