video 3-6 A

Lesson 3-6: Compound Inequalities

Name: KEY

When people plan a house, they often have many requirements in mind that can be written as inequalities. Such requirements could be the dimensions of rooms or the overall size of the house. In this activity, we will investigate what happens when we combine requirements. First, we will graph each requirement separately, then we will graph combinations of those requirements. Here are the basic requirements we will work with:

Dimension Requirements:
Requirement A: $d > 5$ ft
Requirement B: $d \le 12$ ft
Requirement C: $d < 10$ ft

Area Requirements:
Requirement D: $A \le 1500$ sq ft
Requirement E: $A > 1200$ sq ft
Requirement F: $A \ge 1800$ sq ft

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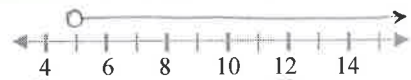
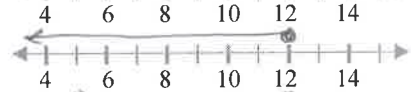
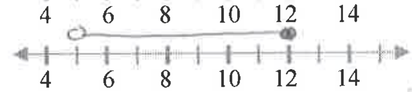
1. First, let's investigate what happens when we combine requirements A & B with **"and"**:
   a. Graph the numbers that meet requirement A: $d > 5$
   

   b. Graph the numbers that meet requirement B: $d \le 12$
   

   c. Graph only the numbers that meet both A **and** B:
   

   d. Write the solution as an inequality: $5 < d \le 12$

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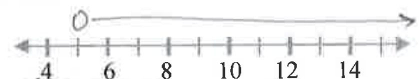
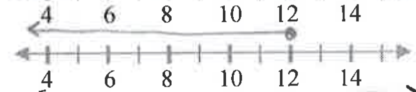
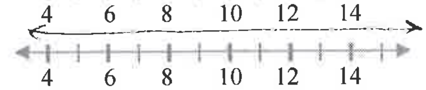
2. Now let's investigate what happens when we combine requirements A & B with **"or"**:
   a. Graph the numbers that meet requirement A: $d > 5$
   

   b. Graph the numbers that meet requirement B: $d \le 12$
   

   c. Graph all the numbers that meet either A **or** B:
   

   d. Write the solution as an inequality: $\mathbb{R}$

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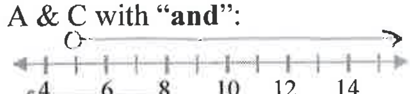
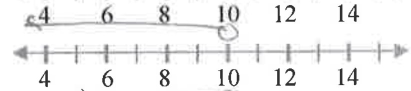
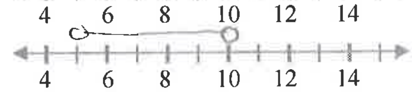
3. Now investigate what happens when we combine requirements A & C with **"and"**:
   a. Graph the numbers that meet requirement A: $d > 5$
   

   b. Graph the numbers that meet requirement C: $d < 10$
   

   c. Graph only the numbers that meet both A **and** C:
   

   d. Write the solution as an inequality: $5 < d < 10$

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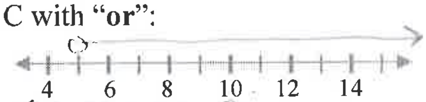
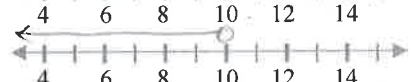
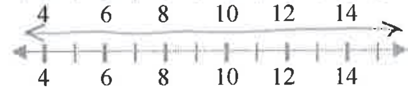
4. Investigate what happens when we combine requirements A & C with **"or"**:
   a. Graph the numbers that meet requirement A: $d > 5$
   

   b. Graph the numbers that meet requirement C: $d < 10$
   

   c. Graph all the numbers that meet either A **or** C:
   

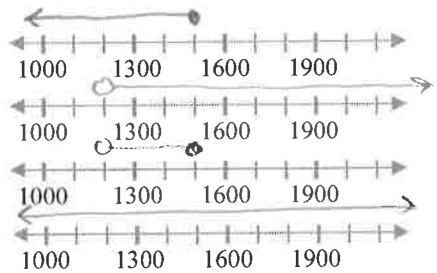
   d. Write the solution as an inequality: $\mathbb{R}$

Each graph that you have drawn on a number line represents the **solution set** or **truth set**.

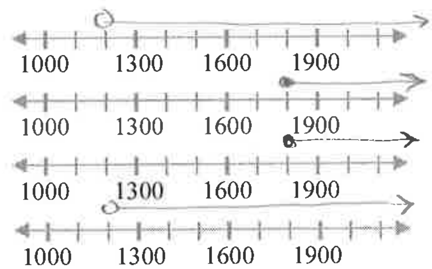
Solution Set (or Truth Set)

A *solution set* is all the numbers that make a statement true.

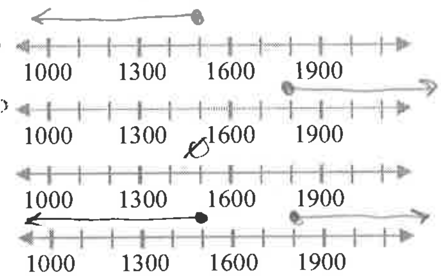
5. Next, combine requirements D & E:
   a. Graph the numbers that meet requirement D: $A \le 1500$
   b. Graph the numbers that meet requirement E: $A > 1200$
   c. Graph the numbers that meet requirements D **and** E:
   d. Graph all the numbers that meet requirement D **or** E:



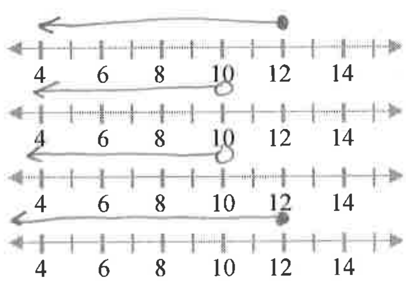
6. Now combine requirements E & F:
   a. Graph the numbers that meet requirement E: $A > 1200$
   b. Graph the numbers that meet requirement F: $A \ge 1800$
   c. Graph the numbers that meet requirements E **and** F:
   d. Graph all the numbers that meet requirement E **or** F:



7. Now combine requirements D & F:
   a. Graph the numbers that meet requirement D: $A \le 1500$
   b. Graph the numbers that meet requirement F: $A \ge 1800$
   c. Graph the numbers that meet requirements D **and** F:
   d. Graph all the numbers that meet requirement D **or** F:



8. Now combine requirements B & C:
   a. Graph the numbers that meet requirement B: $d \le 12$
   b. Graph the numbers that meet requirement C: $d < 10$
   c. Graph the numbers that meet requirements B **and** C:
   d. Graph all the numbers that meet requirement B **or** C:



9. Now write some notes to help you remember what you have learned about combining *solution sets* using the words **and** & **or**.

   When combining with "and", take the overlapping portion of the two graphs
   when combining with "or", keep everything from both graphs, don't leave anything out that was colored in.

More 3-6: Lines Dancing

Graphing Compound Inequalities

Combining two inequalities with the word "**or**" creates the **union** of the two solution sets. The symbol for the *union* of two sets is "∪". Any value that is in the solution set to <u>either</u> of the original inequalities is in the solution set of compound inequality.

Combining two inequalities with the word "**and**" creates the **intersection** of the two solution sets. The symbol for the *intersection* of two sets is "∩". Only values that are in the solution set to <u>both</u> original inequalities may be in the solution set of the compound inequality.

Use the table of inequality requirements below to find each union or intersection. Sketch each individual requirement first, and then sketch the compound inequality on the third number line.

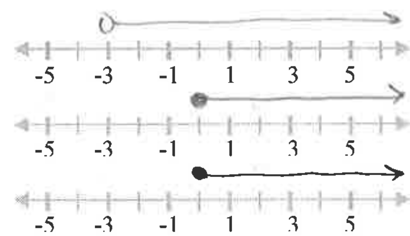
Requirement	Inequality
Requirement **A**:	$x > -3$
Requirement **B**:	$x < 2$
Requirement **C**:	$x \geq 0$
Requirement **D**:	$x \leq -1$
Requirement **E**:	$x \leq 4$
Requirement **F**:	$x > 2$
Requirement **G**:	$x < 0$

1. Requirements **A *and* C.**

$x > -3$ A:

$x \geq 0$ C:

A ∩ C:



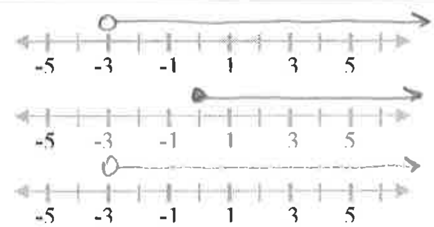
Solution: $x \geq 0$

2. Requirements **A *or* C.**

$x > -3$ A:

$x \geq 0$ C:

A ∪ C:



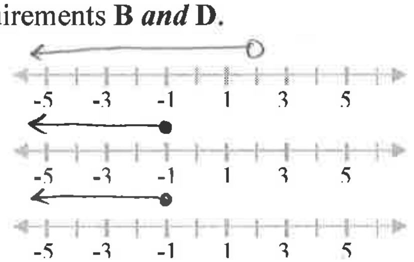
Solution: $x > -3$

3. Requirements **B *and* D.**

$x < 2$ B:

$x \leq -1$ D:

B ∩ D:



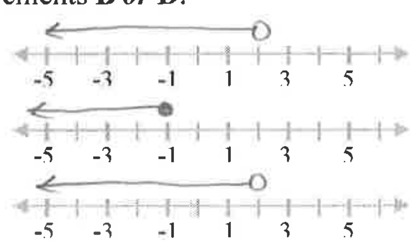
Solution: $x \leq -1$

4. Requirements **B *or* D.**

$x < 2$ B:

$x \leq -1$ D:

B ∪ D:



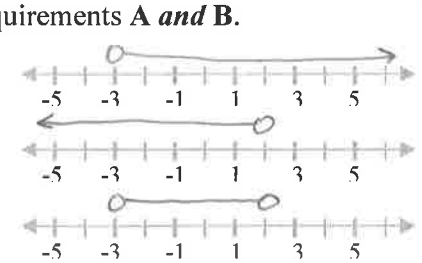
Solution: $x < 2$

5. Requirements **A *and* B.**

$x > -3$ A:

$x < 2$ B:

A ∩ B:



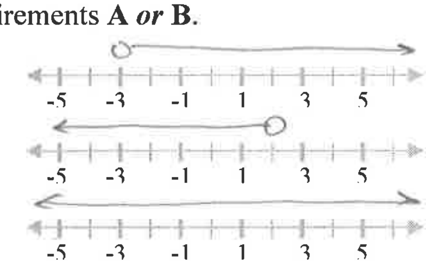
Solution: $-3 < x < 2$

6. Requirements **A *or* B.**

$x > -3$ A:

$x < 2$ B:

A ∪ B:



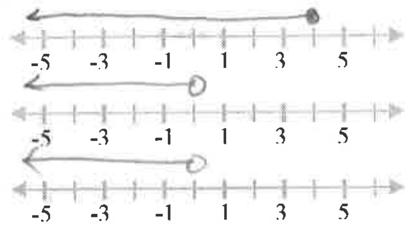
Solution: $\mathbb{R}$

Graph each set of requirements as indicated and write the solution as an inequality. Remember to label each number line!

7. Requirements **E *and* G.**

$x \le 4$

$x < 0$

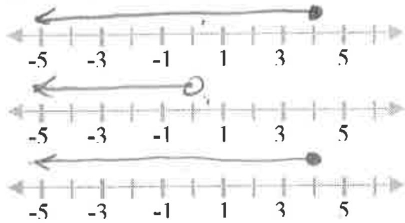


Solution: $x < 0$

8. Requirements **E *or* G.**

$x \le 4$

$x < 0$

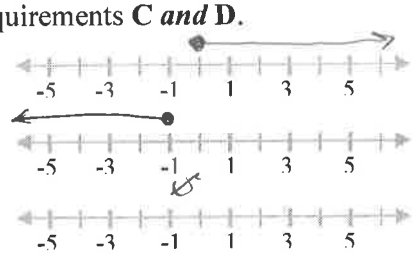


Solution: $x \le 4$

9. Requirements **C *and* D.**

$x \ge 0$

$x \le -1$

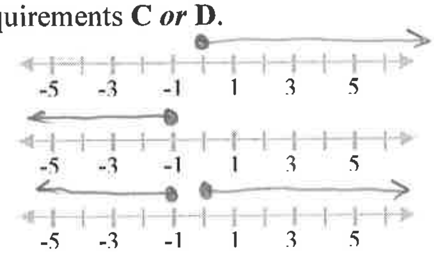


Solution: $\emptyset$ no solution

10. Requirements **C *or* D.**

$x \ge 0$

$x \le -1$

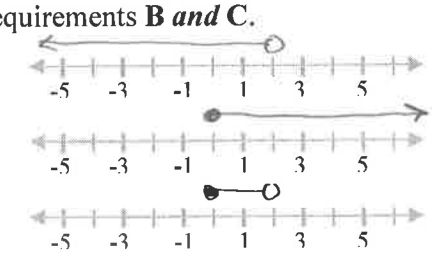


Solution: $x \le -1$ or $x \ge 0$

11. Requirements **B *and* C.**

$x < 2$

$x \ge 0$

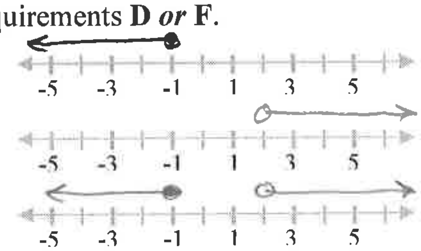


Solution: $0 \le x < 2$

12. Requirements **D *or* F.**

$x \le -1$

$x > 2$

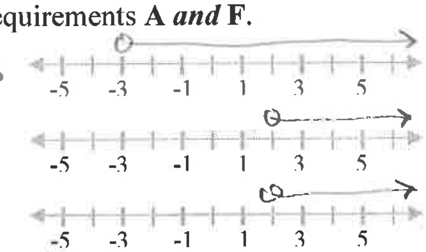


Solution: $x \le -1$ or $x > 2$

13. Requirements **A *and* F.**

$x > -3$

$x > 2$

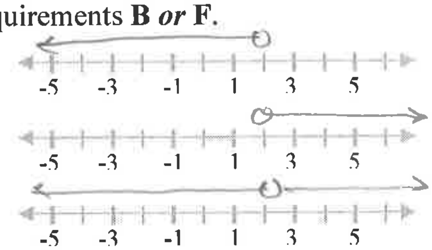


Solution: $x > 2$

14. Requirements **B *or* F.**

$x < 2$

$x > 2$



Solution: $\mathbb{R}$ except 2 $(x \ne 2)$

15. Based on these graphs, what generalizations can you make about the differences between these two types of compound inequalities (*unions* and *intersections*)?

"or" graphs tend to include more numbers.
Only "and" graphs can be one piece without any arrows.
Only "or" graphs can be two pieces, one going each direction.