PRINCIPLES - LESSON 3E
SOLVING SIMPLE INEQUALITIES

Recall: Solving Equations

When you find the solution to an equation, you are finding the value of the variable that makes the equation true.

Solve the equation.

ex1) $3(x-2)+2x=x+5$

$3x-6+2x=x+5$

$5x-6=x+5$

$-x \quad -x$

$4x-6=5$

$+6 \quad +6$

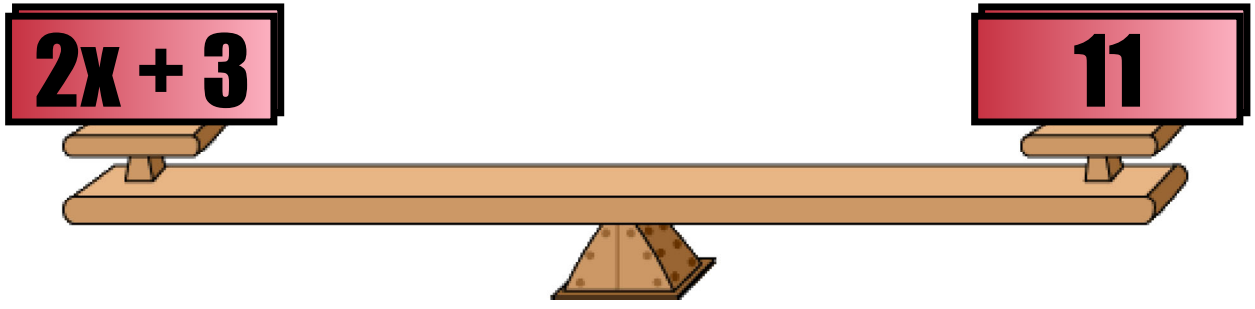
$\frac{4x}{4}=\frac{11}{4}$

$x=\frac{11}{4}$

THE DIFFERENCE BETWEEN EQUATIONS & INEQUALITIES

In an **equation**, both sides are **equal**. An equation is a balanced scale.

$$2x + 3 = 11$$



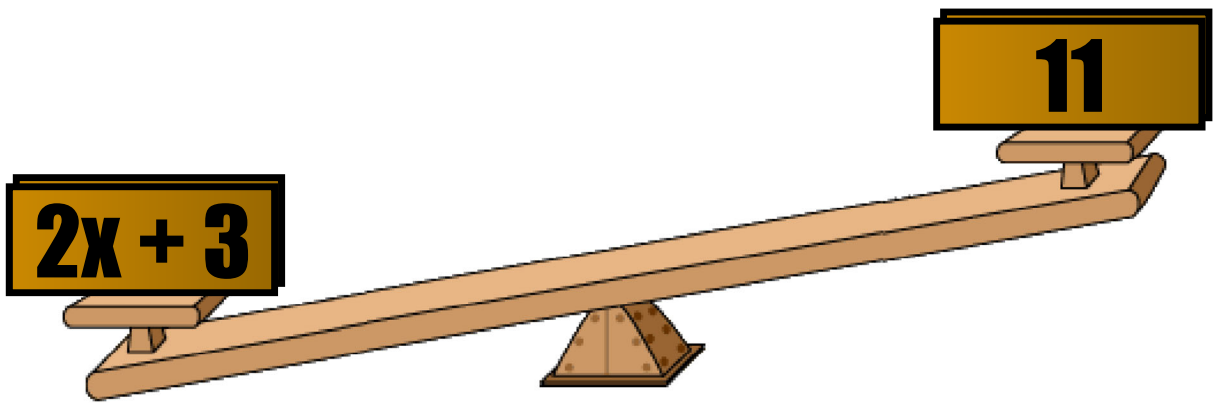
When solving an equation, your job is to find the value of the variable that perfectly balances the scale. This makes the equation **TRUE**.

If you follow the rules of Algebra, the scale stays balanced at all times.

THE DIFFERENCE BETWEEN EQUATIONS & INEQUALITIES

In an **inequality**, one side is bigger than the other.

$$2x + 3 > 11$$



When solving an inequality, your job is to find **ALL OF THE VALUES** of the variable that make the inequality true.

Just like when solving an equation, follow all the rules of Algebra.

THE SYMBOLS OF INEQUALITY

Recall: The symbols of inequality

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

SOLVING INEQUALITIES

Solving for a variable in an inequality is almost the same as solving for a variable in an equation.

Solve the inequality.

ex2) $4(2n+1)+2n < 3n-10$

$8n+4+2n < 3n-10$

$10n+4 < 3n+10$

$-3n \quad\quad -3n$

$7n+4 < 10$

$-4 \quad\quad -4$

$\frac{7n}{7} < \frac{6}{7}$

$$\boxed{n < \frac{6}{7}}$$

FLIPPING THE DIRECTION

Whenever you multiply or divide both sides of an inequality by a negative number, you must FLIP the direction of the inequality.

Solve the inequality.

ex3) $3 - 5n < 18$

$-3 \qquad -3$

$\frac{-5n}{-5} \; \textcircled{<} \; \frac{15}{-5}$

$n \; \textcircled{>} \; -3$

I just divided both sides by a negative. FLIP the direction of the inequality!

TO FLIP OR NOT TO FLIP?

$x + 3 \geq -8$

$-3 \quad -3$

NO FLIP

$-5n \leq -25$

$-5 \quad -5$

$\geq$

FLIP

$\frac{4y}{4} < \frac{-24}{4}$

NO FLIP

$\frac{m}{3} > -9$ (·3 ·3)

NO FLIP

$\frac{k}{-8} > 5$ (·(−8) ·(−8))

$<$

FLIP

$-1w \leq 2$

$-1 \quad -1$

$\geq$

FLIP

SOLVING INEQUALITIES

Solve the inequality.

ex4) $3p + 2 < 7p - 3$

$-7p \qquad -7p$

$-4p + 2 < -3$

$\quad -2 \quad -2$

$\frac{-4p}{-4} \; \textcircled{<} \; \frac{-5}{-4}$

$p \; \textcircled{>} \; \frac{5}{4}$

I just divided both sides by a negative. FLIP the direction of the inequality!

SOLVING INEQUALITIES

Solve the inequality.

ex5) $-4(2n-3)+6n \geq -5(n+2)-1$

$-8n+12+6n \geq -5n-10-1$

$-2n+12 \geq -5n-11$

$+5n \qquad +5n$

$3n+12 \geq -11$

$-12 \qquad -12$

$\frac{3n}{3} \geq \frac{-23}{3}$

No flip

$$\boxed{n \geq \frac{-23}{3}}$$

FUN WITH INEQUALITIES

When you get an answer like $x > 3$, there is more than one value of x that will make the inequality true.

ex6) List all the values of x, for which $x > 3$.

4, 5, 6, 7, 8, 9, 10, 11 ...

3.1, 3.2, 3.3, 3.4, ...

3.01, 3.02, 3.03, 3.04, ...

Impossible to list all of them!

Let's draw a picture of all of them instead..

GRAPHING INEQUALITIES

When it is impossible to list an infinite number of values, we instead draw a picture of the answers.

ex7) Graph $x \leq 4$.

SAME OR DIFFERENT?

Is there a difference in the solutions of these two inequalities?

$n \geq -6$ -6 itself IS a solution here.

$n > -6$ -6 itself IS NOT a solution here.

OPEN OR CLOSED?

Whenever you are graphing an inequality that uses "greater than" or "less than" your graph must have an OPEN circle.

$>$ OR $<$ USE ○

Whenever you are graphing an inequality that uses "greater than or equal to" or "less than or equal to" your graph must have a CLOSED circle.

$\geq$ OR $\leq$ USE ●

SOLVING INEQUALITIES

Solve and graph the inequality.

ex8) $7j - 2(j - 1) > 42$

$7j - 2j + 2 > 42$

$5j + 2 > 42$

$-2 \quad -2$

$\frac{5j}{5} > \frac{40}{5}$

No flip

$\boxed{j > 8}$

SOLVING INEQUALITIES

Solve and graph the inequality.

ex9) $\frac{-2m}{3} + \frac{4}{3} \leq \frac{3}{4}$ $\cdot 12$ $\cdot 12$ $\cdot 12$

Clear fractions by multiplying all terms by a common denominator.

$-8m + 16 \leq 9$

$-16 \quad -16$

Divide by bottom multiply by top

$\frac{-8m}{-8} \geq \frac{-7}{-8}$

FLIP!

$m \geq \frac{7}{8}$