

MATH 1010 ~ Intermediate Algebra

Chapter 2: LINEAR EQUATIONS AND
INEQUALITIES

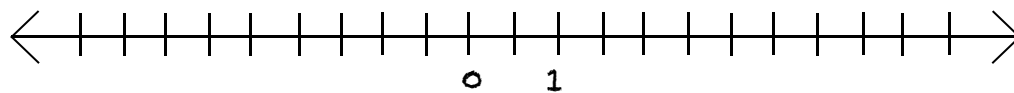
Section 2.4: Linear Inequalities

Objectives:

- * Sketch the graph of inequalities on a number line.
- * Use properties of inequalities to solve linear inequalities.
- * Solve compound inequalities.
- * Solve application problems involving inequalities.

Sketch the solution on the number line:

$$-3 \leq x < 2$$



INTERVALS ON A REAL NUMBER LINE

<i>interval</i>	Notation	Inequality	Graph
[closed (open	[a,b]	$a \leq x \leq b$	
	(a,b)	$a < x < b$	
	[a,b)	$a \leq x < b$	
	(a,b]	$a < x \leq b$	
	[a, ∞)	$x \geq a$	
	(a, ∞)	$x > a$	
	(-∞, b]	$x \leq b$	
	(-∞, b)	$x < b$	
	(-∞, ∞)		

$a < b$

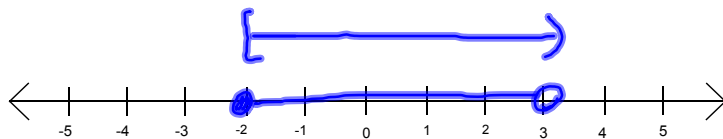
ex $3 \leq x < 5$



① EXAMPLE:

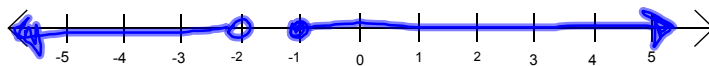
Graph each inequality.

a) $-2 \leq x < 3$

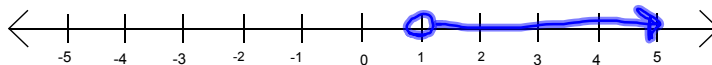


*compound inequality
"and"*

b) $x \geq -1$ or $x < -2$



c) $x > 1$



Properties of Inequalities

1. Addition and Subtraction Properties

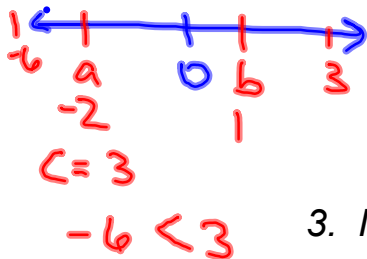
$$\frac{a+c}{\Delta} \quad \frac{b+c}{\Delta} \quad a < b \quad \text{can add/subtract same quantity to both sides}$$

$$a+c < b+c$$

2. Multiplication and Division Properties: Positive Quantities

$$a < b \quad \underline{\underline{c > 0}}$$

$$ac < bc$$



3. Multiplication and Division Properties: Negative Quantities

A number line with arrows at both ends. Tick marks are labeled with -3, -1, 0, 1, and 3. Below the tick mark for -1 is the number -1. Below the tick mark for 3 is the number 3. To the right of the number line, the text '1 < 3' is written, followed by '-1 < 3 · -1 ?' and '-1 > -3'.

$$a < b \Rightarrow ac > bc$$

if $c < 0$

4. Transitive Property

if $a < b$ and $b < c$, then $a < c$.



SOLVING LINEAR INEQUALITIES

① EXAMPLE:

$$3x + 12 < x + 18$$

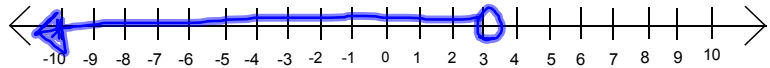
$$\begin{array}{r} -x \\ -x \end{array}$$

$$2x + 12 < 18$$

$$\begin{array}{r} -12 \\ -12 \end{array}$$

$$\frac{2x}{2} < \frac{6}{2}$$

$$\Leftrightarrow x < 3 \quad \text{or} \quad (-\infty, 3)$$



②

$$-7 \leq 5x - 2 < 8$$

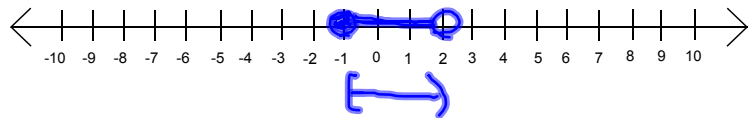
$$\begin{array}{r} +2 \\ +2 \\ +2 \end{array}$$

$$-5 \leq 5x < 10$$

$$\begin{array}{r} \frac{-5}{5} \\ \frac{5}{5} \\ \frac{10}{5} \end{array}$$

$$-1 \leq x < 2$$

$$\text{or} \quad [-1, 2)$$



③

$$-3x + 6 \leq 2 \quad \text{or} \quad -3x + 6 \geq 7$$

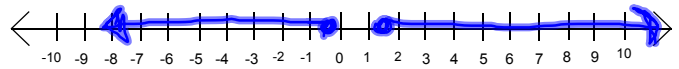
$$\begin{array}{r} -6 \\ -6 \end{array} = \begin{array}{r} -6 \\ -6 \end{array}$$

$$\frac{-3x}{-3} \leq \frac{-4}{-3} \quad \left| \quad \frac{-3x}{-3} \geq \frac{1}{-3}$$

$$x \geq \frac{4}{3} \quad \text{or} \quad x \leq -\frac{1}{3}$$

$$\left[\frac{4}{3}, \infty \right) \cup \left(-\infty, -\frac{1}{3} \right]$$

④



$$9 - x \leq 3 + 2x$$

$$\begin{array}{r} -2x \\ -2x \end{array}$$

$$\begin{array}{r} 9 \\ -9 \end{array} - 3x \leq \begin{array}{r} 3 \\ -9 \end{array}$$

$$\frac{-3x}{-3} \leq \frac{-6}{-3}$$

$$x \geq 2$$

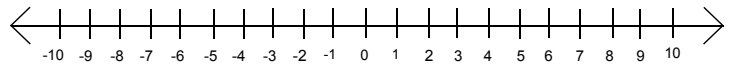
and

$$3x - 7 \leq -22$$

$$\begin{array}{r} +7 \\ +7 \end{array}$$

$$\frac{3x}{3} \leq \frac{-15}{3}$$

$$x \leq -5$$



$$x \geq 2 \quad \text{and} \quad x \leq -5$$

$$2 \leq x \leq -5$$

$$\emptyset$$

N.S.

(no shading because
no x -values work)