ALG I - §3-4 NOTES

Algebra 1

Lesson 3-4: Multi-Step Inequalities

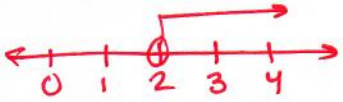
Objective: *To solve multi-step inequalities*

Warm-Up: Solve each inequality and graph the solution.

1. $-5p < -10$

$\frac{-5p}{-5} < \frac{-10}{-5}$ FLIP

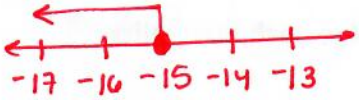
$p > 2$



2. $5(-3) \geq 5\left(\frac{m}{5}\right)$

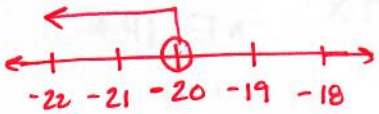
$-15 \geq m$

$m \leq -15$



3. $-\frac{4}{3}\left(-\frac{3}{4}x\right) > -\frac{4}{3}(15)$ FLIP

$x < -20$

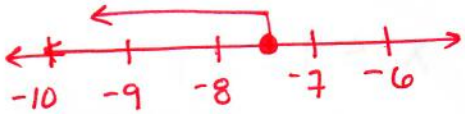


4. $2n \leq -15$

$\frac{2n}{2} \leq \frac{-15}{2}$

$n \leq -\frac{15}{2}$

$n \leq -7\frac{1}{2}$



RULE OF SOLVING INEQUALITIES: Complete the statement.

When you multiply or divide by a negative

you **MUST** FLIP the inequality.

Example 1 Solve each inequality.

a. $9 + 4m > 21$

$-9 \quad -9$

$4m > 12$

$\frac{4m}{4} > \frac{12}{4}$

$m > 3$

b. $-6x - 7 \leq 17$

$+7 \quad +7$

$-6x \leq 24$

$\frac{-6x}{-6} \leq \frac{24}{-6}$

$x \geq -4$ *FLIP*

Example 2 Solve each inequality.

a. $-4 < 5 - 3n$

$-5 \quad -5$

$-9 < -3n$

$\frac{-9}{-3} < \frac{-3n}{-3}$

$3 > n$

$n < 3$

* FLIP *

b. $50 > 8x + 10$

$-10 \quad -10$

$40 > 8x$

$\frac{40}{8} > \frac{8x}{8}$

$5 > x$

$x < 5$

Example 3 Solve each inequality.

a. $6x + 2(1 + 3x) \leq 14$

$6x + 2 + 6x \leq 14$

$12x + 2 \leq 14$

$-2 \quad -2$

$12x \leq 12$

$\frac{12x}{12} \leq \frac{12}{12}$

$x \leq 1$

b. $167 < 6 + 7(2 - 7x)$

$167 < 6 + 14 - 49x$

$167 < 20 - 49x$

$-20 \quad -20$

$147 < -49x$

$\frac{147}{-49} < \frac{-49x}{-49}$ *FLIP*

$-3 > x$

$x < -3$

Example 4 Solve each inequality.

a. $28 - p > 7(p - 4)$

$28 - p > 7p - 28$

$28 > 8p - 28$

$56 > 8p$

$\frac{56}{8} > \frac{8p}{8}$

$7 > p$

$p < 7$

b. $-5n - 6n \leq 8 - 8n - n$

$-11n \leq 8 - 9n$

$+9n \quad +9n$

$-2n \leq 8$

$\frac{-2n}{-2} \leq \frac{8}{-2}$ *FLIP*

$n \geq -4$

When solving equations or inequalities, 3 cases can occur:

1. 1 Soln (Ex $x=3$; $x<3$)
2. 0 Solns $\Longrightarrow$ No soln (Ex $1=2$; $1<2$) False
3. Infinite Soln $\Rightarrow$ All $\mathbb{R}$ (Ex $6=6$; $6 \leq 6$)

Example 5 Solve each inequality, if possible.

a. $2x - 8 \geq 2(x - 4)$

$2x - 8 \geq 2x - 8$

$-2x \quad -2x$

$-8 \geq -8$

All $\mathbb{R}$

b. $2x - 8 \geq 2(x + 4)$

$2x - 8 \geq 2x + 8$

$-2x \quad -2x$

$-8 \geq 8$

No soln

Example 6 Solve each inequality, if possible.

a. $-5m + 6 < -5(m + 2)$

$-5m + 6 < -5m - 10$

$6 < -10$

No soln.

b. $6w - 4 \leq 2(3w - 2)$

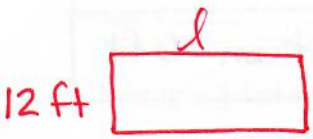
$6w - 4 \leq 6w - 4$

$-6w \quad -6w$

$-4 \leq -4$

All $\mathbb{R}$

Example 7 In a community garden, you want to fence in a rectangular garden adjacent to your friend's garden. The width of the garden is 12 feet. You have at most 42 feet of fence. What are the possible lengths of your garden?



let l = length of garden

$2l + 2w \leq 42$

$2l + 2(12) \leq 42$

$2l + 24 \leq 42$

$-24 \quad -24$

$\frac{2l}{2} \leq \frac{18}{2}$

$l \leq 9$

The length can be at most 9 ft.

Example 8 A grandmother says that her grandson is two years older than her granddaughter, and together, they are at least 22 years old. How old are the grandson and the granddaughter?

let g = age of granddaughter

granddaughter's age + grandson's age ≥ 22

$$g + (g + 2) \geq 22$$

$$2g + 2 \geq 22$$

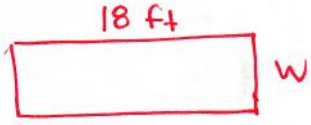
$$-2 \quad -2$$

$$\frac{2g}{2} \geq \frac{20}{2}$$

$$g \geq 10$$

The granddaughter is at least 10 yrs old, and the grandson at least 12 yrs

Example 9 You want to make a rectangular banner that is 18 feet long. You have no more than 48 feet of trim for the banner. What are the possible widths of the banner?



let w = width

$$2l + 2w \leq 48$$

$$2(18) + 2w \leq 48$$

$$36 + 2w \leq 48$$

$$-36 \quad -36$$

$$\frac{2w}{2} \leq \frac{12}{2}$$

$$w \leq 6$$

The width is no more than 6 ft.