3.1 Two-step Equations

So far we have solved only one-step equations. Many times more than one step is required.

What has been done to *x*? It was multiplied by \_\_\_\_\_\_\_ and we added\_\_\_\_\_\_\_\_.

How are we going to undo this problem to get *x* alone?

**Step 1**: add or subtract (cancel the constant)

**Step 2**: multiply or divide (cancel the coefficient)

Example1:

First: subtract 1 from both sides. Simplify.

Second: divide by 2.

*x* = \_\_\_\_\_\_\_

* Now let’s check it. Put the 4 in as the *x* in the original equation:

Example: 2



First we need to subtract 5.

Then multiply by 2.

Practice.

1. 2.

3. 4. 

5. 6.

HW: You MUST show 2 steps of work: 3.1 (page 123) #8 – 19 all and Tricky Two-Step Equations (next page in notes)

Pre-Algebra: “Tricky” Two-step equations

When solving two-step equations:

**Step 1:** Cancel the constant (on the same side as the variable) by adding or subtracting. \*Use inverse operations. \*Simplify each side of the equation.

**Step 2**: Solve the equation by multiplying or dividing. \*Use inverse operations.

1. 5.
2. 6.
3. 7.
4. 8.

3.1 Continued: Two-Step Equations- Problem Solving

Many times, we can solve a real-world problem by writing the situation as a two-step equation.

Example 1:

A school was taking 331 students on a field trip. Six buses were filled and 7 students traveled in cars. How many students were on each bus?

Step 1: Define your variable. What is our unknown?

Let \_\_\_\_\_\_= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Step 2: Use the information given in the word problem to write an equation. (\*Do not set up with your variable already by itself.) Then solve.

Example 2:

Maria put $7 in her piggy bank. A week later, she spent half of her money at the movies. She now has $22 in her piggy bank. With how much money did she start?

Let \_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Example 3:

Shayna won 40 bouncy balls playing a game at her school’s game night. Later, she gave two to each of her friends. She now has 8 remaining. How many friends received bouncy balls?

Let \_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Homework- 3.1 (page 123) #20, 23– 27 AND Independent Practice Problems below

Independent Practice: Write and solve an equation for each word problem.

1. You bought a book for $12 and 3 magazines that were the same price. You spent a total of $21. How much did each magazine cost?

2. Ali had $18 to spend. She bought a dozen bagels. After buying them, she had $9 remaining. What is the cost of each bagel?

3.2 Solving Equations with Like Terms and Parentheses

In Chapter 2, you learned how to simplify expressions using the Distributive Property and Combining Like Terms. Today, we are going to apply that to the equation-solving process.

When solving multi-step equations, be sure to simplify each side of the equation before using inverse operations.

Example 1:

**Step 1**: Clear parentheses by using the Distributive Property.

**Step 2**: Combine any like terms.

**Step 3**: Cancel the constant by adding or subtracting.

**Step 4**: Solve by using multiplication or division.

Example 2:

\*Notice that there are no parentheses.

\* Skip “Step 1” and combine like terms.

Example 3:

Distribute -3 OR Cancel -3 by dividing.

\*Notice that we don’t have any like terms.

\*Skip “Step 2” and cancel the constant by adding or subtracting.

Practice:

1. 2.

3. 4.

5. 6.

6. Find the width of the rectangle below.

Perimeter = 28cm., Length = 10 cm., Width = \_\_\_\_\_\_\_\_\_\_\_

10 cm

*x* + 2

Homework:

Day 1: 3.2 (page 127) #11-21

Day 2: 3.2 (page 128) #22-29, 33-37

Ch.3 Lesson 3: Solving Equations with Variables on Both Sides

**Things to remember:**

* You can skip a step if it doesn’t apply to the equation you are solving.
* When combining like terms:
  + The sign in front of the term stays with that term.
  + The value (positive or negative) once the terms are combined becomes the operational sign (addition or subtraction).

We are going to follow the same basic steps as we did yesterday, but we are going to add one more step in the middle of the process.

1. Clear any parentheses by using the distributive property.
2. Combine any like terms that are on the same side of the equation.
3. **Cancel one term that has a variable by adding or subtracting the entire term from both sides of the equation.**
4. Cancel the constant that is on the same side as the variable by adding or subtracting.
5. Cancel the coefficient by dividing or cancel the denominator by multiplying.

Examples:

1. 2.

3. 4.

* When you get an answer that isn’t a whole number, leave it as an improper fraction in lowest terms.

Sometimes, the equations give us an answer that results in ***no solution OR any real number***.

5.

- The terms with the variables cancel. We are left with two numbers that are not equal, which makes an untrue equation.

* When this happens, there is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to this equation.

6.

- When we simplify both sides of our

equation, we can see the same terms on both sides.

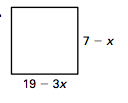
* This means that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be substituted into this equation and it will be true.

Practice:

7.

8.

9. Find the perimeter of the square.



* Since we have a square, what must be true about all 4 sides? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Therefore, what is true about these two expressions? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Set the expressions equal to each other, then solve for *x*.

HW: 3.3 (page 134) #11-21 odd, 23-27 odd, 29-31, 34-37

3.4 Solving Inequalities Using Addition and Subtraction

* Inequalities show the relationship between two unequal expressions.

You already know \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Today, we are going to learn two new symbols:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Write the following phrases using numbers and symbols:

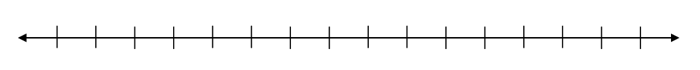
* I am over 21 years of age. \_\_\_\_\_\_\_\_\_\_\_\_\_
* The speed limit is 55 mph. \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* In order to write these algebraically, we need to use an inequality.

If I give you the inequality

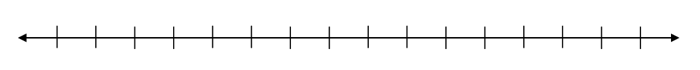
Is a solution? Yes or No

Is a solution? Yes or No

Is a solution? Yes or No

How would you show on a number line? 

What about ?



**TO GRAPH:**

* Use a \_\_\_\_\_\_\_\_\_\_\_\_\_\_circle if it has the less than or equal to OR the greater than or equal to.
* Use an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ circle if it is less than OR greater than.
* The open circle means the point is \_\_\_\_\_\_\_\_\_ included in the solution set.

Practice graphing:

1. 2.

3. 4.

Sometimes, the inequality is a bit more complex than . For example:

We get the *x* by itself the SAME way we would if there were an equal sign.

Now show the answer on a number line.

Sometimes, the variable is on the right side of the inequality.

First, get the *x* alone, just as if it were an equal sign.

That inequality can be confusing to a lot of students, so let’s turn it around and get the *x* on the left side. We CANNOT just flip it, we must imagine it in a mirror.

Think about it, if 12 is**greater** than to *x*, then *x* must be **less than** to 12.

Practice. Solve and graph. Show at least 3 points on the number line.

5. 6.

7. 8.

HW: 3.4 (page 143) #12 – 40 even

3.5 Solving Inequalities Using Multiplication and Division

We all agree that .

Fill in the following True/False Chart.

True /False (adding 2 to both sides)

True/False (subtracting 2 from both sides )

True/False (multiplying each side by 2)

True/False (multiplying each side by -2)

True/False (dividing each side by 2)

True/False (dividing each side by -2)

When we multiply or divide by a negative number, the inequality is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Yesterday we learned that we could add or subtract in an inequality just like an equation.

But, today, we found out that we CANNOT just multiply or divide without thinking:

* When we multiply by a positive number, everything stays the same.
* **BUT when we multiply by a negative number, the INEQUALITY SIGN SWITCHES DIRECTIONS.** The math computation STAYS THE SAME.

Example 1:

* When we divide by a positive, nothing changes.

Example 2:

* We had to switch the sign to keep the inequality correct.

Example 3:

* Notice that the sign of the other number doesn’t matter. You only switch the sign when you are trying to cancel a negative number.
* ***Only flip the sign when you multiply or divide by negative number.***

Solve the inequality and graph the solution.

1. 2.

3. 4.

5. 6. 

7. 8. 

HW 3.5 (page 148) # 20 – 27 all & 29 – 35 all, 45

3.6 Two-Step Inequalities

Solving two-step inequalities is similar to solving two-step equations, just remember the new rule: **WHEN MULTIPLYING OR DIVIDING BY A NEGATIVE NUMBER, YOU MUST SWITCH THE SIGN!**

\***Switch the sign when dividing by a negative.**

Other than the new rule from yesterday, we solve inequalities the same as equalities.

Practice:

1. 2.

3. 4.

5. 6.

HW: 3.6 (page 153) #10, 12, 14-16, 18-19 AND #1-8 in notes (Below)

1. 2.

3. 4.

5. 6.

7. 8.

3.6 Continued- Solving Multi-Step Inequalities

Solving multi-step inequalities is similar to solving multi-step equations, just remember the new rule: **WHEN MULTIPLYING OR DIVIDING BY A NEGATIVE NUMBER, YOU MUST SWITCH THE SIGN!**

Example 1:

\*Combine Like Terms.

Example 2:

\*Use the Distributive Property.

Example 3:

\*Use the Distributive Property.

\*Then Combine Like Terms.

Homework: 3.6 (page 153) #17, 20-21 and Solve the following inequalities. Graph the solutions.

1. 2.

3. 4.

5. 6.