Date ______________

Dear Family,

In Chapter 3, your child will learn to solve inequalities in one variable.

Inequality Signs	
$>$	greater than
$<$	less than
$\geq$	greater than or equal
$\leq$	less than or equal
$\neq$	not equal

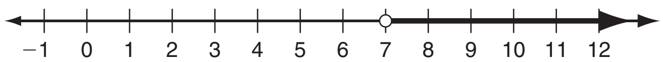
An **inequality** is a statement that two quantities or expressions are *not* equal. An inequality looks very much like an equation, but it contains a sign other than the equal sign ($=$).

A **solution** is a value that makes the inequality true. Inequalities frequently have too many solutions to name individually, so all of the possibilities are shown by graphing them on a number line.

Inequality: $x - 2 > 5$

Solution: Any value of x greater than 7 makes the inequality true, or $x > 7$.

Graph:



Graphing Inequalities on a Number Line	
For a boundary point that **is a solution...**	...use a **solid** circle.
For a boundary point that **is not a solution...**	...use an **open** circle.
For a continuous series of points **greater than...**	...use an arrow to the **right**.
For a continuous series of points **less than...**	...use an arrow to the **left**.

You solve an inequality in much the same way that you solve an equation: you **isolate the variable** by using **inverse operations** in the reverse order. However, there is one major difference: when you multiply or divide both sides of the inequality by a *negative* number, you must reverse the inequality sign. You can see why this is true with a simple example:

True Inequality:	8	$>$	-2	
	$8(-3)$		$-2(-3)$	*Multiply both sides by* -3.
True Inequality:	-24	$<$	6	$>$ must change to $<$.

With this one exception, solving one-step inequalities, multi-step inequalities, and inequalities with variables on both sides follows the same process as solving an equation.

Solve $\mathbf{5x - 4 \leq 8x + 2}$.

$$\begin{array}{rcrl}
\underline{-8x} & & \underline{-8x} & \textit{Collect the variables on one side.} \\
-3x - 4 & \leq & 2 & \\
\underline{+\ 4} & & \underline{+\ 4} & \textit{Collect the constants on the other side.} \\
\dfrac{-3x}{-3} & \leq & \dfrac{6}{-3} & \textit{Divide both sides by } -3. \\
x & \geq & -2 & \textit{Reverse the inequality when dividing by a negative.}
\end{array}$$

Also like equations, inequalities can result in identities and contradictions. An **identity** is an inequality that is *always* true. A **contradiction** is an inequality that is *never* true.

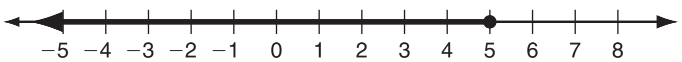
Identities:	$3 < 5$	$x \geq x$	$x + 2 > x + 1$
Contradictions:	$2 > 10$	$x < x$	$x + 5 \leq x$

A **compound inequality** is formed when two inequalities are combined using the words AND or OR. On a number-line graph, a compound inequality with AND represents the overlap, or **intersection**, of two inequalities. A compound inequality with OR represents the combined total, or **union**, of two inequalities.

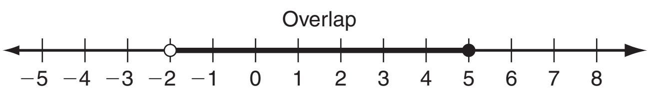
Solve $\quad$ $\boldsymbol{x > -2}$ $\quad$ **AND** $\quad$ $\boldsymbol{x \leq 5}$

This intersection could also be written as $-2 < x \leq 5$.

Graph of $x > -2$.

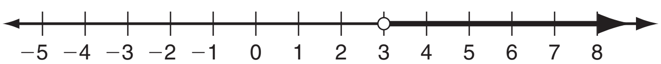


Graph of $x \leq 5$.

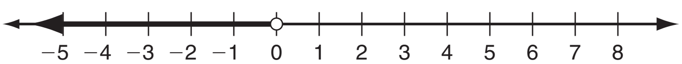


Graph of the intersection.

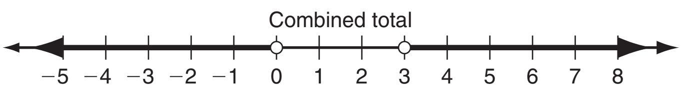
Solve $\quad$ $\boldsymbol{x > 3}$ $\quad$ **OR** $\quad$ $\boldsymbol{x < 0}$



Graph of $x > 3$.



Graph of $x < 0$.



Graph of the union.

As with all topics in algebra, inequalities can be applied to model and solve real-world problems. Here's an example:

> **Karyn has a coupon for 15% off at an online bookstore. If the total of her purchases *after* any discounts is at least $25, she will get free shipping. How much do her purchases need to total *before* the coupon in order to get free shipping?**
>
> Let x represent the total of Karyn's purchases *before* the coupon. Then $x - 0.15x$ represents her purchases *after* the coupon.
>
> "At least" means the purchases must equal or be greater than $25.
>
> **Inequality:** $x - 0.15x \geq 25$

For additional resources, visit go.hrw.com and enter the keyword MA7 Parent.