

Learning Target: Today you will be able to WRITE, GRAPH, AND IDENTIFY SOLUTIONS OF INEQUALITIES

Question/Main Ideas:	Notes:
Definition: Inequality	A mathematical sentence that uses an inequality symbol to compare the values of two expressions.
Inequality Symbols	$<$ - less than \leq - less than or equal to $>$ - greater than \geq - greater than or equal to
Example 1: Writing Inequalities from Verbal Expressions	<p>Write an inequality that represents the given verbal expression.</p> <p>a. all real numbers x less than or equal to -7 $x \leq -7$</p> <p>b. The sum of x and 6 is greater than -3 $x + 6 > -3$</p>
Now It's Your Turn	<p>Write an inequality that represents the given verbal expression.</p> <p>a. all real numbers p greater than or equal to 1.5 $p \geq 1.5$</p> <p>b. The difference of x and 10 is less than or equal to 5 $x - 10 \leq 5$</p>
Definition: Solutions to an inequality	Any number that makes an inequality true.
Example 2: Listing Solutions	<p>List five numbers that are solutions to the given inequality.</p> <p>a. $x > 8$ $9, 11.6, 15, 18, 300$</p> <p>b. $x + 11 \leq 19$ $-3, -1, 0, 2.6, 6$</p>

Example 3: Checking Solutions to Inequalities

Is the number a solution of $2x + 1 > -3$?

a. -3

$$\begin{aligned} 2(-3) + 1 &> -3 \\ -6 + 1 &> -3 \\ -5 &> -3 \\ \text{Yes} \end{aligned}$$

b. -1

$$\begin{aligned} 2(-1) + 1 &> -3 \\ -2 + 1 &> -3 \\ -1 &> -3 \\ \text{No} \end{aligned}$$

c. -2

$$\begin{aligned} 2(-2) + 1 &> -3 \\ -4 + 1 &> -3 \\ -3 &> -3 \\ \text{No} \end{aligned}$$

Now It's Your Turn

Is the number a solution of $4x - 6 \leq 10$?

a. 4

$$\begin{aligned} 4(4) - 6 &\leq 10 \\ 16 - 6 &\leq 10 \\ 10 &\leq 10 \\ \text{Yes} \end{aligned}$$

b. -6

$$\begin{aligned} 4(-6) - 6 &\leq 10 \\ -24 - 6 &\leq 10 \\ -30 &\leq 10 \\ \text{Yes} \end{aligned}$$

c. 0

$$\begin{aligned} 4(0) - 6 &\leq 10 \\ 0 - 6 &\leq 10 \\ -6 &\leq 10 \\ \text{Yes} \end{aligned}$$

Keys to Graphing Inequalities

Mark the number...

- closed circle $\leq \geq$ - equal to
- open circle $< >$ - not equal to

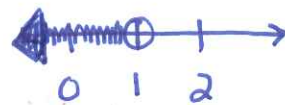
Pick a number and plug it in for x

Shade the side that is true

Example 4: Graphing Inequalities

Graph each inequality.

a. $n < 1$



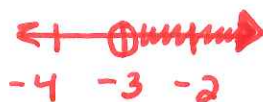
b. $a \geq 0$



Now It's Your Turn

Graph each inequality.

a. $f > -3$







b. $-2 \geq x$ $x \leq -2$







Summary: _____

Learning Target: Today you will be able to SOLVE ONE-STEP INEQUALITIES (WATCH YOUR NEGATIVES).

Question/Main Ideas:	Notes:	
Exploring the Properties of Inequalities	<p style="text-align: center;">Addition Property of Inequality</p> $\begin{array}{r} 6 < 12 \\ +6 & +6 \\ \hline 12 < 18 \checkmark \end{array}$ $\begin{array}{r} 6 < 12 \\ +(-6) & +(-6) \\ \hline 0 < 6 \checkmark \end{array}$	<p style="text-align: center;">Subtraction Property of Inequality</p> $\begin{array}{r} 6 < 12 \\ -6 & -6 \\ \hline 0 < 6 \checkmark \end{array}$ $\begin{array}{r} 6 < 12 \\ --6 & --6 \\ \hline 12 < 18 \checkmark \end{array}$
	<p style="text-align: center;">Multiplication Property of Inequality</p> $\begin{array}{r} 6 < 12 \\ \cdot 6 & \cdot 6 \\ \hline 36 < 72 \checkmark \end{array}$ $\begin{array}{r} 6 < 12 \\ \cdot (-6) & \cdot (-6) \\ \hline -36 < -72 \times \end{array}$	<p style="text-align: center;">Division Property of Equality</p> $\begin{array}{r} 6 < 12 \\ \frac{6}{6} & \frac{12}{6} \\ \hline 1 < 2 \checkmark \end{array}$ $\begin{array}{r} 6 < 12 \\ \frac{6}{-6} & \frac{12}{-6} \\ \hline -1 < -2 \times \end{array}$
THE BIG IDEA IS...	<p style="text-align: center;">When solving an inequality, if you multiply or divide by a negative number, you must... FLIP the inequality symbol</p>	
Example 1: Solving Inequalities	<p>Solve each inequality. Graph your solutions.</p> <p>a. $x + 4 \leq -7$</p> $\begin{array}{r} -4 & -4 \\ \hline x & \leq -11 \end{array}$  <p>b. $-5x < -35$</p> $\begin{array}{r} -5 & -5 \\ \hline x & > 7 \end{array}$ 	
Now It's Your Turn	<p>Solve each inequality. Graph your solutions.</p> <p>a. $6 < 16 + 2x$</p> $\begin{array}{r} -16 & -16 \\ \hline -10 & < 2x \\ \frac{-10}{2} & \frac{2x}{2} \\ \hline -5 & < x \end{array}$  <p>b. $-4x - 12 \geq 20$</p> $\begin{array}{r} +12 & +12 \\ \hline -4x & \geq 32 \\ \frac{-4x}{-4} & \frac{32}{-4} \\ \hline x & \leq -8 \end{array}$ 	

Summary: _____

Learning Target: Today you will be able to SOLVE MULTI-STEP INEQUALITIES (WATCH YOUR NEGATIVES)

Question/Main Ideas:	Notes:
<p>Remember Yesterday's Big Idea:</p>	<p>When you multiply or divide an inequality by a negative number... FLIP the inequality symbol</p>
<p>Example 1: Solving Inequalities</p>	<p>Solve each inequality. Graph your solutions.</p> <p>a. $3(x+1) - 4x \geq -5$</p> $\begin{array}{r} 3x + 3 - 4x \geq -5 \\ -1x + 3 \geq -5 \\ \quad -3 \quad -3 \\ \hline -1x \leq -8 \\ \quad -1 \quad -1 \\ \hline x \geq 8 \end{array}$  <p>b. $10 - 8x \geq 2(6 - 5x)$</p> $\begin{array}{r} 10 - 8x \geq 12 - 10x \\ \quad +10x \quad \quad +10x \\ \hline 10 + 2x \geq 12 \\ -10 \quad \quad -10 \\ \hline 2x \geq 2 \\ \quad 2 \quad 2 \\ \hline x \geq 1 \end{array}$ 
<p>Now It's Your Turn</p>	<p>Solve each inequality. Graph your solutions.</p> <p>a. $15 \leq 5 - 2(4x + 7)$</p> $\begin{array}{r} 15 \leq 5 - 8x - 14 \\ 15 \leq -8x - 9 \\ \quad +9 \quad \quad +9 \\ \hline 24 \leq -8x \\ \quad -8 \quad -8 \\ \hline -3 \geq x \end{array}$  <p>b. $8 + 6x > 5x + 2 - x$</p> $\begin{array}{r} 8 + 6x > 4x + 2 \\ \quad -4x \quad -4x \\ \hline 8 + 2x > 2 \\ -8 \quad \quad -8 \\ \hline 2x > -6 \\ \quad 2 \quad 2 \\ \hline x > -3 \end{array}$ 

Example 2:
Inequalities with
Special Solutions

Solve each inequality.

a. $10 - 8a \geq 2(5 - 4a)$

$$\begin{array}{r} 10 - 8a \geq 10 - 8a \\ + 8a \quad + 8a \\ \hline \end{array}$$

$$10 \geq 10$$

true

all real numbers

b. $6m - 5 > 7m + 7 - m$

$$\begin{array}{r} 6m - 5 > 6m + 7 \\ - 6m \quad - 6m \\ \hline \end{array}$$

$$-5 > 7$$

Not true

No solution

Now It's Your Turn

Solve each inequality.

a. $9 + 5n \leq 5n - 1$

$$\begin{array}{r} -5n - 5n \\ \hline \end{array}$$

$$9 \leq -1$$

Not true

No solution

b. $8 + 6x \geq 7x + 2 - x$

$$\begin{array}{r} 8 + 6x \geq 6x + 2 \\ - 6x \quad - 6x \\ \hline 8 \geq 2 \end{array}$$

true

all real numbers

Inequalities with No
Solutions

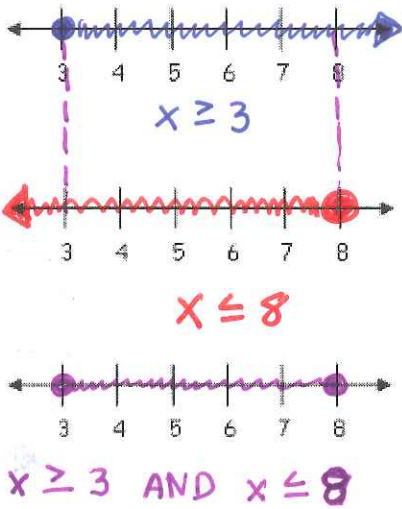
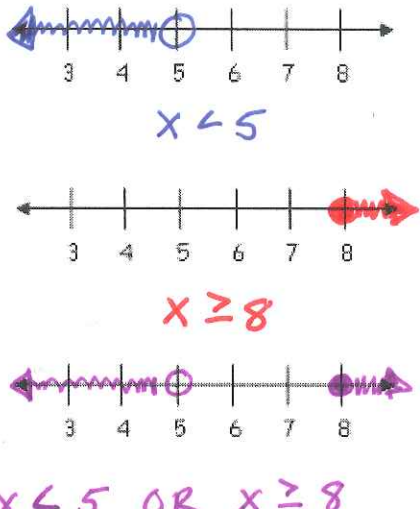


When the coefficients match (variables disappear) and the resulting statement is false

Inequalities Solutions
of All Real Numbers

When the coefficients match (variables disappear) and the resulting statement is true

Summary:

Learning Target: Today you will be able to SOLVE AND GRAPH INEQUALITIES WITH THE WORD OR AND SOLVE AND GRAPH INEQUALITIES WITH THE WORD AND

Question/Main Ideas:	Notes:	
<p>Definition: Compound Inequality</p>	<p>Consists of two distinct inequalities joined by the word <u>AND</u> or the word <u>OR</u></p>	
<p>Graphing Compound Inequalities</p>	<p style="text-align: center;">With the Word <u>AND</u></p> 	<p style="text-align: center;">With the Word <u>OR</u></p> 
<p>Writing a Compound Inequality with the word <u>AND</u> as a single inequality</p>	<p>We can write $x \geq 3$ AND $x \leq 8$ as one inequality $3 \leq x \leq 8$ ← This only works for AND inequalities</p>	
<p>Example 1: Writing and Graphing Compound Inequalities</p>	<p>Write a compound inequality that represents the phrase. Graph the solutions.</p> <p>a. all real numbers that are greater than -2 and less than 6 $-2 < x < 6$</p>  <p>b. all real numbers that are less than 0 or greater than or equal to 5 $x < 0$ OR $x \geq 5$</p> 	

Now It's Your Turn

Write a compound inequality that represents the phrase. Graph the solutions.

a. all real numbers that are greater than or equal to -4 and less than 6

$$-4 \leq x < 6$$

b. all real numbers that are less than or equal to 2.5 or greater than 6

$$x \leq 2.5 \text{ OR } x > 6$$

Example 2: Solving Compound Inequalities

Solve each inequality. Graph your solutions.

a. $-8 \leq -2x + 12 < 10$

$$\begin{array}{r} -12 \quad -12 \quad -12 \\ \hline -20 \leq -2x < -2 \\ \hline -2 \quad -2 \quad -2 \end{array}$$

$$10 \geq x > 1$$

$$1 < x \leq 10$$



b. $3x + 2 < -7$ or $-4x + 5 < 1$

$$\begin{array}{r} -2 \quad -2 \\ \hline 3x < -9 \\ \hline 3 \quad 3 \end{array} \quad \begin{array}{r} -5 \quad -5 \\ \hline -4x < -4 \\ \hline -4 \quad -4 \end{array}$$

$$x < -3 \quad \text{OR} \quad x > 1$$



Now It's Your Turn

Solve each inequality. Graph your solutions.

a. $-2 < 3x - 4 < 14$

$$\begin{array}{r} +4 \quad +4 \quad +4 \\ \hline 2 < 3x < 18 \\ \hline 3 \quad 3 \quad 3 \end{array}$$

$$\frac{2}{3} < x < 6$$



b. $-2x + 7 < 1$ or $4x + 3 \leq -5$

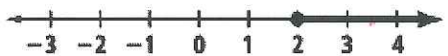


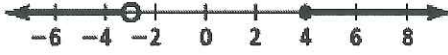
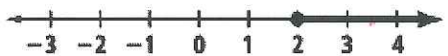


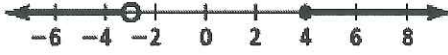
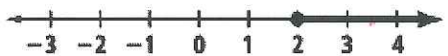


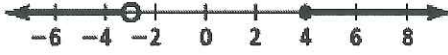
$$\begin{array}{r} -7 \quad -7 \\ \hline -2x < -6 \\ \hline -2 \quad -2 \end{array} \quad \begin{array}{r} -3 \quad -3 \\ \hline 4x \leq -8 \\ \hline 4 \quad 4 \end{array}$$

$$x > 3 \quad \text{OR} \quad x \leq -2$$



Summary: _____

Learning Target: Today you will be able to WRITE INEQUALITIES IN INTERVAL NOTATION.

Question/Main Ideas:	Notes:																	
<p>Definition: Interval Notation</p>	<p>Another way to write an inequality that uses parenthesis, brackets, and infinity symbols.</p> <table border="1" data-bbox="402 489 1531 747"> <tr> <td data-bbox="402 489 781 747"> Parenthesis: Used to represent $<, >$ </td> <td data-bbox="781 489 1159 747"> Brackets: Used to represent \leq, \geq </td> <td data-bbox="1159 489 1531 747"> Infinity: ∞ and $-\infty$ are used to show the values go on forever </td> </tr> </table>			Parenthesis: Used to represent $<, >$	Brackets: Used to represent \leq, \geq	Infinity: ∞ and $-\infty$ are used to show the values go on forever												
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<p>Concept: All Three Representations</p>	<table border="1" data-bbox="402 747 1531 1255"> <thead> <tr> <th data-bbox="402 747 704 806">Inequality</th> <th data-bbox="704 747 1227 806">Graph</th> <th data-bbox="1227 747 1531 806">Interval Notation</th> </tr> </thead> <tbody> <tr> <td data-bbox="402 806 704 919">$x \geq 2$</td> <td data-bbox="704 806 1227 919">  </td> <td data-bbox="1227 806 1531 919">$[2, \infty)$</td> </tr> <tr> <td data-bbox="402 919 704 1033">$x < 2$</td> <td data-bbox="704 919 1227 1033">  </td> <td data-bbox="1227 919 1531 1033">$(-\infty, 2)$</td> </tr> <tr> <td data-bbox="402 1033 704 1146">$1 < x \leq 5$</td> <td data-bbox="704 1033 1227 1146">  </td> <td data-bbox="1227 1033 1531 1146">$(1, 5]$</td> </tr> <tr> <td data-bbox="402 1146 704 1255">$x < -3$ OR $x \geq 4$</td> <td data-bbox="704 1146 1227 1255">  </td> <td data-bbox="1227 1146 1531 1255">$(-\infty, 3) \cup [4, \infty)$</td> </tr> </tbody> </table>			Inequality	Graph	Interval Notation	$x \geq 2$		$[2, \infty)$	$x < 2$		$(-\infty, 2)$	$1 < x \leq 5$		$(1, 5]$	$x < -3$ OR $x \geq 4$		$(-\infty, 3) \cup [4, \infty)$
Inequality	Graph	Interval Notation																
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$x < 2$		$(-\infty, 2)$																
$1 < x \leq 5$		$(1, 5]$																
$x < -3$ OR $x \geq 4$		$(-\infty, 3) \cup [4, \infty)$																
<p>Example 1: Using Interval Notation</p>	<p>a. Write $[-4, 6)$ as an inequality. $-4 \leq x < 6$</p> <p>b. Write $x \leq -1$ or $x > 2$ in interval notation. $(-\infty, -1] \cup (2, \infty)$</p>																	
<p>Now It's Your Turn</p>	<p>a. Write $(-2, 7]$ as an inequality. $-2 < x \leq 7$</p> <p>b. Write $x > 7$ in interval notation. $(7, \infty)$</p>																	

Summary: _____

Learning Target: Today you will be able to SOLVE EQUATIONS INVOLVING ABSOLUTE VALUE

Question/Main Ideas:	Notes:
<p>Definition: Absolute Value (Equations)</p>	<p>An absolute value is the distance a number is away from zero.</p> <p>what numbers are 5 units away from 0? $\rightarrow x = 5$ $x = 5, -5$</p>
<p>Steps to Solving Absolute Value Equations</p>	<p>Step 1: Use your properties of equations to isolate the absolute value. So your equation will look like...</p> $ A = b$ <p>Step 2: Solve $A = b$ by setting up two equations, one with a positive b and one with a negative b.</p> $A = b \quad A = -b$
<p>Example 1: Solving Absolute Value Equations</p>	<p>Solve each equation.</p> <p>a. $x + 2 = 9$</p> $\begin{array}{r} -2 -2 \\ \hline x = 7 \\ x = 7 \quad x = -7 \\ x = \pm 7 \\ \nearrow \\ \text{plus or minus} \end{array}$ <p>b. $3 2x + 8 - 22 = -10$</p> $\begin{array}{r} +22 +22 \\ \hline 3 2x+8 = \frac{12}{3} \\ 2x+8 = 4 \\ \begin{array}{l} 2x+8=4 \\ -8 \quad -8 \\ \hline 2x=-4 \\ \frac{2}{2} \quad \frac{-4}{2} \\ x=-2 \end{array} \quad \begin{array}{l} 2x+8=-4 \\ -8 \quad -8 \\ \hline 2x=-12 \\ \frac{2}{2} \quad \frac{-12}{2} \\ x=-6 \end{array} \end{array}$

Now It's Your Turn

Solve each equation.

a. $|x| - 5 = -2$

$$\underline{+5+5}$$

$$|x| = 3$$

$$x = 3 \quad x = -3$$

b. $4|3x - 8| - 11 = 17$

$$\underline{+11+11}$$

$$\frac{4|3x-8|}{4} = \frac{28}{4}$$

$$|3x-8| = 7$$

$$3x-8=7$$

$$3x=15$$

$$x=5$$

$$3x-8=-7$$

$$3x=1$$

$$x = \frac{1}{3}$$

Absolute Value Equations with No Solution

When $|A|$ is isolated and it is equal to a negative number, then there is no solution, because absolute values cannot be negative

Example 2: Solving Absolute Value Equations With No Solution

Solve $3|2x + 9| + 12 = 10$

$$\frac{3|2x+9|}{3} = \frac{-2}{3}$$

$$|2x+9| = -\frac{2}{3}$$

An absolute value cannot equal a negative

No Solution

Now It's Your Turn

Solve $|3x + 6| - 5 = -7$



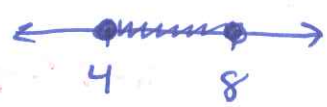
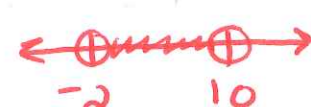

$$\underline{+5+5}$$

$$|3x+6| = -2$$

No Solution

Summary: _____

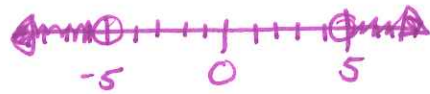
Learning Target: Today you will be able to SOLVE INEQUALITIES INVOLVING ABSOLUTE VALUE

Question/Main Ideas:	Notes:
<p>Solving Absolute Value Inequalities $A < b$</p>	<p>$x < 5$</p> <p>What numbers are less than 5 units from zero?</p>  <p>$-5 < x < 5$</p>
<p>Example 1: Solving Absolute Value Inequalities $A < b$</p>	<p>Solve each inequality. Graph the solutions.</p> <p>a. $x + 3 < 10$</p> $\begin{array}{r} -10 < x + 3 < 10 \\ -3 \quad -3 \quad -3 \\ \hline -13 < x < 7 \end{array}$  <p>b. $2x - 12 \leq 4$</p> $\begin{array}{r} -4 \leq 2x - 12 \leq 4 \\ +12 \quad +12 \quad +12 \\ \hline 8 \leq 2x \leq 16 \\ \frac{8}{2} \leq \frac{2x}{2} \leq \frac{16}{2} \\ 4 \leq x \leq 8 \end{array}$ 
<p>Now It's Your Turn</p>	<p>Solve each inequality. Graph the solutions.</p> <p>a. $x - 4 < 6$</p> $\begin{array}{r} -6 < x - 4 < 6 \\ +4 \quad +4 \quad +4 \\ \hline -2 < x < 10 \end{array}$  <p>b. $5x + 5 \leq 20$</p> $\begin{array}{r} -20 \leq 5x + 5 \leq 20 \\ -5 \quad -5 \quad -5 \\ \hline -25 \leq 5x \leq 15 \\ \frac{-25}{5} \leq \frac{5x}{5} \leq \frac{15}{5} \\ -5 \leq x \leq 3 \end{array}$ 

Solving Absolute Value Inequalities $|A| > b$

$$|x| > 5$$

what numbers are greater than 5 units from zero?



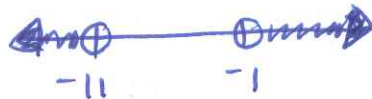
$$x < -5 \text{ OR } x > 5$$

Example 1: Solving Absolute Value Inequalities $|A| > b$

Solve each inequality. Graph the solutions.

a. $|x + 6| > 5$

$$\begin{array}{r} x + 6 > 5 \\ -6 \quad -6 \\ \hline x > -1 \end{array} \quad \begin{array}{r} x + 6 < -5 \\ -6 \quad -6 \\ \hline x < -11 \end{array}$$



b. $|4x + 10| \geq 14$

$$\begin{array}{r} 4x + 10 \geq 14 \\ -10 \quad -10 \\ \hline 4x \geq 4 \\ \frac{4x}{4} \geq \frac{4}{4} \\ x \geq 1 \end{array} \quad \begin{array}{r} 4x + 10 \leq -14 \\ -10 \quad -10 \\ \hline 4x \leq -24 \\ \frac{4x}{4} \leq \frac{-24}{4} \\ x \leq -6 \end{array}$$



Now It's Your Turn

Solve each inequality. Graph the solutions.

a. $|x - 7| \geq 4$

$$\begin{array}{r} x - 7 \geq 4 \\ +7 \quad +7 \\ \hline x \geq 11 \end{array} \quad \begin{array}{r} x - 7 \leq -4 \\ +7 \quad +7 \\ \hline x \leq 3 \end{array}$$



b. $|2x - 7| > 17$

$$\begin{array}{r} 2x - 7 > 17 \\ +7 \quad +7 \\ \hline 2x > 24 \\ \frac{2x}{2} > \frac{24}{2} \\ x > 12 \end{array} \quad \begin{array}{r} 2x - 7 < -17 \\ +7 \quad +7 \\ \hline 2x < -10 \\ \frac{2x}{2} < \frac{-10}{2} \\ x < -5 \end{array}$$



Absolute Value Inequalities with Special Solutions

$|x| > -\#$
all real Numbers

$|x| < -\#$
No Solution

Summary: