Name: ____________________________________ Date: __________________

SOLVING LINEAR INEQUALITIES
COMMON CORE ALGEBRA I

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.

***Exercise* #1:** 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?

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

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

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

Hmm… Based on Exercise #1, you might conclude that the **truth values** of **inequalities** have the same properites as the **truth values** for **equalities** (**equations**). But there is one huge difference between linear inequalities and linear equations.

***Exercise* #2:** 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?

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

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.

***Exercise* #3:** Write a true inequality and show that it becomes false when multiplying (or dividing, your choice) each side by a negative.

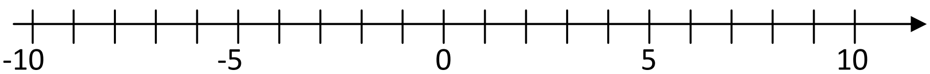
Now that we know the ways that the truth value of an inequality can remain the same or change, we can solve linear inequalities.

***Exercise* #4:** 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).

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



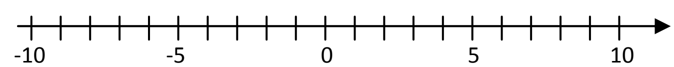
***Exercise* #5:** Given the linear inequality $8-2x>16$ do the following:

(a) Rewrite the left hand expression as an equivalent expression using addition.

(b) Solve the inequality by applying the properties of inequalities.

(c) Pick a number that is true based on your solution to (b) and show that it makes the original inequality true.

(d) Graph the solution to the inequality on the number line below.



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* #6:** 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.

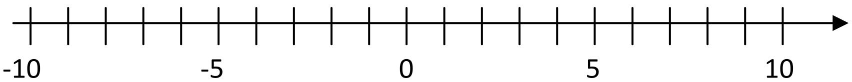
Name: ____________________________________ Date: __________________

SOLVING LINEAR INEQUALITIES
COMMON CORE ALGEBRA I HOMEWORK

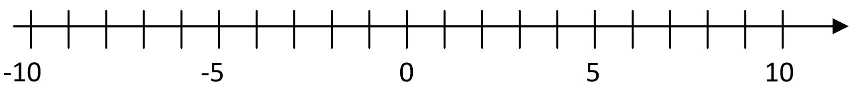
FLUENCY

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

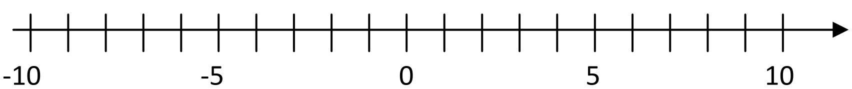
(a) $5x-6\leq 24$



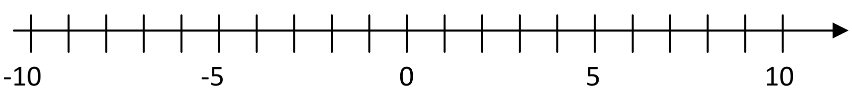
(b) $2(5-x)\leq 12$



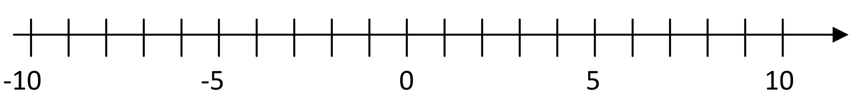
(c) $6-4x>18$



(d) $8x-6\left(x-2\right)>20-2x$



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



APPLICATIONS

2. Two siblings Edwin and Rhea are both going skiing but choose different payment plans. Edwin's plan charges \$45 for rentals and \$5.25 per lift up the mountain. Rhea's plan was a bundle where her entire day cost \$108.

   (a) Set up an inequality that models the number of trips, n, up the mountain for which Edwin will pay more than Rhea. Solve the inequality.

   (b) What is the greatest amount of trips that Edwin can take up the mountain and still pay less than Rhea? Explain how you arrived at your answer.

REASONING

3. Given a, b, c, d are all positive, solve the following inequalities for x.

   (a) $ax + b \geq cd$

   (b) $\dfrac{a(x+2)}{b} > c$

4. If $ax + b > d$ and $a < 0$ then

   (1) $x > \dfrac{d-b}{a}$

   (3) $x < \dfrac{d}{a} - b$

   (2) $x < \dfrac{d-b}{a}$

   (4) $x > \dfrac{d}{a} - b$