

Name: \_\_\_\_\_

Date: \_\_\_\_\_

UNIT 3 DAY 2: SOLVING LINEAR INEQUALITIES



Just as we can solve linear equations by using properties of **expressions** (commutative, associative, and distributive) and **equations** (addition and multiplication properties), we can do the same for inequalities. But, we have to make sure we know what those properties are. Let's test them.

**Do Now:** Consider the **true** inequality  $4 < 8$ .

(a) If we add 3 to both sides of the inequality, what is the resulting inequality? Is it true?

$$7 < 11$$

True

(b) If we subtract 4 from both sides of the inequality, what is the resulting inequality? Is it true?

$$0 < 4$$

True

(c) If we multiply both sides of the inequality by 2, what is the resulting inequality? Is it true?

$$8 < 16$$

True

(d) If we divide both sides of the inequality by 2, what is the resulting inequality? Is it true?

$$2 < 4$$

True

Hmm... Based on the Do Now, you might conclude that the **truth values** of **inequalities** have the same properties as the **truth values** for **equalities (equations)**. But there is one huge difference between linear inequalities and linear equations.

**Exercise #1:** Returning to our **true** inequality  $4 < 8$ .

(a) If we multiply both sides of the inequality by -2, what is the resulting inequality? Is it true?

$$\begin{array}{r} 4 < 8 \\ \times -2 \quad \times -2 \\ \hline -8 < -16 \end{array}$$

FALSE

(b) If we divide both sides of the inequality by -2, what is the resulting inequality? Is it true?

$$\begin{array}{r} 4 < 8 \\ \div -2 \quad \div -2 \\ \hline -2 < -4 \end{array}$$

FALSE

PROPERTIES OF INEQUALITIES

1. **THE ADDITION (AND SUBTRACTION) PROPERTY:** If  $a > b$  is true then  $a + c > b + c$  is true.
2. **THE MULTIPLICATION (AND DIVISION) PROPERTY:** If  $a > b$  is true then  $c \cdot a > c \cdot b$  will be true if  $c$  is a positive number and  $c \cdot a < c \cdot b$  will be true if  $c$  is a negative number.

Now that we know the ways that the truth value of an inequality can remain the same or change, we can solve linear inequalities!

$$\begin{array}{r} 2 > 1 \\ +2 \quad +2 \\ \hline 4 > 3 \end{array}$$

$$\begin{array}{r} 2 > 1 \\ \cdot 10 \quad \cdot 10 \\ \hline 20 > 10 \end{array}$$

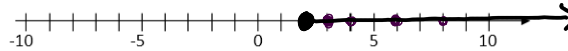
**Exercise #2:** Given the linear inequality  $4x - 3 \geq 5$  do the following:

- (a) Solve the inequality by applying the properties of inequalities that we found earlier. (b) Write 5 numbers that make the final solution true and plot them on the number line below (c).

$$\begin{array}{r}
 4x - 3 \geq 5 \\
 +3 \quad +3 \\
 \hline
 4x \geq 8 \\
 \frac{4x}{4} \geq \frac{8}{4} \\
 x \geq 2
 \end{array}$$

3, 6, 2, 4, 8

(c) Now, graph all of the solutions on the number line below (this is called the **solution set**).



**Exercise #3:** Given the linear inequality  $8 - 2x > 16$  do the following:

- (a) Solve the inequality by applying the properties on inequality. (b) Graph the solution to the inequality on the number line below.

$$\begin{array}{r}
 8 - 2x > 16 \\
 -8 \quad -8 \\
 \hline
 -2x > 8 \\
 \frac{-2x}{-2} > \frac{8}{-2} \\
 x < -4
 \end{array}$$

< >  
↓  
OPEN CIRCLE

When we solve inequalities, we will also use the **commutative**, **associative**, and **distributive properties of numbers** (not equations) to write **simpler equivalent expressions** on both sides of the inequality.

**Exercise #4:** Consider the inequality  $8(x-2) - 3(2x+1) \leq 7x+4 - 3(x+1)$ .

- (a) Use the distributive, commutative, and associative properties of numbers to **simplify** the left and right hand expressions of this inequality. (b) Solve the inequality using the properties of inequality and graph the final solution set on a number line that you draw by hand.

$$\begin{array}{l}
 8(x-2) - 3(2x+1) \leq 7x+4 - 3(x+1) \\
 (8x-16) - (6x+3) \leq 7x+4 - (3x+3) \\
 2x - 19 \leq 4x + 1 \\
 \quad +19 \quad \quad +19 \\
 2x \leq 4x + 20 \\
 -4x \quad \quad -4x \\
 -2x \leq 20 \\
 \quad -2 \quad \quad -2 \\
 x \geq -10
 \end{array}$$



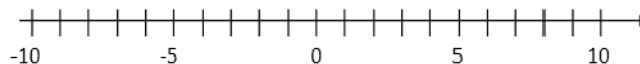
Name: \_\_\_\_\_

Date: \_\_\_\_\_

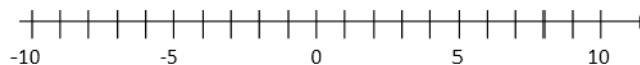
**SOLVING LINEAR INEQUALITIES  
HOMEWORK**

1. Solve the inequality using the properties of inequality and graph the final solution set on the number line provided.

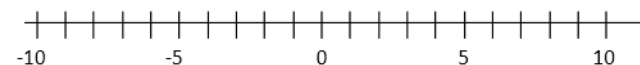
(a)  $5x - 6 \leq 24$



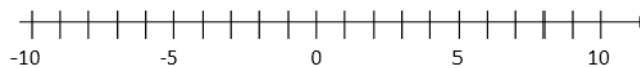
(b)  $2(5 - x) \leq 12$



(c)  $6 - 4x > 18$



(d)  $8x - 6(x - 2) > 20 - 2x$



(e)  $\frac{3(2x+2)}{6} > \frac{1}{3}x + 2$

