Lesson 1-4

Solving Inequalities

Lesson Objectives	NAEP 2005 Strand: Algebra
▼ 1 Solving and graphing inequalities ▼ 2 Compound inequalities	Topic: Equations and Inequalities Local Standards: _____

Vocabulary and Key Concepts

Properties of Inequalities
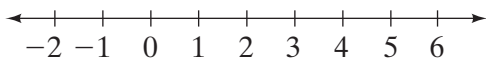
Let a, b, and c represent real numbers.

	Property	If $a \leq b$ and $b \leq c$, then $a \leq c$.	
	Property	If $a \leq b$, then $a + c \leq b + c$.	
	Property	If $a \leq b$, then $a - c \leq b - c$.	
	Property	If $a \leq b$ and $c > 0$, then $ac \leq bc$. If $a \leq b$ and $c < 0$, then $ac \geq bc$.	← **Notice that the inequality is reversed**
	Property	If $a \leq b$ and $c > 0$, then $\frac{a}{c} \leq \frac{b}{c}$. If $a \leq b$ and $c < 0$, then $\frac{a}{c} \geq \frac{b}{c}$.	← **when c is negative.**

A compound inequality is _____

_____

Example

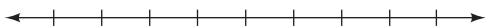**1** **Solving and Graphing Inequalities** Solve $-2x < 3(x - 5)$. Graph the solution.

$-2x < 3(x - 5)$

$-2x < \boxed{} - \boxed{}$ $\boxed{}$ **Property**

$\boxed{} < \boxed{}$ **Subtract** $\boxed{}$ **from both sides.**

$x \boxed{}\boxed{}$ **Divide each side by** $\boxed{}$ **and** $\boxed{}$ **the inequality.**

$$\overset{\longleftarrow \;|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\;\;|\; \longrightarrow}{\;\;-2 \;-1 \;\;\; 0 \;\;\; 1 \;\;\; 2 \;\;\; 3 \;\;\; 4 \;\;\; 5 \;\;\; 6}$$

Quick Check

1. Solve each inequality. Graph the solution.

a. $3x - 6 < 27$

b. $12 \geq 2(3n + 1) + 22$

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Examples

❷ **No Solutions or All Real Numbers as Solutions** Solve $7x \geq 7(2 + x)$.
Graph the solution.

$$7x \geq 7(2 + x)$$
$$7x \geq \boxed{} + \boxed{} \qquad \boxed{} \text{ Property}$$
$$\boxed{} \geq 14 \qquad \textbf{Subtract } \boxed{} \textbf{ from both sides.}$$

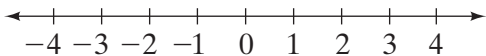The last inequality is always false, so $7x \geq 7(2 + x)$ is always $\boxed{}$.
It has $\boxed{}$ solution.

❸ **Compound Inequality Containing *And*** Graph the solution of $2x - 1 \leq 3x$
and $x > 4x - 9$.
$$2x - 1 \leq 3x \quad \text{and} \quad x > 4x - 9$$
$$-1 \leq \boxed{} \quad | \quad \boxed{} > 3x$$
$$\boxed{} \leq x \quad \text{and} \quad \boxed{} > x$$

This compound inequality can be written as $-1 \boxed{} x \boxed{} \boxed{}$.

$$\xleftarrow{\quad | \quad | \quad | \quad | \quad | \quad | \quad | \quad | \quad \rightarrow}$$
$$-4 \ -3 \ -2 \ -1 \ \ 0 \ \ 1 \ \ 2 \ \ 3 \ \ 4$$

Quick Check

2. Solve each inequality. Graph the solution.
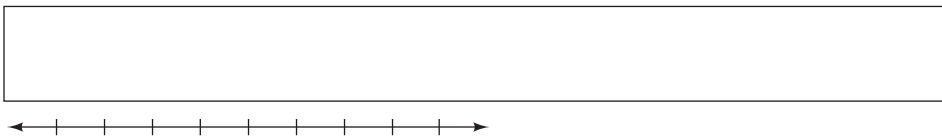 **a.** $2x < 2(x + 1) + 3$ **b.** $4(x - 3) + 7 \geq 4x + 1$
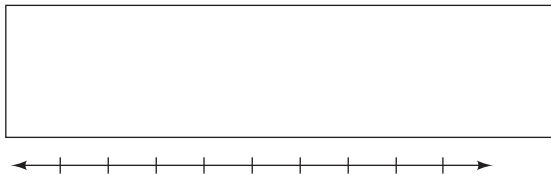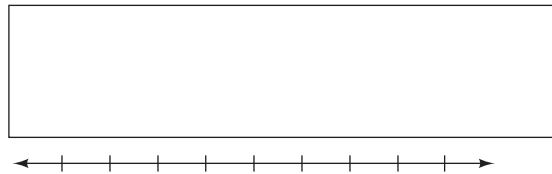
 c. Critical Thinking Find values of a such that $2x + a > 2x$ has no solution. Then find values of a such that all real numbers are solutions.

3. Graph the solution of $2x > x + 6$ and $x - 7 < 2$.

Examples

④ Compound Inequality Containing *Or* Graph the solution of $3x + 9 < -3$ or $-2x + 1 < 5$.

$3x + 9 < -3$ or $-2x + 1 < 5$

$3x < \boxed{}$ | $-2x < \boxed{}$

$x < \boxed{}$ or $x \boxed{} \boxed{}$

$$\xleftarrow{\quad} \overset{\displaystyle -4 \; -3 \; -2 \; -1 \;\; 0 \;\; 1 \;\; 2 \;\; 3 \;\; 4}{\rule{8cm}{0.4pt}} \xrightarrow{\quad}$$

⑤ Applying Compound Inequalities A strip of wood is to be 17 cm long with a tolerance of ±0.15 cm. How much should be trimmed from a strip 18 cm long to allow it to meet specifications?

Relate $\boxed{\text{minimum length}}$ $\leq$ $\boxed{\text{final length}}$ $\leq$ $\boxed{\text{maximum length}}$

Define   Let $\boxed{x}$ = number of centimeters to remove.

Write $17 - 0.15$ $\leq$ $18 - \boxed{}$ $\leq$ $17 + 0.15$

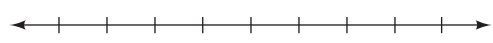$\boxed{} \leq 18 - x \leq 17.15$ **Simplify.**

$\boxed{} \leq -x \leq \boxed{}$ **Subtract** $\boxed{}$.

$1.15 \boxed{} x \boxed{} 0.85$ **Multiply by** $\boxed{}$.

At least $\boxed{}$ cm and no more than $\boxed{}$ cm should be trimmed.

Quick Check

4. Solve the compound equality $x - 1 < 3$ or $x + 3 > 8$. Graph the solution.

$$\xleftarrow{\quad}\ \underline{\ +\ +\ +\ +\ +\ +\ +\ +\ +\ +\ +\ }\ \xrightarrow{\quad}$$

5. The plans for a circular part in a medical instrument require a diameter to be within 0.2 in. of 1.5 in. A machinist finds that the diameter is now 1.73 in. By how much should the diameter be decreased?