

## Inequalities Notes

Mathematical sentences that use any of the following symbols

- $>$  Greater than
- $<$  Less than
- $\leq$  Less than or equal to
- $\geq$  Greater than or equal to

## Solving Inequalities

- Done the same way you solve equations.
- **Exception:** when you **multiply** or **divide** both sides of an inequality by a **negative** number, you must **change** the direction of the inequality symbol.

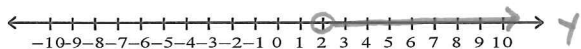
### Example: Solving Inequalities Using Addition/Subtraction

Solve the following inequalities and graph the solution on the number line.

a.  $y + 3 > 5$

Step 1: Isolate y variable  
Subtract 3 from both sides

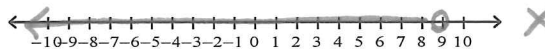
$$\begin{array}{r} y + 3 > 5 \\ -3 > -3 \\ \hline y > 2 \end{array}$$



b.  $x - 3 < 5$

Step 1: Isolate the x variable  
add 3 to both sides

$$\begin{array}{r} x - 3 < 5 \\ +3 < +3 \\ \hline x < 9 \end{array}$$



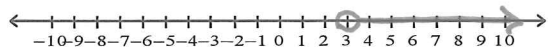
### Example: Solving Inequalities Using Multiplication/Division

Solve the following inequalities and graph the solution on the number line.

a.  $4y > 12$

Step 1: Isolate y variable  
divide both sides by 4

$$\begin{array}{r} 4y > 12 \\ \frac{4y}{4} > \frac{12}{4} \\ y > 3 \end{array}$$

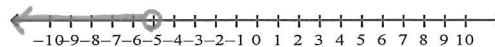


b.  $-3y > 15$

Step 1: Isolate the y variable  
divide both sides by -3

$$\begin{array}{r} -3y > 15 \\ \frac{-3y}{-3} > \frac{15}{-3} \end{array}$$

$y < -5$  (since we divided by negative, ineq switched)



## Solving Inequalities (Multi-Step)

- Complete the Distributive Property
- Simplify by adding like terms.
- Eliminate the variable on 1 side
- Eliminate constant term on the side with variable
- Solve for the variable
- Check solution
- Remember: addition/subtraction must be done before multiplication/division
- Note: some inequalities have no solution and others are true for all real numbers.

### Example: Solving Inequalities (Multi-Step)

Solve the following inequalities and graph the solution on the number line.

a.  $2y + 3 < 9$

**Step 1:** Opposite of add is subtract  
So subtract 3 from both sides

**Step 2:** Perform the necessary operation

$$\begin{array}{r} 2y + 3 < 9 \\ -3 \quad -3 \\ \hline 2y < 6 \end{array}$$

**Step 3:** Opposite of multiply is divide  
So, divide by 2

**Step 4:** Perform the necessary operation

$$\begin{array}{r} \frac{2y}{2} < \frac{6}{2} \\ y < 3 \end{array}$$

b.  $3y + 2y > 15$

**Step 1:** Add like terms  
So add  $3y + 2y$

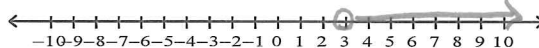
**Step 2:** Perform the necessary operation

$$5y > 15$$

**Step 3:** Opposite of multiply is divide  
So, divide by 5

**Step 4:** Perform the necessary operation

$$\begin{array}{r} \frac{5y}{5} > \frac{15}{5} \\ y > 3 \end{array}$$



### Compound Inequalities

- 2 inequalities joined by the word “and” or “or”
- Example:  $-5 \leq x \leq 7$  is the same as  $x \geq -5$  and  $x \leq 7$

### Example: Solving Compound Inequalities (and/or)

Solve the following compound inequalities and graph the solution on the number line.

a.  $-4 < r - 5 \leq -1$

**Step 1:** Isolate the variable r

Add 5 to all sides

$$-4 < r - 5 \leq -1$$

$$\begin{array}{r} +5 \quad +5 \quad +5 \\ \hline \end{array}$$

$$1 < r \leq 4$$

b.  $4v + 3 < -5$  or  $-2v + 7 < 1$

**Step 1:** Isolate the variable v

$$4v + 3 < -5 \text{ or } -2v + 7 < 1$$

$$\begin{array}{r} -3 \quad -3 \quad \quad -7 \quad -7 \\ \hline \end{array}$$

$$\frac{4v}{4} < \frac{-8}{4} \text{ or } \frac{-2v}{-2} < \frac{-6}{-2}$$

$$v < -2 \text{ or } v > 3$$

