Compound Inequalities!

Before we learn about them, we are going to have a quick refresher on SETs!

REVIEW

Set Notation

A *Set* is a collection of "well-defined" objects.

"well-defined means that there is a rule for determining whether or not the object is in the set.

Elements are the objects in a set.

We use curly braces { } to encolse the elements. If we have set D that includes elements 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, then we would write it like:

D={0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

When we list the elements out like this, we are representing the set using the*Roster Method*.

a.) Use the Roster Method to represent the set of all even digits.

Set Notation Cont.

Set-Builder Notation is a way to denote a set.

For Example: The numbers in set D={0, 1, 2, 3, 4, 5, 6, 7, 8, 9}are called Digits. Set-Builder Notaion would be D={x|x is a digit}.

We name sets by using capital letters.

Ex: We could name the set of even numbers E.
So, E={x|x is an even number}

When we talk about rules for sets, we usually use the sets A and B.

Most of our definitions will have sets A and B.

END

of

REVIEW

Sets

Consider the table:

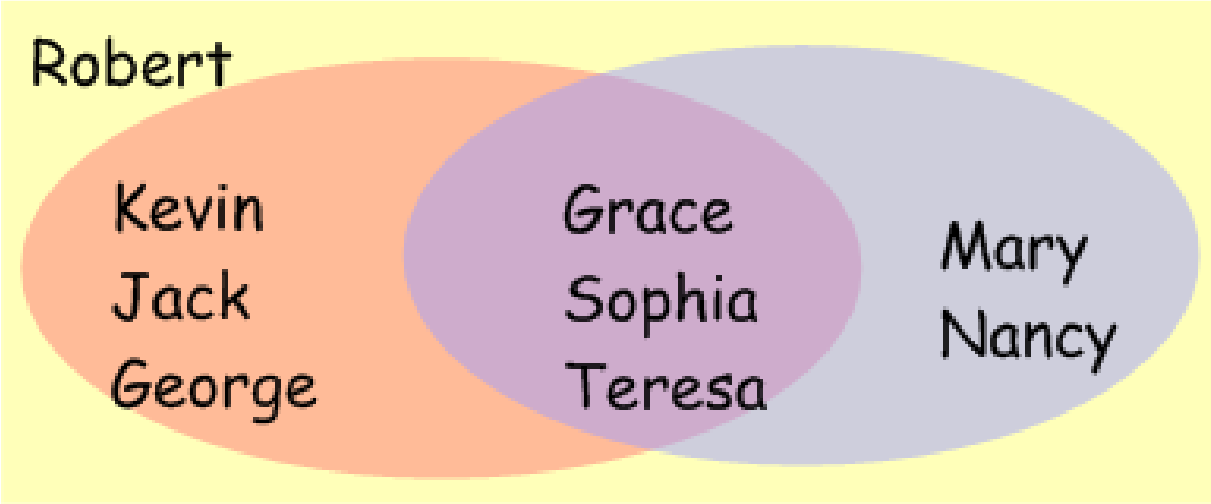
Student	Age	Gender
Grace	19	F
Sophia	23	F
Kevin	20	M
Robert	32	M
Jack	19	M
Mary	35	F
Nancy	40	F
George	22	M
Teresa	20	F

Let set A be the set of all students whose age is less than 25.

Let set B be the set of all students who are female.

A= {Grace, Sophia, Kevin, Jack, George, Teresa}

B= {Grace, Sophia, Mary, Nancy, Teresa}



Sets

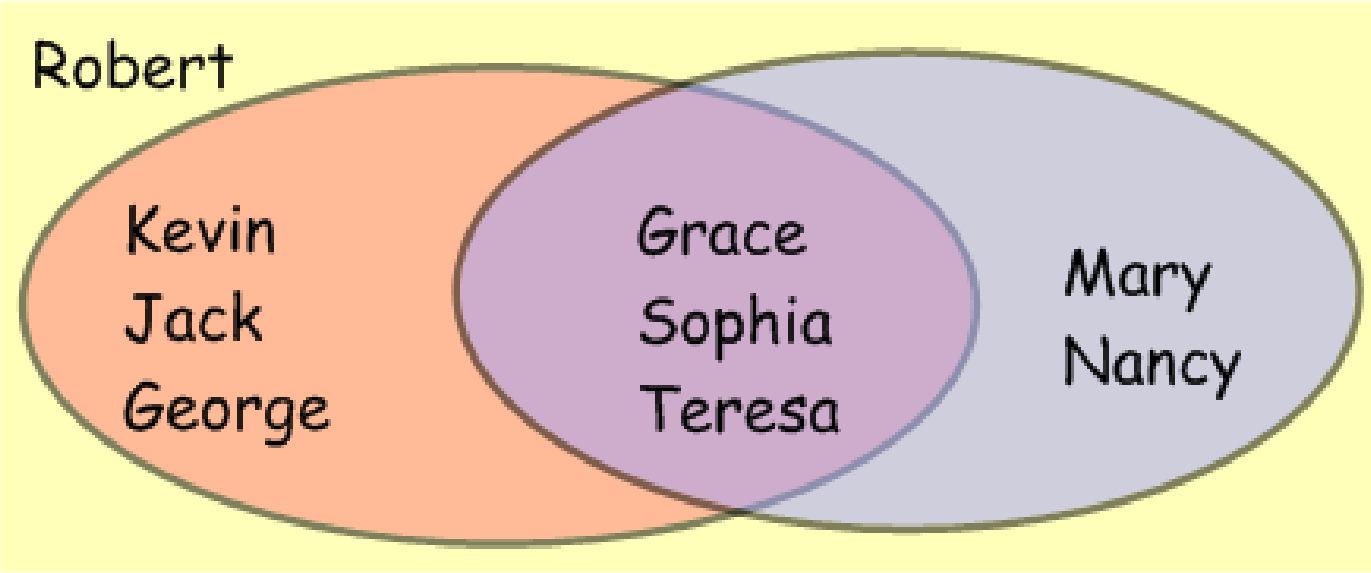
Example 1:

a.) List all the students that are in set A or set B.

This is called the **Union** of the sets.

Writen as:

$$A \cup B$$



Sets

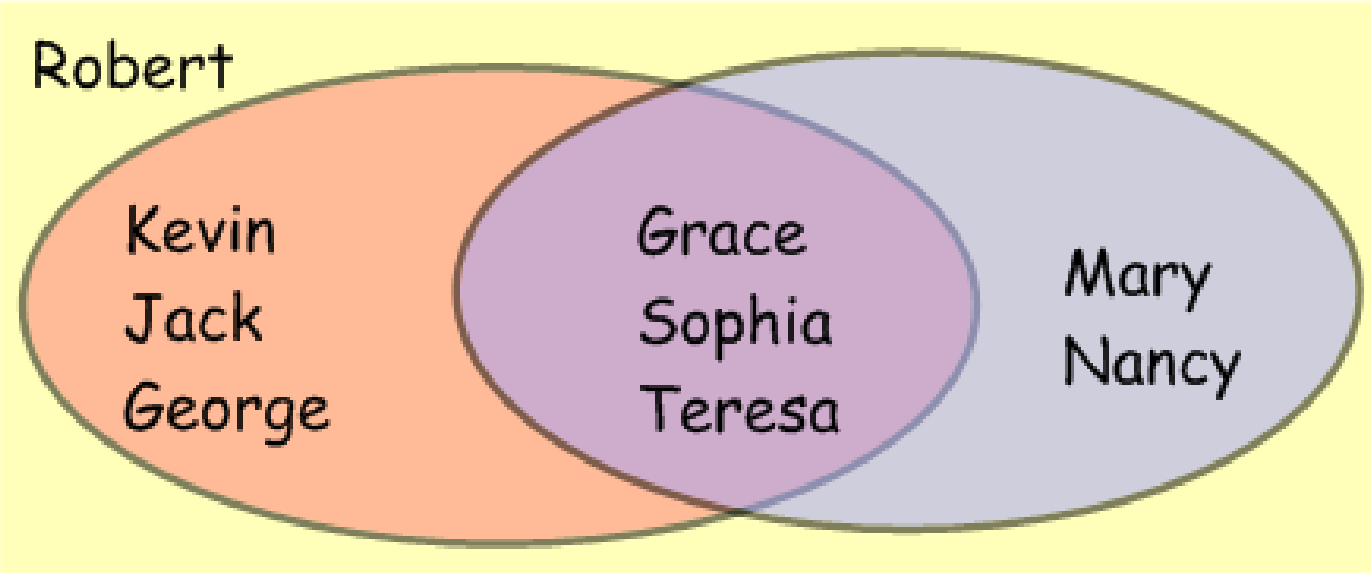
Example 1 (cont.):

b.) List all the students that are in A**and** B.

This is called the
Intersection of the sets.

Writen as:

$$A \cap B$$



Example 2:

Find the Intersection and the Union of the sets.

$A = \{1, 3, 5, 7, 9\}$ $B = \{1, 2, 3, 4, 5\}$

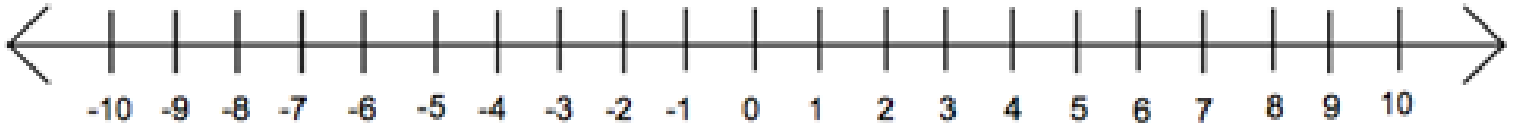
Lesson 1.5: Compound Inequalities

Example 3:

Find the Intersection and the Union of the sets.

$A = \{x | x \leq 2\}$, $B = \{x | x \geq -1\}$, $C = \{x | x < -3\}$

a.) Determine $A \cap B$. Graph the set and write in set builder notation and interval notation.

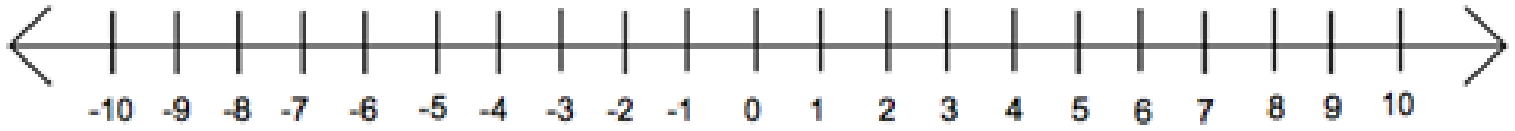


Example 3:

Find the Intersection and the Union of the sets.

$A = \{x \mid x \leq 2\}$, $B = \{x \mid x \geq -1\}$, $C = \{x \mid x < -3\}$

b.) Determine $A \cup C$ Graph the set and write in set builder notation and interval notation.



Compound Inequalities:

Compound inequalities are just two regular inequalities smashed into one using "and" or "or".

For Example:

Two regular inequalities are $3x + 1 > 4$, $2x - 3 < 7$.

If we put an "and" or an "or" in between, then we make a compound inequality.

$$3x + 1 > 4 \text{ and } 2x - 3 < 7$$

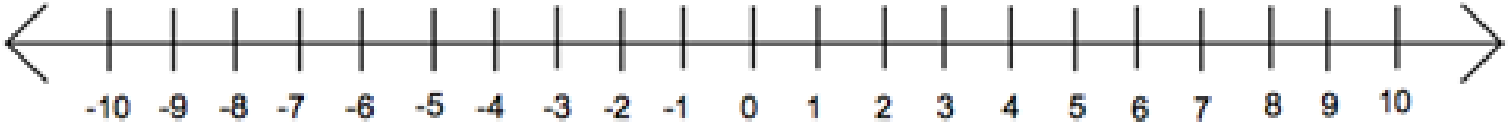
Example 4: Inequalities involving "AND"

Solve $3x + 2 > -7$ and $4x + 1 \leq 9$. Graph the solution set.

Steps to solve a compound inequalitiy involving "and":

Step 1: Solve each inequality separately.

Step 2: Find the INTERSECTION of the solution sets.



Lesson 1.5: Compound Inequalities

We can write inequalities involving "and" a little more compactly.

If we have $a < b$ and our answers are $x > a$ and $x < b$, we can write them like this:

$$a < x < b$$

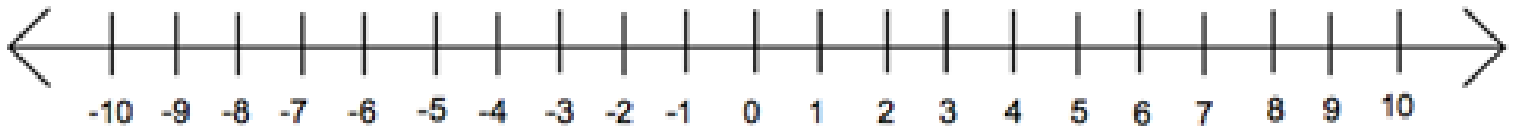
For example:

If we have $x > -2$ and $x < 5$, we can write them like this:

$$-2 < x < 5$$

Example 5:

Solve $-3 < -4x + 1 < 13$. Graph the solution set.



Example 6: Inequalities involving "OR"

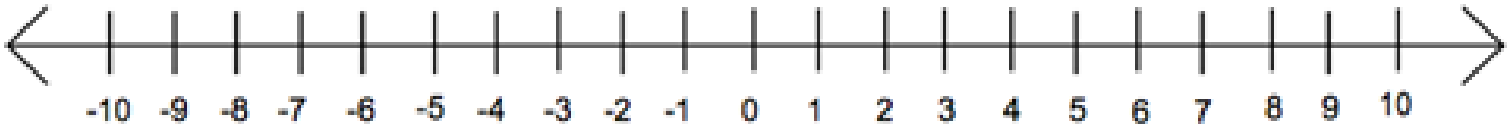
Solve $\frac{1}{2}x - 1 < 1 \; or \; \frac{2x-1}{3} \geq -1$

Graph the solution set.

Steps to solve a compound inequalitiy involving "or":

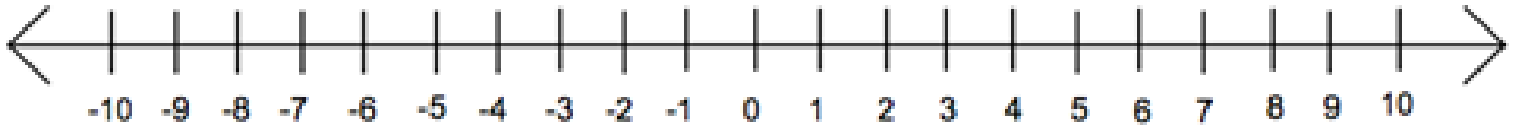
Step 1: Solve each inequality separately.

Step 2: Find the UNION of the solution sets.



Example 7: Solve and graph.

$$5(x + 2) > 20 \text{ or } 4(x - 4) < -20$$



Lesson 1.5: Compound Inequalities

Ex 8: In 2005, a married couple filing a joint federal tax return whose income places them in the 25% tax bracket will pay federal income taxes between $8180 and $23,317.50, inclusive. The couple must pay federal income taxes equal to $8180 plus 25% of the amount over $59,400. Find the range of taxable income the couple makes in order for them to be in the 25% tax bracket.

Step 1: Identify

We need to find the range of taxable income for a married couple in the 25% tax bracket. This is a direct translation problem involving an inequality.

Step 2: Name

Let's have ***t*** represent the taxable income.

Step 3: Translate

Find the range of taxable income.

The federal tax bill equals \$8180 plus 25% of the taxable income over \$59,4000.
Because the tax bill is between \$8180 and \$23,317.50, we have:

$$8180 \leq 8180 + 0.25(t - 59{,}400) \leq 23{,}317.50$$

Step 4 : Solve

Step 5: Check Find the range of taxable income.

Step 6: Answer the Question

Homework:

Pg 109-112: #'s 2, 4, 5, 7, 9, 11-19 all,
21-43 odds, 79, 80, 81, 85

(30 problems)

On #'s 17 - 43, please give the intersection/union in set builder notation, interval notation, and graph.

Homework: Alternative

Pg 109-112: #'s 2, 4, 5, 7, 9, 11-17 all, 19, 21-25 odds, 33, 37-43 odds, 79, 80, 83

(24 problems)

On #'s 17 - 43, please give the intersection/union in set builder notation, interval notation, and graph.