

Day 3 Notes – Solving Multi-Step Inequalities

Just as we can undo operations to solve multiple step equations we can undo operations to solve multiple step inequalities.

The most important thing to remember when solving multiple step inequalities is that if you **multiply or divide** by a **negative** you must **Flip** the inequality sign.

Using **inverse** operations you are going to **solve** for your variable. Don't forget order of operations!

EXAMPLE 1: Solve and graph the solution $3b + 7 \leq 13$

$$\begin{array}{r} -7 \quad -7 \\ 3b + 7 \leq 13 \\ \hline 3b \leq 6 \\ \hline b \leq 2 \end{array}$$

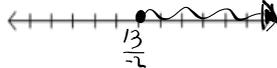


Example 2: Solve the inequalities DON'T FORGET TO WATCH YOUR SIGNS

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

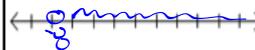


$$\begin{array}{r} 23 \geq 10 - 2w \\ -10 \quad -10 \\ \hline 13 \geq -2w \\ \hline \frac{13}{-2} \leq w \\ w \geq \frac{13}{-2} \end{array}$$



Example 2: Solve the inequalities DON'T FORGET TO WATCH YOUR SIGNS

$$\begin{array}{r} 43 > -4y + 11 \\ -11 \quad -11 \\ \hline 32 > -4y \\ \hline \frac{32}{-4} > \frac{-4y}{-4} \\ -8 < y \\ y > -8 \end{array}$$



$$\begin{array}{r} 13 - 11d \geq 79 \\ -13 \quad -13 \\ \hline -11d \geq 66 \\ \hline \frac{-11d}{-11} \geq \frac{66}{-11} \\ d \leq -6 \end{array}$$



Whenever you see parenthesis that means that you need to Distribute first and then use inverse operations to get the variable by itself.

When we have variables on both sides of the equation always move the variable that has the smaller coefficient.

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


A number line with tick marks from 0 to 10. A green arrow points to the right starting from 4, indicating the solution set $t \geq 4$.

$$\begin{array}{l}
 6(5z-3) \leq 36z \\
 30z-18 \leq 36z \\
 -30z \quad -30z \\
 -18 \leq 6z \\
 \frac{-18}{6} \leq \frac{6z}{6} \\
 -3 \leq z \\
 z \geq -3
 \end{array}$$


A number line with tick marks from -4 to 4. A blue arrow points to the right starting from -3, indicating the solution set $z \geq -3$.

Writing and Solving inequalities

We can translate sentences into multi-step inequalities and then solve them using the properties we have learned so far.

Our first step is to define the variable and then set up an inequality and finally solve the inequality.

Example 3:

a) five minus six times a number is more than four times the number plus 45

$$\begin{array}{l}
 5 - 6n > 4n + 45 \\
 +6n \quad +6n \\
 5 > 10n + 45 \\
 -45 \quad -45 \\
 -40 > 10n \\
 \frac{-40}{10} > \frac{10n}{10} \\
 -4 > n \\
 \boxed{n < -4}
 \end{array}$$

b) two more than half of a number is greater than twenty-seven

$$\begin{array}{l}
 2 + \frac{n}{2} > 27 \\
 -2 \quad -2 \\
 \frac{n}{2} > 25 \\
 2 \cdot \frac{n}{2} > 25 \cdot 2 \\
 n > 50
 \end{array}$$

Application: 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?

$$\begin{aligned}
 & \downarrow 10\% \\
 & .10s + \$2000 \geq \$4000 \\
 & \quad \quad \quad -2000 \quad \quad \quad -2000 \\
 & \quad \quad \quad \hline
 & \quad \quad \quad .10s \geq 2000 \\
 & \quad \quad \quad \cdot 10 \quad \quad \quad \cdot 10 \\
 & \quad \quad \quad \hline
 & \quad \quad \quad s \geq 20,000
 \end{aligned}$$

$$4n + 12 < n - 3$$

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Define the variable:

Set up an Inequality:

Solve the Inequality: