

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
	$ax + b = c$		$ax + b < c$
	$2x - 6 = 0$		$2x - 6 > 0$
	$x = 3$		$x > 3$
	Solution: _____ value		Solution: _____ of values
	$2(3) - 6 = 0$		$2() - 6 > 0$
	$0 = 0$ ✓		> 0

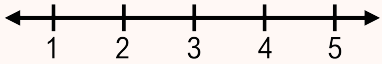
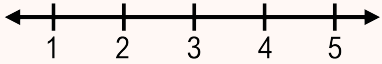
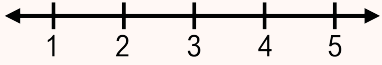
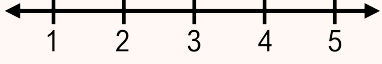
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Representing Solutions to Linear Inequalities

◆ 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>		
$x \geq 3$	$\{ \quad \quad \}$		
$x < 3$	$\{ \quad \quad \}$		
$x \leq 3$	$\{ \quad \quad \}$		

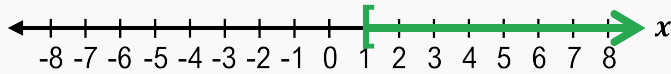
◆ When graphing, values can also be **excluded** with an open circle ○ or **included** with a closed circle ●.

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PRACTICE

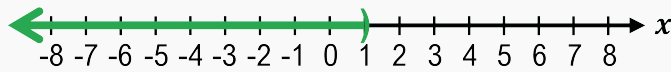
Which inequality matches the graph?

(A)



- A. $x \geq 1$
- B. $x \leq 1$
- C. $x > 1$
- D. $x < 1$

(B)



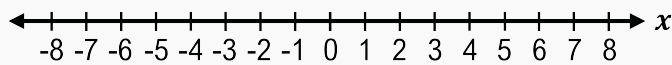
- A. $x \geq 1$
- B. $x \leq 1$
- C. $x > 1$
- D. $x < 1$

PRACTICE

Use the number line to graph the following inequality.

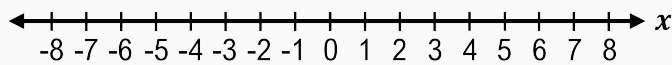
(A)

$x \geq 6$



(B)

$x \geq -7$



PRACTICE

Write the following in interval notation.

(A)

$x \geq 0$

(B)

$x < 7$

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PRACTICE

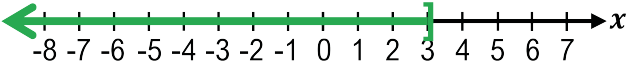
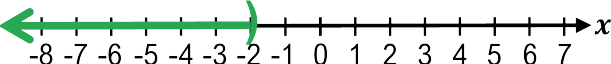
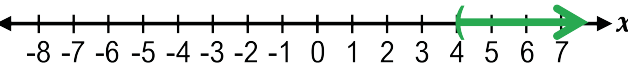
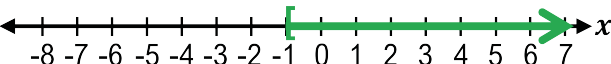
Rewrite the following as an inequality statement.

(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
$x > -2$	$-1 \leq x$
$x \geq -5$	 <p>A number line from -8 to 7 with tick marks every 1 unit. A green closed bracket is at 3, and a green arrow points to the left from 3.</p>
$(4, \infty)$	$(-2, \infty)$
 <p>A number line from -8 to 7 with tick marks every 1 unit. A green open parenthesis is at -2, and a green arrow points to the left from -2.</p>	 <p>A number line from -8 to 7 with tick marks every 1 unit. A green open parenthesis is at 4, and a green arrow points to the right from 4.</p>
$(-\infty, 3]$	$[-5, \infty)$
 <p>A number line from -8 to 7 with tick marks every 1 unit. A green closed bracket is at -1, and a green arrow points to the right from -1.</p>	$(-\infty, -2)$

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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**.

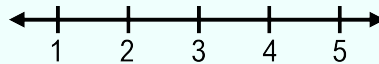
Property	If $a > b$, then...	Example
Addition & Subtraction	$a + c > b + c$	$x - 3 > 11$
	$a - c > b - c$	
Multiplication & Division for _____ c	$ac > bc$	$2 < \frac{x}{5}$
	$\frac{a}{c} > \frac{b}{c}$	
Multiplication & Division for _____ c	$ac < bc$	$-7x \geq 21$
	$\frac{a}{c} < \frac{b}{c}$	

◆ 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.

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

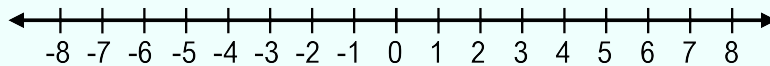
New

$$a < x < b$$

Solution Set:

Interval Notation:

Graph:



PRACTICE

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

(A) $-4 \leq 2x + 1 \leq 7$

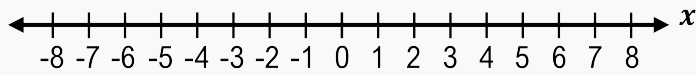
(B) $1 < \frac{x-2}{2} \leq 4$

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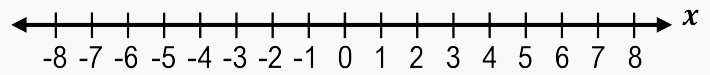
PRACTICE

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.

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

