

**Lesson 5.3 Notes (Solving Multi-Step Inequalities)**

**Objectives:**

- Solve linear inequalities involving more than one operation.
- Solve linear inequalities involving the Distributive Property.

**Multi-Step Inequalities** – solved by undoing operations in the same way you would solve a multi-step equation

- **Exception!** Multiply/divide by a negative → reverse direction of inequality
- Examples:

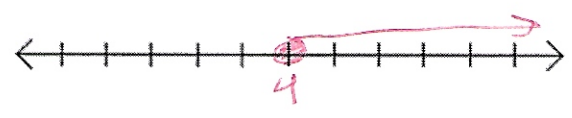
1. Solve each inequality. Then, graph the solution set on a number line.

a.  $-11y - 13 > 42$

$$\begin{array}{r} -11y - 13 > 42 \\ +13 \quad +13 \\ \hline -11y > 55 \\ \hline -11 \quad -11 \\ \hline y < -5 \end{array}$$

b.  $4(3t - 5) + 7 \geq 8t + 3$

$$\begin{array}{r} 4(3t - 5) + 7 \geq 8t + 3 \\ 12t - 20 + 7 \geq 8t + 3 \\ 12t - 13 \geq 8t + 3 \\ 12t \geq 8t + 16 \\ 4t \geq 16 \\ t \geq 4 \end{array}$$



2. Define a variable, write an inequality, and solve the problem.

- a. Write and solve an inequality to find the sales Mrs. Jones needs if she earns a monthly salary of \$2000 plus a 10% commission on her sales. Her goal is to make at least \$4000 per month. What sales does she need to meet her goal?

$$\begin{array}{r} 2000 + .10s \geq 4000 \\ .10s \geq 2000 \\ s \geq 20,000 \end{array}$$

she must make at least \$20,000 in sales to meet her monthly goal.

- b. Five minus 6 times a number is more than 4 times the number plus 45.

$$\begin{array}{r} 5 - 6n > 4n + 45 \\ 5 > 10n + 45 \\ -40 > 10n \\ -4 > n \Rightarrow n < -4 \end{array}$$

**Special Cases:**

- **Empty Set** ( $\emptyset$ ) – solving results in a statement that is *never true*
  - the inequality has no solutions
    - Notation:  $\emptyset$
- **All Real Numbers** – solving results in a statement that is *always true*
  - All real numbers are part of the solution set
    - Notation:  $\{x \mid x \text{ is a real number}\}$
- Examples: Solve each inequality.

3.  $9t - 5(t - 5) \leq 4(t - 3)$

$$9t - 5t + 25 \leq 4t - 12$$

$$4t + 25 \leq 4t - 12$$

$$\begin{array}{r} -4t \\ \hline 25 \leq -12 \end{array}$$

Never true

No solution  $\Rightarrow$   $\boxed{\{\emptyset\}}$

4.  $6(5z - 3) \leq 36z$

$$30z - 18 \leq 36z$$

$$\begin{array}{r} -30z \\ \hline -18 \leq 6z \end{array}$$

$$\frac{-18}{6} \leq \frac{6z}{6}$$

$$-3 \leq z \Rightarrow \boxed{z \geq -3}$$

5.  $3(4m + 6) \leq 42 + 6(2m - 4)$

$$12m + 18 \leq 42 + 12m - 24$$

$$12m + 18 \leq 18 + 12m$$

$$\begin{array}{r} -12m \\ \hline 18 \leq 18 \end{array}$$

Always True

Solution:  $\boxed{\{m \mid m \text{ is a real number}\}}$