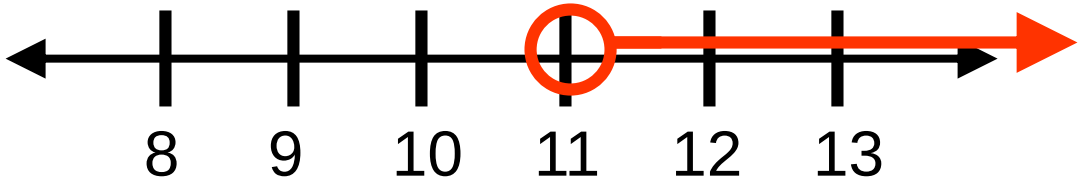
Math-2
Lesson 1-4
Solve Linear Inequalities.

What does the following inequality mean?

$x > 11$ "all the numbers that are greater than 11"

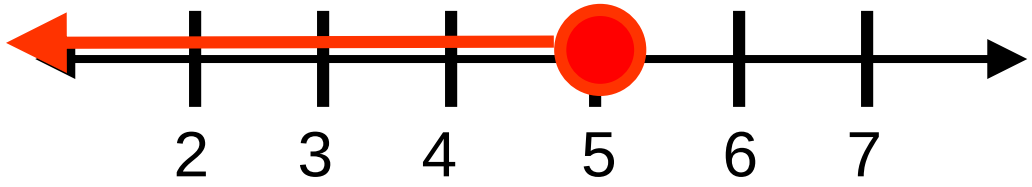
Number line equivalent: (shade all #'s that are solutions)



Interval notation equivalent: $x = (11, \infty)$

$x \leq 5$ "all the number that are less than or equal to 5"

Number line equivalent:



Interval notation equivalent: $x = (-\infty, 5]$

$5 > 3$ True or false?

+2 +2 Add 2 left and right (of the “>” symbol) and rewrite

$7 > 5$ True or false?

This will always work for addition.

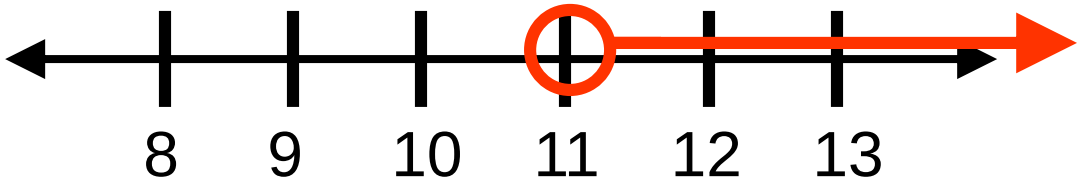
<u>Addition Property of Inequality</u>: adding the same number left and right of the “<, >, ≤, or ≥” symbol will result in an equivalent inequality.

$x - 4 > 7$

+4 +4

$x > 11$

Number line:



$2 < 6$ True or false?

$-1 \quad -1$ Subtract “1” left and right (of the “<” symbol) and rewrite

$1 < 5$ True or false? This will always work for subtraction.

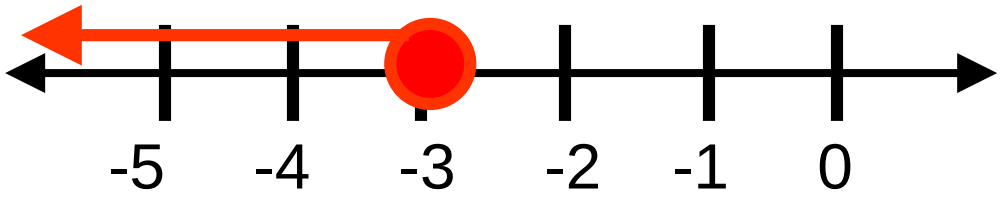
<u>Subtraction Property of Inequality</u>: subtracting the same number left and right of the “<, >, ≤, or ≥” symbol will result in an equivalent inequality.

$x + 5 \leq 2$

$-5 \quad -5$

$x \leq -3$

Number line:



Your turn: Start with the following:

$3 < 5$ True or false?

*2 *2 Multiply by “2” left and right (of the “<” symbol), rewrite

$6 < 10$ True or false?

This works for multiplication of positive numbers, BUT…..

$6 < 8$ True or false?

-1 -1 Multiply by "-1" left and right (of the "<" symbol), rewrite

$-6 < -8$ True or false? $-6 > -8$

This will work for multiplication of negative numbers if we reverse the direction of the inequality.

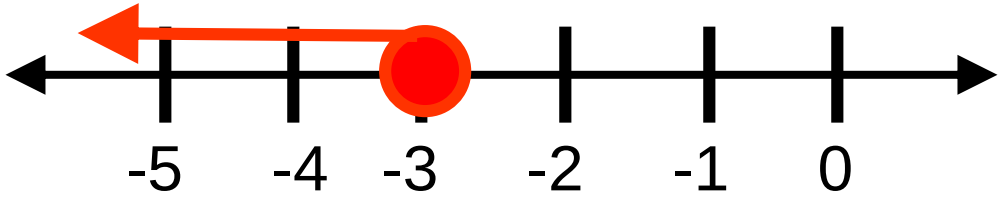
Multiplication Property of Inequality: multiplying the same positive number left and right of the "<, >, ≤, or ≥" symbol will result in an equivalent inequality. We reverse the direction of <, >, ≥, and ≤ if the factor is negative.

$-2x \geq 6$

$*(\div -2)$ $*(-\frac{1}{2})$

$x \leq -3$

Number line:



Your turn: Solve the inequalities (one step-rewrite)

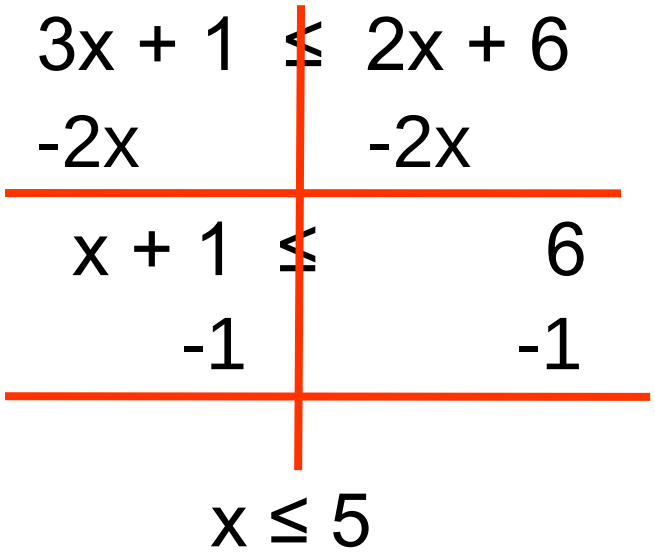
$2x + 2 \leq 6$

$2(x - 3) \geq 8$

$-14 < -5x + 6$

Draw the equivalent number line for each solution.

Solving inequalities (variable on both sides of a single inequality symbol)



(Subtraction Property Of Inequality

(Subtraction Property Of Inequality

Your turn: Solve the inequality

$2x - 6 \leq 3 - x$

$18 + 2x \geq 9x + 4$

$5(x - 2) < 5x + 6$

Draw the equivalent number line for each solution.

If you are wearing a red shirt OR if you are wearing blue pants, you will be awarded $100. Which of the individuals below will get $100?.

Person 1: Wearing green shirt, black pants — No

Person 2: Wearing red shirt, black pants — yes

Person 3: Wearing red shirt, blue pants — yes

Person 4: Wearing blue shirt, blue pants — yes

Logical Word "OR:" two or more required conditions are given. If either of the conditions is met then the statement is true.

If you are under the age of 15 AND are walking/running with a dog, then you are pretty cool.

Which picture shows a person(s) who is(are) “pretty cool?”

Not cool (walking dogs but over 15)

Not cool (under 15, but not “walking”)

Cool (under 15 and also walking/running)

Logical Word “AND:” two or more required conditions are given. If BOTH of the conditions are met then the statement is true.

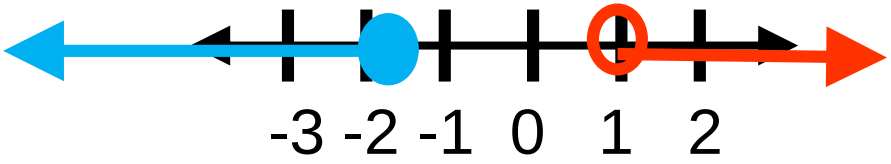
Compound Inequality: the result of combining two simple inequalities with the logical words “and” or “OR”.

“OR” type

$x \leq -2$ or $x > 1$

Is -3 a solution ?

Or means: the numbers that satisfy either condition will make the compound inequality “true”.



$x = (-\infty, -2] \; U \; (1, \infty)$

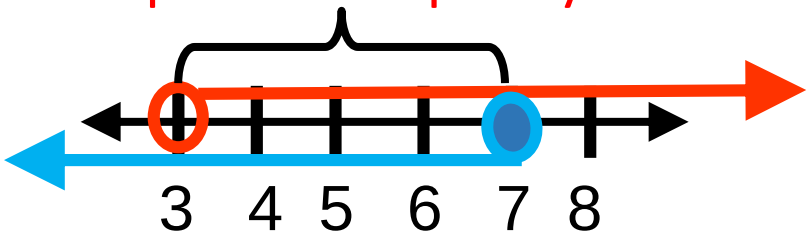
“union” symbol (“or”)

“AND” type

$x > 3$ and $x \leq 7$

Is -3 a solution ?

AND means: the numbers must that satisfy both conditions will make the compound inequality “true”.



$x = (3, 7]$

Solve and graph the compound inequality:

Solve each simple inequality separately.

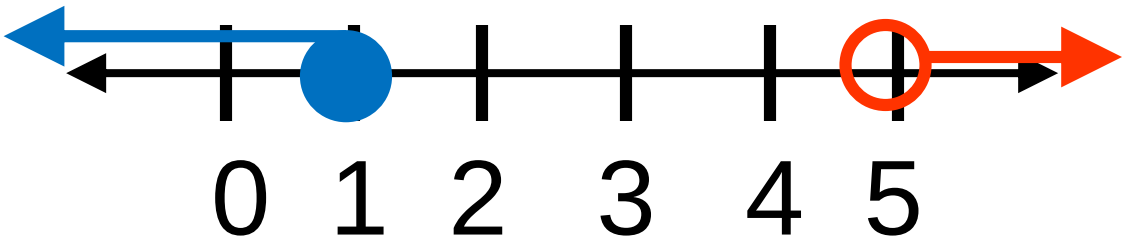
$2x + 3 \leq 5$ or $x - 3 > 2$

$-3 \quad -3 \qquad\qquad +3 \quad +3$

$2x \leq 2$ or $x > 5$

$\div 2 \quad \div 2$

$x \leq 1$ or $x > 5$

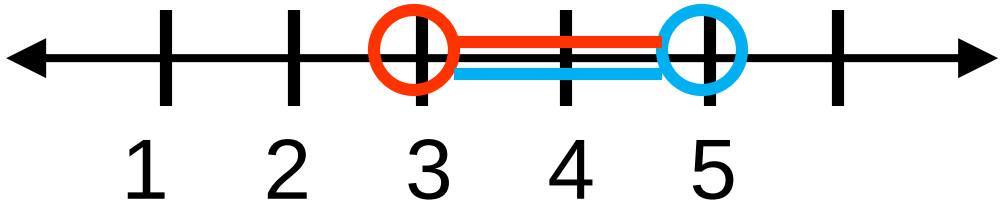


Vocabulary

Compound inequality $x > 3$ and $x < 5$

Hint: This can also be written as: $3 < x < 5$

Hint: Inequality with “and” looks like: → ←



Verbal Inequalities

The cost of a car is at most $20,000. $c \leq \$20{,}000$

It takes Joe no less than 5 minutes to run a mile.

$t \geq 5 \text{ min}$

It takes between 3 and 8 months to build a house.

$3 \text{ months} \leq t \leq 8 \text{ months}$

The cost of a loaf of bread is less than $2

$c \leq \$2$

You can't buy a car for less than $8000.

$c \geq \$8000$

Your turn: (a) Write in inequality notation
(b) Graph the inequality

There are least 65,000 spectators at the game.

It never gets above 100 degrees in Huntsville.

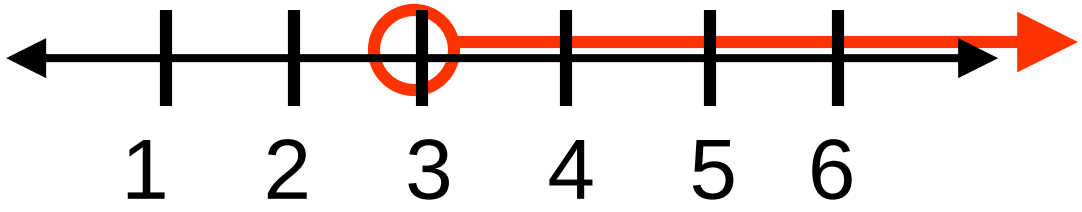
You can fit, at most, 5 cars in your garage.

Three Ways to show an Inequality

1. Inequality: $x > 3$

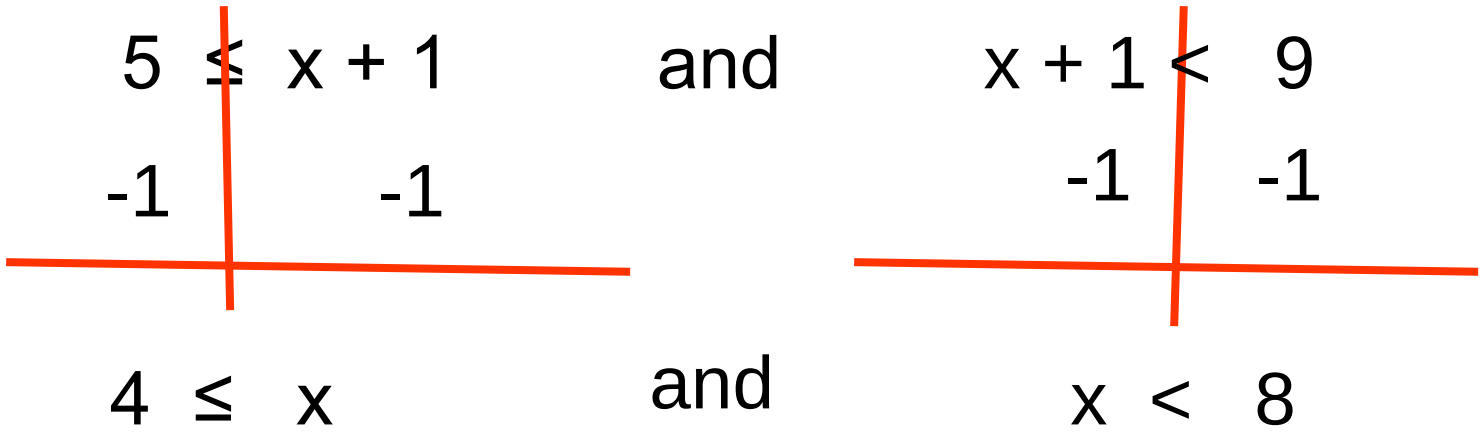
2. Interval Notation: $(3, \infty)$

3. Number line drawing:



Compound inequalities (two inequality symbols)

$5 \leq x + 1 < 9$



$4 \leq x$ and $x < 8$

Same as: $4 \leq x < 8$

<u>KEY POINT</u>: This is an AND inequality. Break it into two simple inequalities separated by “AND”.

Your turn: Solve the inequality

$-3 < x - 4 \leq 3$

$-5 < x + 1$ and $x + 1 \leq 6$

$4x - 7 \leq 5$ or $3x + 2 > 23$

Sometimes there is no solution

Solution: the value(s) of the variable that make the statement true.

$$2(x-4) > 2x+1$$

$$2x-8 > 2x+1$$

$$-2x \qquad -2x$$

$$-8 > 1$$

No solution: when the variable dissappears and the resulting statement is false.

Sometimes the solution is all real numbers.

$$\begin{array}{rcl|l} 4x - 5 & \leq & 4(x+2) & \\ 4x - 5 & \leq & 4x + 8 & \\ -4x & & -4x & \\ \hline -5 & \leq & 8 & \end{array}$$

Infinitely many solutions: when the variable dissappears and the resulting statement is true.