

TOPIC: LINEAR INEQUALITIES IN ONE VARIABLE

Introduction to Linear Inequalities

- ◆ A **linear equation** with an _____ symbol instead of an equal sign is a **linear inequality**.
- Just like a linear eqn, the **solution** of a linear inequality is the value(s) of x that makes the inequality *true*.

Recall	Linear Equation	New	Linear Inequality
	$ax + b = c$		$ax + b \neq c$
	$2x - 6 = 0$		$2x - 6 > 0$
	$x = 3$		$x > 3$
	Solution: _____ value		Solution: _____ of values
	$2(3) - 6 = 0$		$2(\quad) - 6 > 0$
	$0 = 0$ ✓		> 0

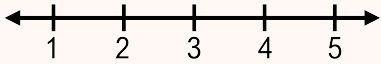
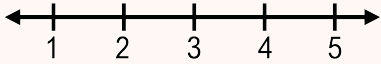
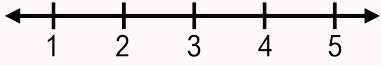
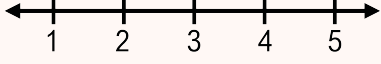
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Representing Solutions to Linear Inequalities

◆ Since the solution to an inequality is a *range* of values, there are different ways to represent & visualize it.

► **Exclude** a value with parentheses **()**. In interval notation, always use parentheses for _____.

► **Include** a value with square brackets **[]**.

Inequality	Set Builder Notation	Number Line (Graph)	Interval Notation
$x > 3$	$\{ \quad \quad \}$ <i>"the set of x such that x is greater than 3"</i>		
$x \geq 3$	$\{ \quad \quad \}$		
$x < 3$	$\{ \quad \quad \}$		
$x \leq 3$	$\{ \quad \quad \}$		

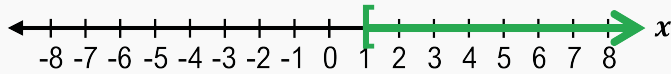
◆ When graphing, values can also be **excluded** with an open circle **○** or **included** with a closed circle **●**.

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PRACTICE

Which inequality matches the graph?

(A)



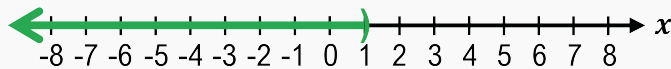
A. $x \geq 1$

B. $x \leq 1$

C. $x > 1$

D. $x < 1$

(B)



A. $x \geq 1$

B. $x \leq 1$

C. $x > 1$

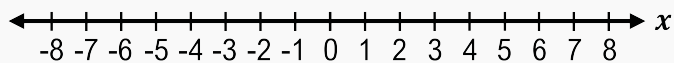
D. $x < 1$

PRACTICE

Use the number line to graph the following inequality.

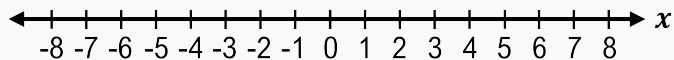
(A)

$x \geq 6$



(B)

$x \geq -7$



PRACTICE

Write the following in interval notation.

(A)

$x \geq 0$

(B)

$x < 7$

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PRACTICE Rewrite the following as an inequality statement.

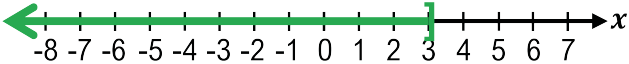
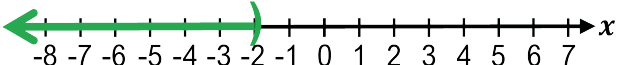
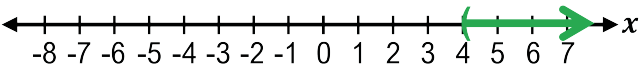
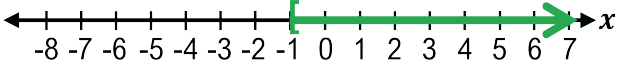
(A)

$(-\infty, 2]$

(B)

$(1, \infty)$

EXAMPLE Match the inequalities, interval notation, and graphs in Column A with their corresponding items in Column B.

A	B
$x > -2$	$-1 \leq x$
$x \geq -5$	
$(4, \infty)$	$(-2, \infty)$
	
$(-\infty, 3]$	$[-5, \infty)$
	$(-\infty, -2)$

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Solving Linear Inequalities

◆ The same properties used to solve linear **equations** by isolating the variable can be used for linear **inequalities**.

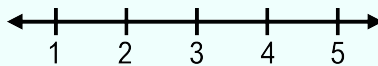
Property	If $a < b$, then...	Example
Addition & Subtraction	$a + c < b + c$	$x - 3 > 11$
	$a - c < b - c$	
Multiplication & Division for _____ c	$ac < bc$	$2 < \frac{x}{5}$
	$\frac{a}{c} < \frac{b}{c}$	
Multiplication & Division for _____ c	$ac > bc$	$-7x \geq 21$
	$\frac{a}{c} > \frac{b}{c}$	

◆ When multiplying or dividing by a **negative** number, you must _____ the inequality symbol.

EXAMPLE

Solve the given linear inequality, then graph your answer & express in interval notation.

$$x + 8 \leq 12 - x$$



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PRACTICE

Solve the following linear inequalities and write the solution in interval notation.

(A)

$$7x + 3 < 2x + 13$$

(B)

$$2(x + 4) \leq 3(x - 1) + x$$

(C)

$$-\frac{5}{6}x < 3$$

EXAMPLE

Solve the following inequalities.

(A)

$$2x - 5 < 2x + 10$$

(B)

$$x + 2 \geq x + 8$$

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Solving Three Part Inequalities

◆ In a **Three Part Inequality**, the variable expression is between ____ inequality symbols.

► To solve, follow the same steps for simple inequalities on all ____ sides to isolate the variable.

EXAMPLE

Solve the three part inequality and graph the solution.

$$-14 \leq 2x - 10 < 2$$

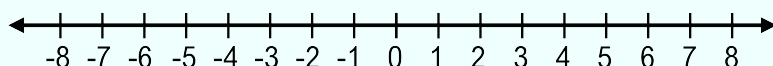
New

$$a < x < b$$

Solution Set:

Interval Notation:

Graph:



PRACTICE

Solve the following inequalities and express the answer in interval notation.

(A)

$$-4 \leq 2x + 1 \leq 7$$

(B)

$$1 < \frac{x-2}{2} \leq 4$$

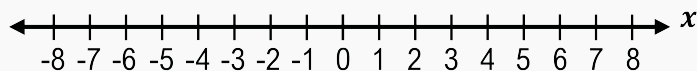
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PRACTICE

Solve the following inequalities and graph the solution.

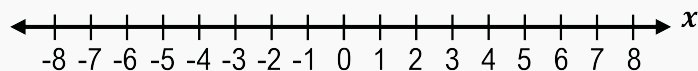
(A)

$$-6 < 2x - 4 < 4$$



(B)

$$-6 \leq 0.5(x - 4) < -3$$



EXAMPLE

Solve the following inequality and express the solution in interval notation. Then, graph the solution.

$$4 < 6 - x \leq 8$$

