4-3: Solving Multi-Step Inequalities

Solve Multi-Step Inequalities Multi–step inequalities can be solved by undoing the operations in the same way you would solve a multi-step equation.

1. Solve $-11y - 13 > 42$. Graph the solution on a number line.

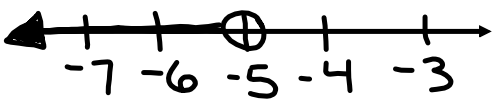
$-11y - 13 > 42$ — original inequality

$-11y > 55$ — Addition Prop. (+13 each side)

$\frac{-11y}{-11} < \frac{55}{-11}$ — Division Prop. (÷ -11 each side)

$y < -5$ — Simplify

divided by a negative # → flip the inequality sign



TRY SOME: Solve each inequality. Check your solution.

2. $23 \geq 10 - 2w$

$-10 \quad -10$

$13 \geq -2w$

$\frac{13}{-2} \geq \frac{-2w}{-2}$

$-6.5 \leq w$

$w \geq -6.5$

3. $43 > -4y + 11$

$-11 \quad -11$

$32 > -4y$

$\frac{32}{-4} < \frac{-4y}{-4}$

$-8 < y \rightarrow y > -8$

Now, how about something a bit more challenging:

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

$30z - 18 \leq 36z$

$-30z \quad -30z$

$-18 \leq 6z$

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

$-3 \leq z$

$z \geq -3$

5. $2(h + 6) > -3(8 - h)$

$2h + 12 > -24 + 3h$

$-2h \quad -2h$

$12 > -24 + h$

$+24 \quad +24$

$36 > h$

$h < 36$

Solve each inequality, check your solution. Does anything "weird" happen?

6. $9t - 5(t - 5) \leq 4(t - 3)$

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

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

$-4t \downarrow \quad | \quad -4t \downarrow$

$25 \leq -12$

FALSE → NO SOLUTION!

When your variables cancel out, leaving a FALSE inequality, there is NO SOLUTION.

$\emptyset$

7. $3(4m + 6) \leq 42 + 6(2m - 4)$

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

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

$-12m \downarrow \quad -12m \downarrow$

True $18 \leq 18$ infinite solutions

When your variables cancel out, leaving a TRUE inequality, ALL VALUES are solutions. This is called an IDENTITY.

Define a variable, write an inequality, and solve each problem. Then interpret your solution.

8. Keith's dog weighs 90 pounds. A healthy weight for his dog would be less than 75 pounds. If Keith's dog can lose an average of 1.25 pounds per week on a certain diet, after how long will the dog reach healthy weight?

w = weeks

$90 - 1.25w < 75$

$-90 \downarrow \quad | \quad -90$

$-1.25w < -15$

$\frac{-1.25w}{-1.25} < \frac{-15}{-1.25}$

$w > 12$

After 12 weeks

9. A high school drama club is performing a musical to benefit a local charity. Tickets are \$5 each. They also received donations of \$565. They want to raise at least \$1500.

t = tickets

a. Write an inequality that describes this situation. Then solve the inequality.

$5t + 565 \geq 1500$

$\downarrow -565 \quad | \quad -565$

$\frac{5t}{5} \geq \frac{935}{5}$

$t \geq 187$

At least 187 tickets must be sold.

b. Graph the solution.

closed circle because ≥ means we include 187.