

# Honors Algebra I      Summer Work Packet 2025      Grade 8

June 4, 2025

Dear Student,

Welcome to Algebra 1! Algebra 1 is the branch of mathematics which uses letters and symbols to express relationships between quantities in terms of formulas, and equations. Algebraic symbolism and operations enter into nearly all branches of science, including the various subdivisions of mathematics.

Topics in Algebra I include real numbers and their operations, simplifying expressions, solving linear equations and inequalities, functions, systems of equations, polynomials, factoring, exponents and radical expressions, and quadratic equations.

Your summer math work addresses the material that you were exposed to in 7th grade. I am giving you the majority of the first unit of our Algebra I curriculum. You will also receive a few other review pages.

Please use the student handouts for each lesson in unit one to help with the work that will be following each lesson on PINK colored paper. Please keep all pages in order. You will lastly work on the additional pages that are colored pink. Please bring the binder and all work completed to our first class next year!

Your summer work will serve two purposes:

1. It will allow you to remain mathematically fresh during the summer.
2. It will allow you to enter Algebra 1 prepared, and ready, with a review of previous mathematical concepts.

To receive credit, **all work must be shown in the space provided for each question. This includes any multiple choice section.** All work must be done in pencil, neat and organized (boxed answers after steps shown).

This **WILL** be graded and count towards your first trimester grade.

I hope that you have an enjoyable summer and return ready for Algebra I!

*Mrs. DiBerardinis*

# SIMPLIFYING EXPRESSIONS

## EXPRESSIONS

- An expression is a mathematical phrase that may contain numbers, variables and/or operators (like Addition and Subtraction).
- A variable is a letter that represents an unknown value.
- Terms are separated by + and - signs.
- The coefficient is the value in front of a Variable in a term.
- A term without any variables is known as a Constant.

## TERMS & COEFFICIENTS

Based on the definitions above, complete the table for each expression below.

$$5x + 17 - 11y$$

TERMS	$5x, 17, -11y$
VARIABLES	$x, y$
COEFFICIENTS	5, -11
CONSTANTS	17

$$-2.5y - 8 + z + 9$$

TERMS	$-2.5y, -8, z, 9$
VARIABLES	$y, z$
COEFFICIENTS	-2.5, 1
CONSTANTS	-8, 9

## LIKE TERMS

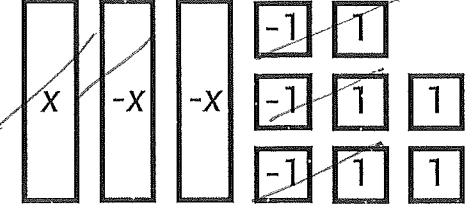
- Like terms have both the same base (or variable) and the same exponent (or power).

Classify each pair of terms as "like" or "unlike". Explain your reasoning in the last column.

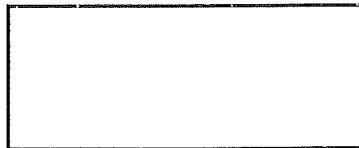
TERMS	LIKE OR UNLIKE?	EXPLAIN
$-3c$ and $5c^2$	unlike	The exponents are not the same.
$\frac{1}{4}$ and 20	like	Both are constants; no variables.
$8.5x$ and $8.5y$	unlike	The variables are not the same.
$100p$ and $-p$	like	The variables & exponents are the same.

Expressions do not contain equal signs, and therefore cannot be solved. However, expressions can be Simplified by combining like terms.

Use algebra tiles to model the expressions in 1-3 (the first has been given as an example). Then, record the simplified version of the expression.

1. $x - 2x - 3 + 5$  $-x + 2$	2. $2 + 2x - 4x - 3$ $(2x - 4x) + (2 - 3)$ $-2x - 1$	3. $-x + x - 5 - 1 + x$ cancel $x - 6$
--	---	---

Simplify each of the expressions below by combining like terms.

4.  $19n + 17r + 15$	5. $-x + 6y - 9x - 2y - 4y$ $-6y + 6y$ cancel $-9x - x$ $E/0x$	6. $1.7 + 8.2j - 3.4 + 4.7j$ $-1.7$ $12.9j - 1.7$
7. $-4\frac{1}{2}x + 15 + \frac{7}{2}x - 23$ $-\frac{9}{2} - 8 + \frac{7}{2}x = -\frac{2}{2}x - 8$ $-x - 8$ ( $\frac{2}{2}x = -1x$ )	8. $4a - 7.5b + 9b - 2.1a$ $1.9a + 1.5b$	9. $\frac{3}{8} + 15g - \frac{11}{8}g - 13g + \frac{1}{8}$ $\frac{4}{8} + 2g - \frac{11}{8}g = \frac{4}{8} + \frac{16}{8}g - \frac{11}{8}g$ $\frac{5}{8}g + \frac{1}{2}$
10. Simplify an expression for the perimeter of the rectangle. $P = 2l + 2w$ $24.6x - 10.4$  $P = 2(24.6x - 10.4) + 2(7x + 3.1)$ Perimeter: $63.2x - 14.6$	11. Marge simplified the expression as shown below. $-8b + 15b + 14 \rightarrow 21b$  What mistake did Marge make, and what is the correct simplified version of the expression?  Marge combined the constant term 14 with the variable terms; $7b + 14$ ↑ correct!	

Summarize today's lesson:

Use Handout #1 as a reference.  
**SIMPLIFYING EXPRESSIONS**

Solve each of the problems below. Be sure to show all work.

1. Which of the following is an example of like terms?

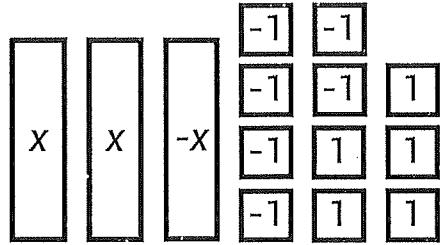
- a.  $-16$  and  $-16x$
- b.  $x$  and  $x^2$
- c.  $50y$  and  $-y$
- d.  $2a$  and  $2$

2. Which of the following is NOT true about the expression given below?

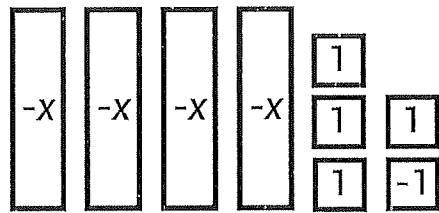
$$14b - 7 + 8b + b$$

- a. There are three terms
- b. There is one constant term
- c. The coefficients are 14, 8 and 1
- d. Three of the terms are like terms

3. Write a simplified algebraic expression for the model.



4. Write a simplified algebraic expression for the model.



Simplify the expressions in 5-9.

5.

$$-4w + 17 - 10w + w$$

6.

$$-8 + 2x + 17 - 9x + 20$$

7.

$$-1.5p - 16.5 + 30 + 4.5p$$

8.

$$\frac{2}{3}y - 25 + \frac{4}{3}y + 26$$

9.

$$13.8b - 2.2 + 9.6 + 10.8b - b$$

10. Matt and Noah simplified the expressions as shown. Who made a mistake, and what should the correct simplified version of the expression be?

MATT

$$12x - 9x + 16 - 0.2x$$

$$-13.2x$$

NOAH

$$-0.4n + 33n - 1.2 + 6$$

$$32.6n + 4.8$$

# SIMPLIFYING EXPRESSIONS

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

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

##  
mazda

**Instructions:** Follow the correct simplified expression of each problem to make it through the maze. Shade or color your path as you go.

START

```

graph TD
    A["6 + 2x - 4x - 3"] --> B["q + 2x"]
    A --> C["-4x - 6 + 5x"]
    B --> D["-x - 6"]
    B --> E["3 - 2x"]
    C --> F["1.2j + 12m"]
    C --> G["1.2j + 12m"]
    D --> H["1.2j + 12m"]
    D --> I["2.4m"]
    E --> J["3.4j - 5y"]
    E --> K["2.4h - 5y"]
    F --> L["3/4h - 5y + 2h"]
    F --> M["-3k + 7"]
    G --> N["-k + -2k + 7"]
    G --> O["5k - 21"]
    H --> P["3k + 7"]
    H --> Q["-16k"]
    I --> R["10y"]
    I --> S["3y + y + 6y"]
    J --> T["3g - 5"]
    J --> U["1/3g - 5 + 2/3g"]
    K --> V["-10f + 2"]
    K --> W["-4.5f - 5.5f + 2"]
    L --> X["m"]
    M --> Y["3m - 5m + 3m"]
    N --> Z["-0.75k - 3q"]
    O --> AA["FINISH!"]
  
```

# SIMPLIFYING EXPRESSIONS

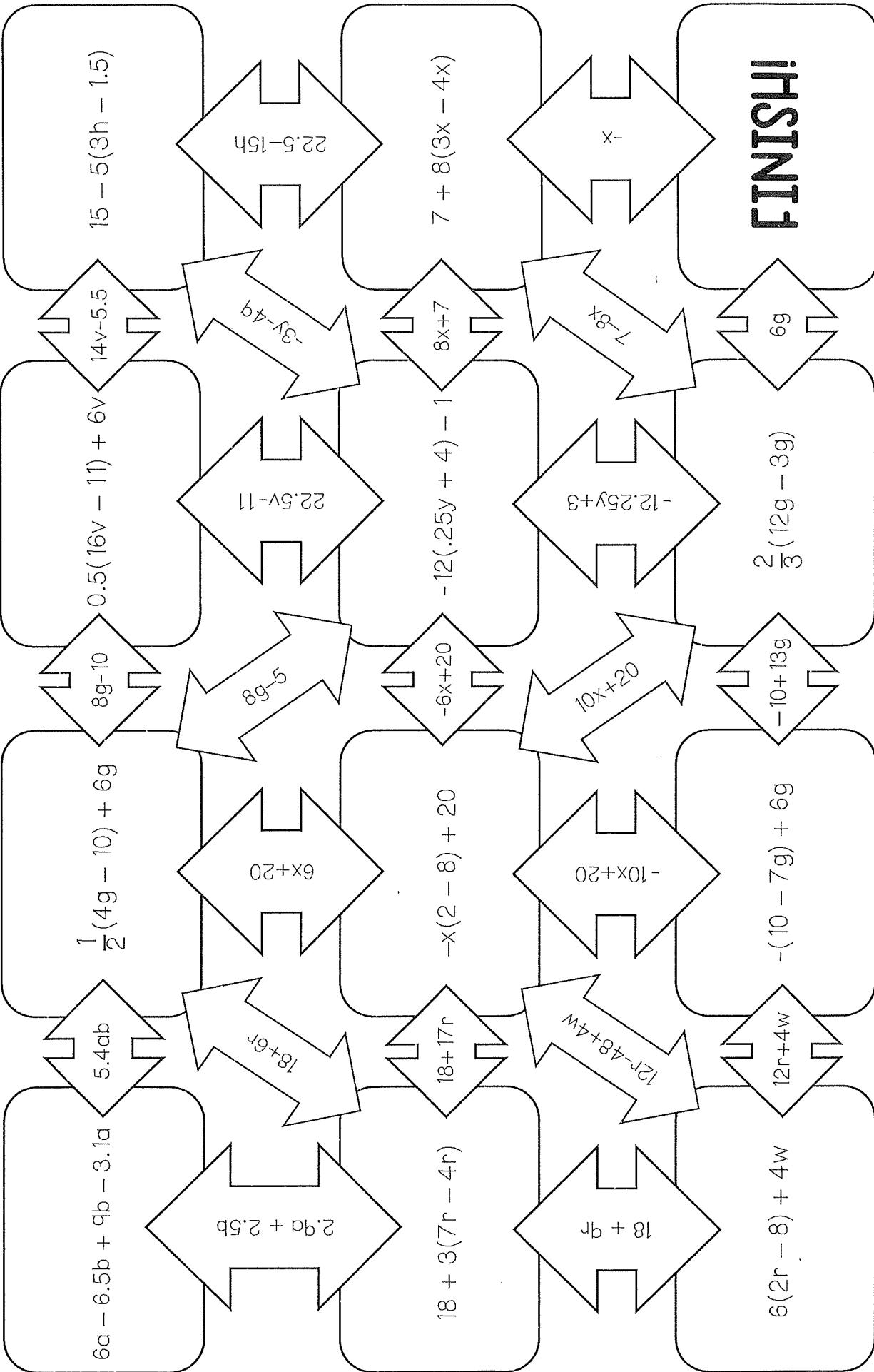
Name: \_\_\_\_\_

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

## MAZE #2

Instructions: Follow the correct simplified expression of each problem to make it through the maze. Shade or color your path as you go.

START



## SIMPLIFYING EXPRESSIONS WITH THE DISTRIBUTIVE PROPERTY

a. Write in words the meaning of  $3(12)$ .

3 groups of 12 OR

3 times 12 OR

3 multiplied by 12

c. Use algebra tiles to sketch  $3(x - 4)$ . Then, write the simplified expression.

distribute if algebra tiles  
are too confusing - they are  
only models!

$$3(x-4) = 3x-12$$

b. Applying your thinking from part a, write the meaning of  $3(x - 4)$ .

3 groups of  $(x-4)$  OR

3 multiplied by  $(x-4)$

d. Explain a method for finding the simplified expression of  $3(x - 4)$  without algebra tiles.

Multiply 3 by  $x$  and  
add it to 3 times  $-4$ .

## DISTRIBUTIVE PROPERTY

- The distributive property allows us to multiply each term inside the parentheses by the number outside the parentheses.
- Algebraically, we would say:

$$a(b + c) = \underline{ab + ac} \quad a(b - c) = \underline{ab - ac}$$

- Be careful with your sign when multiplying positives and negatives!

Using the distributive property, simplify the following expressions.

1.  $\overbrace{4(x + 2)}$

$4x + 8$

2.

$\overbrace{-(5x - 7)}$

$-5x - (-7)$

3.

$-8(0.25x + 2)$

$-2x - 16$

4.

$\frac{1}{2}(x - 9)$

think!!  
 $\frac{1}{2} \times \frac{9}{1}$

$\frac{1}{2}x - \frac{9}{2}$

5.

$\overbrace{14 - 6(3x - 1.5)}$

$14 - 18x + 9$

$23 - 18x$  or

$-18x + 23$

What makes question 5 different than questions 1-4?

Simplify the expressions by distributing and combining like terms, if necessary.

6.

$$16x + 5.6(2x - 11)$$

$$16x + 11.2x - 61.6$$

$$27.2x - 61.6$$

7.

$$13(1.4 + 2w)$$

$$18.2 + 26w$$

8.

$$\frac{3}{4}(16m - 5) - \frac{3}{2}$$

$$12m - \frac{15}{4} - \frac{3}{2}x^2$$

$$12m - \frac{15}{4} - \frac{6}{4}$$

$$12m - \frac{21}{4}$$

9.

$$15.4 - 5.2(3f + 1.2)$$

$$15.4 - 15.6f - 6.24$$

$$9.16 - 15.6f$$

10.

$$\frac{5}{8}x - 14 - 2(7 - \frac{1}{4}x)$$

$$\frac{5}{8}x - 14 + \frac{1}{2}x$$

$$\frac{5}{8}x - 14 + \frac{4}{8}x$$

$$\frac{9}{8}x - 14$$

make common denominators

11. Shondra simplified the following expression but made an error. Describe her mistake and then correctly simplify the expression.

$$26.7 - 6.3(6x - 10.1)$$

$$26.7 - 37.8x - 63.63$$

$$-37.8x - 36.93$$

Shondra forgot to distribute the negative to the 2nd term in the parenthesis. Corrected =  $-37.8x + 90.33$

Shondra forgot to distribute the negative to the 2nd term in the parenthesis. Corrected =  $-37.8x + 90.33$

12. Glenn simplified the following expression but made an error. Describe his mistake and then correctly simplify the expression.

$$18 + \frac{3}{5}(6x - 15)$$

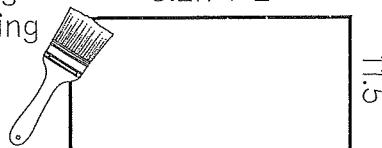
$$3 + \frac{3}{5}(6x)$$

$$3 + \frac{18}{5}x$$

Glenn forgot to distribute before he combined like terms.

$$\text{Answer: } \frac{18}{5}x + 9$$

13. Oscar is painting a wall with the following dimensions.



a. Circle the unit of measurement that would be appropriate for the "height" of the wall. ft<sup>2</sup> ft ft<sup>3</sup> in. area!

a.  $\text{ft}^2$

(b)  $\text{ft}$

c.  $\text{ft}^3$  not volume!

b. Write the simplified expression for the area of the wall using the correct units.

$$A = \ell \times w$$

$$A = 11.5(8.2h + 2)$$

$$94.3h + 23$$

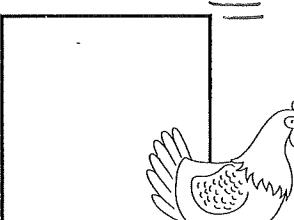
$$94.3h + 23 \text{ ft}^2$$

14. Georgia is fencing in a section of her yard for a chicken coop. The area will be square-shaped. Write the expression that represents the amount of fencing she will need. Perimeter!

$$P = 4s \quad (s = \text{sides})$$

$$P = 4(9\frac{2}{3}x - 19)$$

$$P = 4\left(2\frac{2}{3}x - 19\right)$$



$$9\frac{2}{3}x - 19 \text{ in.}$$

$$P = \frac{116}{3}x - 76$$

$$\frac{116}{3}x - 76 \text{ in.}$$

Summarize today's lesson:

Use Handout #2 as a reference.  
**SIMPLIFYING EXPRESSIONS WITH THE DISTRIBUTIVE PROPERTY**

Each of the cards on the left simplifies to the same expression as one of the cards on the right. Find the matching expressions to complete the sentences below.

A

$$-1 + 0.4(3x - 20)$$

B

$$5x - 7.4(x - 3) + 8.1$$

C

$$-6 + \frac{1}{4}x + 3(\frac{1}{4}x + 6)$$

D

$$16.5 - 2(5.1x + 9)$$

E

$$12 + 5(4x - 6)$$

F

$$17x - 4(4x - 3)$$

G

$$-0.8(3x - 31) + 5.5$$

H

$$-22.8 + 0.6(2x + 23)$$

I

$$11x + 3(3x - 6)$$

J

$$-4.2x - 3(2x + 0.5)$$

1. Card A and Card \_\_\_\_\_ simplify to the expression \_\_\_\_\_.

2. Card B and Card \_\_\_\_\_ simplify to the expression \_\_\_\_\_.

3. Card C and Card \_\_\_\_\_ simplify to the expression \_\_\_\_\_.

4. Card D and Card \_\_\_\_\_ simplify to the expression \_\_\_\_\_.

5. Card E and Card \_\_\_\_\_ simplify to the expression \_\_\_\_\_.

# SOLVING MULTI-STEP EQUATIONS

- Label each part of the equation at the right.
- Explain what it means to solve an equation:

Find the value of the variable  
needed to make the  
equation true.

$30x + 8 = -6$

Coefficient      Variable      Constant

## SOLVING EQUATIONS

- The goal in solving an equation is to isolate the variable by using inverse, or opposite, operations.

- Distribute if necessary
- Combine any like terms
- Isolate the variable:
  - Use addition/subtraction to remove the constant.
  - Use multiplication/division to remove the Coefficient.

## STEPS TO SOLVE

Explain in your own words how you can check your solution after solving:

Plug the solution back into the original  
equation in place of the variable and see if  
it makes the equation true.

Solve each of the equations below. Be sure to show all work and your check-step.

$$8x - 14 + 16x + 5 = 39$$

CHECK:

$$8x + 16x - 14 + 5 = 39$$

$$\begin{aligned} 24x - 9 &= 39 \\ +9 &+9 \\ 24x &= 48 \\ \hline 24 & 24 \end{aligned}$$

$$x = 2$$

$$-3(12x + 9) = 99$$

CHECK:

$$-36x - 27 = 99$$

$$+27 +27$$

$$\begin{aligned} -36x &= 126 \\ \hline -36 & -36 \end{aligned}$$

$$x = -3.5$$

$$-(2x + 5) + 14 = 22$$

CHECK:

$$-2x - 5 + 14 = 22$$

$$\begin{aligned} -2x + 9 &= 22 \\ -9 &-9 \end{aligned}$$

$$\begin{aligned} -2x &= \frac{13}{-2} \\ \hline -2 & -2 \end{aligned}$$

$$x = -6.5$$

$$3.4(x + 7) - 2.1x = 35.5$$

CHECK:

Solve each of the following multi-step equations.

1.

$$\begin{aligned} \frac{1}{2}(b-10) + 2b &= 25 \\ \frac{1}{2}b - 5 + 2b &= 25 \\ \frac{1}{2}b - 5 &= 25 \\ \frac{1}{2}b &= 30 \\ b &= 12 \end{aligned}$$

2.

$$\begin{aligned} 16.75 + 3.2d - 4 + 6d &= 51.39 \\ 12.75 + 9.2d &= 51.39 \\ -12.75 & \\ \frac{9.2d}{9.2} &= \frac{38.64}{9.2} \\ d &= 4.2 \end{aligned}$$

3.

$$\begin{aligned} 19 - 5(2m-3) + 9m &= 36 \\ 19 - 10m + 15 + 9m &= 36 \\ 34 - m &= 36 \\ -34 & \\ \frac{-m}{-1} &= \frac{2}{-1} \\ m &= -2 \end{aligned}$$

4. What value of  $n$  makes the following equation true?

$$3.5 - (n + 21) - 4n = -45$$

$$\begin{aligned} 3.5 - n - 21 - 4n &= -45 \\ -5n - 17.5 &= -45 \\ +17.5 & \\ -5n &= 27.5 \\ n &= 5.5 \end{aligned}$$

5. Determine if  $-6$  is the solution to the equation below. Explain your reasoning.

$$8(0.25x + 5) - 25 = 3$$

$$\begin{aligned} 2x + 40 - 25 &= 3 \\ 2x + 15 &= 3 \\ 2x &= -12 \\ x &= -6 \end{aligned}$$

6. Ms. Cho gives her class the rectangle shown below. Use the dimensions of the rectangle to fill in the appropriate units for the area of the rectangle, then complete a-c.

$$A = 99 \text{ in}^2$$

5  
5  
5

$$A = l \times w$$

a. Write an equation to represent the situation:  $44x + 11 = 99$

$$\begin{aligned} 5.5(8x+2) \\ 44x + 11 = 99 \end{aligned}$$

b. What is the value of  $x$ ?  $x = 2$

$x = 2 \rightarrow 8x + 2 \text{ in} \rightarrow 8(2) + 2 = 18$  c. What are the dimensions of the rectangle?  $5.5 \text{ in by } 18 \text{ in}$

7. Eva bought popcorn, candy and a drink at the movies. The popcorn was three times as expensive as the candy and the drink was twice as expensive as the candy. Eva spent a total of \$10.50.

a. Write an equation to represent the situation. Let  $c$  represent the cost of the candy.

$$C + 3C + 2C = 10.5$$

b. Find the value of  $c$ .

$$\frac{6c}{6} = \frac{10.5}{6} \\ C = 1.75$$

c. How much did Eva's drink cost?

$$C \times 2 = 1.75 \times 2 = \$3.50$$

8. The perimeter of the equilateral triangle is 157.5 inches.

$$P = 157.5 \text{ in.}$$

$$3(4.5x - 1.5)$$

$$13.5x - 4.5 = 157.5$$

$$13.5x = 162 \\ x = 12$$

a. Write an equation to represent the situation.

$$3(4.5x - 1.5) = 157.5$$

b. Find the value of  $x$ .

$$x = 12$$

Summarize today's lesson:

Use handout #3 as a reference.  
**SOLVING MULTI-STEP EQUATIONS**

1. Mateo is going to solve the equation below. Which of the following represents the equation after combining the like terms?

$$-8x + 23 - 22x + 9 = 182$$

- a.  $14x + 32 = 182$
- b.  $-30x + 32 = 182$
- c.  $14x + 14 = 182$
- d.  $-30x + 14 = 182$

2. Joy is going to solve the equation below. Which of the following represents the equation after distributing and combining like terms?

$$14 - 7(2x - 8) = 21$$

- a.  $-14x + 70 = 21$
- b.  $14x - 56 = 21$
- c.  $56x = 21$
- d.  $-14x - 42 = 21$

Solve each of the following equations. Be sure to show all work.

3.  
 $4(8x + 4) - 20 = -20$   
 \_\_\_\_\_

4.  
 $-7b + 22 + b = 55$   
 \_\_\_\_\_

5.  
 $19 + 1.5(10m - 8) = 127$   
 \_\_\_\_\_

6.  
 $\frac{2}{3}(6k - 30) + k = 100$   
 \_\_\_\_\_

7.  
 $11 - (15g - 13) = -6$   
 \_\_\_\_\_

8.  
 $10.25 + 8.9c - 6 - 7c = 10.33$   
 \_\_\_\_\_

9. Use the hints to write the name of the student who solved each equation above the box:

**$2(4x - 12) + 1 = 9$**

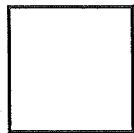
**$2.5x + 1 - 7x = -44$**

**$5 - 4(x - 3) = -15$**

- Rob, Maddie and Belinda each solved an equation.
- The solution to Maddie's equation is twice the solution to Rob's equation.
- The solution to Belinda's equation is 2 more than the solution to Maddie's equation.

Solve each of the following multi-step equations.

10. The perimeter of the square below is 28.4 cm.



$$3.6x - 1.9$$

11. A bus currently has three passengers, Crew, Marty and Blakely. Marty's age is 1.5 times Crew's age. Blakely's age is 0.75 times Crew's age. If the sum of the three ages is 104, find the age of each passenger.

Crew: \_\_\_\_\_

Marty: \_\_\_\_\_

Blakely: \_\_\_\_\_

a. What is the value of  $x$ ? \_\_\_\_\_

b. Find the side length of the square: \_\_\_\_\_

# EQUATIONS WITH VARIABLES ON BOTH SIDES

Keisha modeled the equation  $x - 3 = -2x + 5$  at the right.

- What do you notice about the equation?

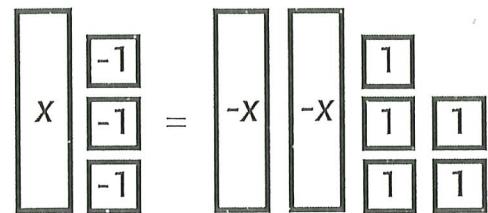
Variables on both sides

- How can Keisha collect the variables on one side of the equation?

Add  $2x$  to each side - cancelling out variables on the right

- How can Keisha collect the constants on one side of the equation?

Add  $3$  to each side - cancelling out the constants on the left



## STEPS TO SOLVE

- Distribute and/or Combine like terms (if necessary)
- Collect Variables on one side of the equal sign
- Collect Constants on the other side of the equal sign
- Solve the equation

Solve each of the equations below. Be sure to show each step of your work.

1.

$$11x - 8 = -7x + 64$$

$$+7x \quad +7x$$

$$18x - 8 = 64$$

$$+8 \quad +8$$

$$\underline{18x} = \underline{\frac{72}{18}}$$

$$x = 4$$

CHECK:

2.

$$-2x + 9 = 5(2x - 3)$$

$$-2x + 9 = 10x - 15$$

$$-10x \quad -10x$$

$$-12x + 9 = -15$$

$$-12x \quad -9$$

$$\underline{-12x} = \underline{\frac{-24}{-12}}$$

$$x = 2$$

CHECK:

3.

$$5(k + 14) = \frac{1}{5}(20k - 80)$$

$$5k + 70 = 4k - 16$$

$$-4k \quad -4k$$

$$k + 70 = -16$$

$$-70 \quad -70$$

$$\underline{k} = \underline{-86}$$

4.

$$2 - 8(0.2h - 1) = 3.5h - 2.75$$

$$2 - 1.6h + 8 = 3.5h - 2.75$$

$$10 - 1.6h = 3.5h - 2.75$$

$$-10 \quad -10$$

$$-1.6h = 3.5h - 12.75$$

$$+3.5h \quad +3.5h$$

$$-5.1h = -12.75$$

5.

$$-(8 - 2n) = 8 - 2(12 - 3n)$$

$$-8 + 2n = 8 - 24 + 6n$$

$$-6n \quad -6n$$

$$-8 - 4n = -16$$

$$+8 \quad +8$$

$$-4n = -8$$

$$\underline{-4} \quad \underline{-4}$$

$$n = 2$$

Explain how you determined which side of the equation to collect your variable terms:

$\underline{-5.1}$   
 $\underline{h} = \underline{2.5}$

Solve each of the equations at the right.

What do you notice about each equation after solving? Compare and contrast the solutions.

$$4(2x - 4) = 8x + 3$$

$$8x - 16 = 8x + 3$$

$$-16 = 3$$

false statement

$$-10x + 16 = -2(5x - 8)$$

$$-10x + 16 = -10x + 16$$

$$16 = 16$$

true statement

### ONE SOLUTION

### TYPES OF SOLUTIONS

Only one value will make the equation true

$$\text{Ex: } 5x - 10 = 20$$

$$\boxed{x = 6}$$

### NO SOLUTION

There is not a value that will make the equation true

$$\text{Ex: } 2x - 1 = 2x + 5$$

$$\begin{array}{r} -2x \\ -1 = 5 \\ \hline -1 = 5 \end{array}$$

### ALL REAL NUMBERS

Any real number will make the equation true; infinite solutions

$$\text{Ex: } 4(2x + 3) = 8x + 12$$

$$\boxed{8x + 12 = 8x + 12}$$

Solve each of the equations. Be sure to show all work.

6.

$$7 - 0.5(10x - 4) = 3 - 5x + 6$$

$$\begin{array}{r} 7 - 5x + 2 = 3 - 5x + 6 \\ +5x \\ \hline 7 + 2 = 3 + 6 \end{array}$$

$$\boxed{9 = 9} \quad \boxed{x = \text{ALL REAL Numbers}}$$

7.

$$-(14 - 9c) = 4(2c + 5)$$

$$\begin{array}{r} -14 + 9c = 8c + 20 \\ -8c + 9c \\ \hline -14 + c = 20 \end{array}$$

$$\boxed{c = 34} \quad \boxed{\text{One solution}}$$

8.

$$-0.75(12x + 60) = -x - 8x - 15$$

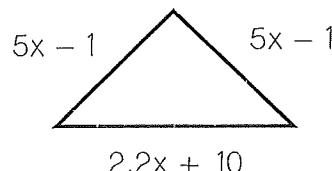
$$\begin{array}{r} -9x - 45 = -9x - 15 \\ +9x \\ \hline -45 = -15 \end{array}$$

$$\boxed{\text{No Solution}}$$

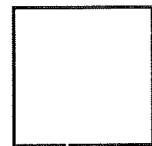
Write an equation to solve each question below.

9. Gil has traveled 4.5 miles and continues at a speed of 62.5 miles per hour. Andy has traveled 29.5 miles and continues at a speed of 50 miles per hour. If the cars continue at the same speed, how many hours will it take until Andy and Gil travel the same number of miles?

10. The perimeter of the triangle and the perimeter of the square are the same. What is the value of  $x$ ?



$$6.5x - 11.8$$



$$\begin{aligned} 2(5x - 1) + 2.2x + 10 &= 4(6.5x - 11.8) \\ 10x - 2 + 2.2x + 10 &= 26x - 47.2 \\ 12.2x + 8 &= 26x - 47.2 \end{aligned}$$

$$\text{Equation: } 12.2x + 8 = 26x - 47.2$$

$$\text{Solution: } x = 4$$

$$-13.8x = -55.2$$

$$\boxed{x = 4}$$

Summarize today's lesson:

Use handout #4 as a reference.  
EQUATIONS WITH VARIABLES ON BOTH SIDES

In 1-6, record the problem number in the box with the correct solution. Then solve questions 7 & 8.

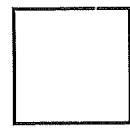
$x = -2$

$x = 3.5$

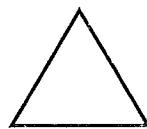
NO SOLUTION

ALL REAL NUMBERS

1. $58 - 8x = 30x - 75$	2. $4.2(15 + 5x) = -20x - 21 - x$	3. $-9.5(2x - 10) = 3.8(-5x + 25)$
4. $-4x + 24 = 8 - \frac{2}{5}(10x - 60)$	5. $-4x + 51 = 2x + 7(x + 11)$	6. $5.5(2x + 1) = -5.5x + 63.25$
7. A pool contains 50 gallons of water and is filling at a rate of 2.3 gallons per minute. A second pool contains 102.2 gallons of water and is draining at a rate of 3.5 gallons per minute. After how many minutes will the pools contain the same amount of water?		8. The square and equilateral triangle below have equal perimeters. Find the value of $x$ . Then, calculate the perimeter of each shape.



$$7x - 8.1$$



$$10x - 13$$

$$x: \underline{\hspace{2cm}}$$

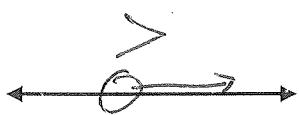
$$\text{Perimeter: } \underline{\hspace{2cm}}$$

## SOLVING ONE AND TWO-STEP INEQUALITIES

An equation uses an equal sign to show that both sides are equal.  
An inequality shows that both sides are not equal.

Write the symbol and sketch a number line for each of the following:

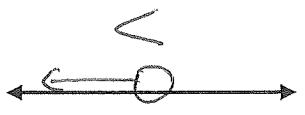
**GREATER THAN**



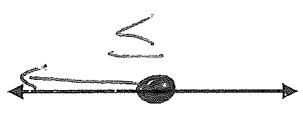
**GREATER THAN OR EQUAL TO**



**LESS THAN**



**LESS THAN OR EQUAL TO**



### SOLVING INEQUALITIES

1. Use the same steps as used in solving equations.
2. When you multiply or divide by a negative number, the inequality sign is flipped (watch for negative signs).
3. Choose a number in your solution set to check the answer.

Solve the inequalities. Then choose a number in your solution set to check and sketch a graph.

1.

$$x - 5 > 32$$

$$+5 +5$$

$$x > 37$$

2.

$$\frac{-13x}{-13} \leq \frac{117}{-13}$$

$$x \geq -9$$

flip!

3.

$$\frac{5}{2}r + 10 < 55$$

$$-10 -10$$

$$\frac{5}{2}r < \frac{45}{2}$$

$$r < \frac{45}{2} \times \frac{2}{5}$$

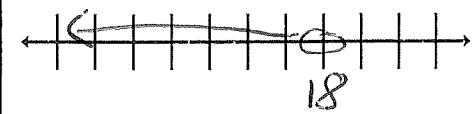
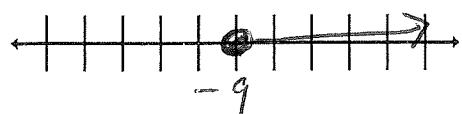
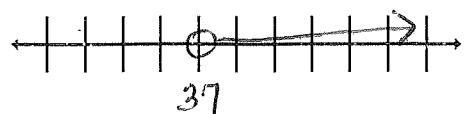
✓ CHECK:

$$39 - 5 > 32$$

$$34 > 32$$

✓ CHECK:

$$r < 18$$



Find the solution set for the following inequalities. For #7 and #8, find and graph the solution set.

4.

$$\begin{aligned} 11 &< -k + 19 \\ +k & \quad +k \\ k + 11 &< 19 \\ k &< 8 \end{aligned}$$

5.

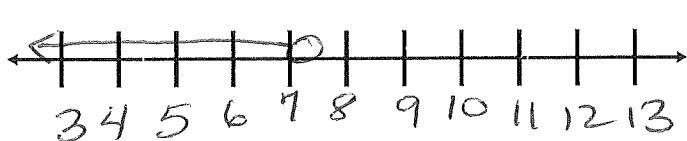
$$\begin{aligned} 4.6f + 15 &\geq 50.88 \\ \frac{4.6f}{4.6} &\geq \frac{35.88}{4.6} \\ f &\geq 7.8 \end{aligned}$$

6.

$$\begin{aligned} \frac{3}{2}x + 14 &\leq 7 \\ \frac{3}{2}x &\leq -14 \\ x &\leq -\frac{14}{\frac{3}{2}} \\ x &\leq -\frac{28}{3} \end{aligned}$$

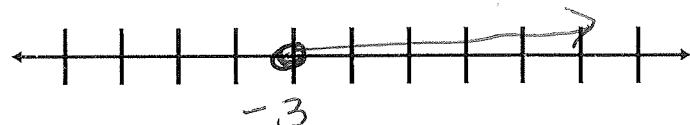
7.

$$\begin{aligned} 5d - 19.8 &< 16.7 \\ +19.8 & \quad +19.8 \\ 5d &< 36.5 \\ d &< 7.3 \end{aligned}$$



8.

$$\begin{aligned} 35 - 9x &\leq 62 \\ -35 & \quad -35 \\ -9x &\leq 27 \\ x &\geq -3 \end{aligned}$$



9. What is the smallest value of  $x$  that is not a solution to  $4x - 26 < 4$ ?

$$\begin{aligned} 4x - 26 &< 4 \\ +26 & \quad +26 \\ 4x &< 30 \end{aligned}$$

$$x < 7.5$$

7.5 is the smallest value!

11. Mason's pet leopard gecko must be kept in a cage with a temperature of at least 82°F. Using the inequality below, solve for  $C$  to determine the safe range of temperatures for his gecko in degrees Celsius.

$$\frac{9}{5}C + 32 \geq 82$$

$$\begin{aligned} \frac{9}{5}C &\geq 50 \\ C &\geq \frac{50}{\frac{9}{5}} \\ C &\geq 27.78 \end{aligned}$$

10. Rashaj has \$37.25 in his wallet. He would like to purchase a movie ticket and some candy. The ticket costs \$7.25 and each box of candy costs \$3.75. He claims he can buy 5 boxes. Do you agree or disagree? Write and solve the inequality to explain your reasoning.

$$7.25 + 3.75c \leq 37.25$$

$$\begin{aligned} 3.75c &\leq 30 \\ 3.75 &\quad 3.75 \end{aligned}$$

"C ≤ 8"  
He can buy 8 or less boxes!

12. Glenn has \$1,250 in his savings account. In order to avoid bank fees, Glenn must keep a minimum of \$150 in his account. His cell phone costs him \$35 per month. Use an inequality to determine how many months Glenn can pay for his cell phone before he would incur fees.

$$\text{Account balance} \geq 150$$

$$\begin{aligned} 1250 - 35m &\geq 150 \\ -35m &\geq -1100 \\ m &\leq 31.43 \end{aligned}$$

Summarize today's lesson:

"degrees" "celsius"

round!!

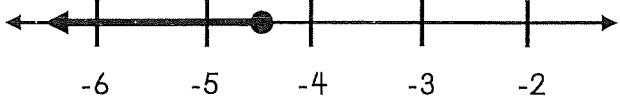
31 months

Use handout #5 as a reference.  
**SOLVING ONE AND TWO-STEP INEQUALITIES**

Find and graph the solution set for each of the following inequalities.

1. $-7.5k \geq -82.5$ 	2. $-6 > 3x - 15$ 	3. $-9.4d + 26 < 91.8$ 
---	--	--

Solve the problems below and be sure to show all work.

4. Which of the following values is not a solution to $-4x - 6.8 \leq 34$ ?  a. $x = -9$ b. $x = -10.2$ c. $x = -11$ d. $x = -10$	5. Which inequality describes the solution to $20x - 4 > -34$ ?  a. $x < -1.9$ b. $x > -1.5$ c. $x > -1.9$ d. $x < -1.5$
6. Audrey's monthly car payment is \$350, and she needs to save at least \$35 each month for gas. If Audrey is paid \$17.50 an hour, write and solve an inequality to represent the number of hours she must work in a month to pay for her car payment and gas.	7. Da'Quan is reading a 532-page book for English. His teacher says that each student must have read at least half of the book by the end of the 1 <sup>st</sup> week. If Da'Quan reads each of the 7 nights, write and solve an inequality to represent the number of pages he should read each night to meet the teacher's requirements.
8. Bacteria cannot live at temperatures higher than 120°F. Using the inequality below, solve for C to determine the temperatures in degrees Celsius in which bacteria cannot survive.  $\frac{9}{5}C + 32 \geq 120$	9. Carlos solved the inequality below and graphed the solution set:  $-19.5x + 21 < 108.75$  Do you agree or disagree with Carlos' graph? Explain your reasoning.

## SOLVING MULTI-STEP INEQUALITIES

### STEPS TO SOLVE

1. Distribute if necessary
2. Combine any like terms
3. Isolate the variable:
  - a. Use addition/subtraction to remove the Constant.
  - b. Use multiplication/division to remove the coefficient

\*Remember to flip the inequality sign if multiplying or dividing by a negative value.

Solve each of the inequalities below. Be sure to show all work and your check-step. Then represent your solution on a number line.

<p>1.</p> $\begin{aligned} 4x + 26 - 2x + 11 &> 49 \\ 2x + 37 &> 49 \\ -37 & \quad -37 \\ 2x &> 12 \\ x &> 6 \\ \boxed{x > 6} \end{aligned}$	<p>2.</p> $\begin{aligned} -2(3x + 15) &\leq 42 \\ -6x - 30 &\leq 42 \\ +30 & \quad +30 \\ -6x &\leq 72 \\ \hline x &\geq -12 \end{aligned}$ <p style="text-align: center;"><i>flip!</i></p>	<p>3.</p> $\begin{aligned} -2x + 6(x - 8) + 10 &< 2 \\ -2x + 6x - 48 + 10 &< 2 \\ 4x - 38 &< 2 \\ 4x &< 40 \\ \boxed{x < 10} \end{aligned}$
<p>✓ CHECK:</p>	<p>✓ CHECK:</p>	<p>✓ CHECK:</p>

Latisha says that  $x = 9$  could be a solution to all the inequalities above. Do you agree? Explain.

Show all work as you solve each inequality below.

Distribute and/or Combine Like Terms

4.

$$4.5k + 18 - 24.1 - 1.3k \geq 14.7$$

$$3.2k - 6.1 \geq 14.7$$

$$\frac{3.2k}{3.2} \geq \frac{20.8}{3.2}$$

$$k \geq 6.5$$

5.

$$\frac{3}{4}(-x + 12) < 18$$

$$\begin{aligned} -\frac{3}{4}x + 9 &< 18 \\ -9 &\quad -9 \\ -\frac{3}{4}x &< \frac{9}{-3/4} \\ -\frac{3}{4} &\quad \boxed{x > -12} \end{aligned}$$

6.

$$24 - 7.2(-4x + 3) \leq -26.4$$

$$24 + 28.8x - 21.6 \leq -26.4$$

$$2.4 + 28.8x \leq -26.4$$

$$-2.4$$

$$\begin{aligned} 28.8x &\leq -28.8 \\ \frac{28.8x}{28.8} &\leq \frac{-28.8}{28.8} \\ \boxed{x \leq -1} \end{aligned}$$

7. Rodney is flying on an airplane to Puerto Rico. His suitcase and the contents inside must weigh less than 50 lbs. His suitcase weighs 4 pounds and the contents he wants to pack weigh 49 pounds. If each of his shirts weighs 0.75 pounds, write an inequality to represent the number of shirts he needs to remove to meet the flight requirements.

$$\text{total weight} < 50 \text{ lbs.}$$

$$\begin{aligned} \text{weight of} & \quad \text{weight of} \\ \text{suitcase} & + \text{contents} < 50 \\ & \boxed{x > 4} \end{aligned}$$

8. Selene and Bennett are solving the inequality below. Selene says you will need to flip the inequality sign while Bennett claims you will not need to flip it. Who is correct? Explain your reasoning.

$$17 - 5(2x + 1) + 12x \leq -22$$

$$17 - 30x - 5 + 12x \leq -22$$

$$\begin{aligned} 12 + 2x &\leq -22 \\ -12 &\quad -12 \end{aligned}$$

$$\begin{aligned} 2x &\leq -34 \\ \boxed{x \leq -17} \end{aligned}$$

Roll a number cube and solve the corresponding inequality for extra practice.

Try on your own! (all)  
SHOW WORK HERE:

ROLL	INEQUALITY	SOLUTION
1	$-(x + 9) + 24 > 17$	
2	$\frac{1}{2}m + 2(m - 3) \leq 13$	
3	$5(-4x + 1) < 45$	
4	$s + 4 - 7s - 9 \geq 31$	
5	$16 > 11 - 2(x - 4)$	
6	$\frac{1}{3}(x - 27) + \frac{1}{3}x > 31$	

Summarize today's lesson:

Use handout #6 as a reference.  
**SOLVING MULTI-STEP INEQUALITIES**

Of the five students who solved inequalities below, three made mistakes. Write the names of the students who made mistakes, describe their errors and record the correct solutions in the table.

**BRYNN**

$$\begin{aligned}-7(x + 4) &< 21 \\ -7x - 28 &< 21 \\ -7x &< 49 \\ x &< -7\end{aligned}$$

**ROMAN**

$$\begin{aligned}-9r + 3.3 + 11.1 + 13r &\geq 30 \\ 14.4 + 4r &\geq 30 \\ 4r &\geq 15.6 \\ r &\geq 3.9\end{aligned}$$

**ALLEN**

$$\begin{aligned}-3(3x - 4) + 12 &> 78 \\ -9x - 4 + 12 &> 78 \\ -9x + 8 &> 78 \\ -9x &> 70 \\ x &< 7.7\end{aligned}$$

**DEMETRIUS**

$$\begin{aligned}14 + 2(7x - 8) &\leq 26 \\ 14 + 14x - 16 &\leq 26 \\ 28x - 16 &\leq 26 \\ 28x &\leq 42 \\ x &\leq 1.5\end{aligned}$$

**PILAR**

$$\begin{aligned}44 &\geq -(x + 13) - 2x \\ 44 &\geq -x - 13 - 2x \\ 44 &\geq -13 - 3x \\ 57 &\geq -3x \\ x &\geq -19\end{aligned}$$

NAME	DESCRIBE THE MISTAKE	CORRECT THE SOLUTION
1.		
2.		
3.		

Use your knowledge of inequalities to answer each question below.

<p>4. Mrs. Kreger created the expression <math>4(h + 11) - 15</math> to estimate the number of hours, <math>h</math>, her students need to study each week to earn a certain grade average. According to the expression, how many hours per week does Lindsey need to study if she wants to have an average of at least 90?</p>	<p>5. Which of the following is not a solution to the inequality below?</p> $41 - 8(2x + 6) + 3x < 58$ <p>a. <math>x = 0</math> b. <math>x = -5</math> c. <math>x = -1</math> d. <math>x = -3</math></p>
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## INEQUALITIES WITH VARIABLES ON BOTH SIDES

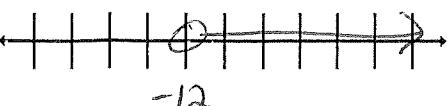
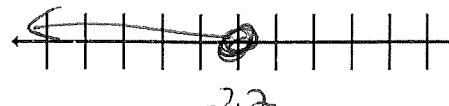
### STEPS TO SOLVE

1. Distribute and/or Combine like terms (if necessary).
2. Collect Variables on one side of the inequality sign. (left side)
3. Collect Constants on the other side of the inequality sign. (right)
4. Solve the inequality.
  - Describe when it is necessary to flip the inequality sign:  
*When multiplying by a "negative" or dividing*

Practice solving the inequalities in the table below. In step 1, collect the variables on the same side of the inequality sign. In step 2, collect the constants on the other side. Then find the solution.

	$21x - 9 \geq 18x + 12$	$-5x + 14 > -9x + 2$	$25 - 7x \leq 3x + 50$
STEP 1	$3x - 9 \geq 12$	$4x + 14 > 2$	$25 - 10x \leq 50$
STEP 2	$3x \geq 21$	$4x > -12$	$-10x \leq 25$
SOLUTION	$x \geq 7$	$x > -3$	$x \geq -2.5$

Solve the inequalities. Then choose a number in your solution set to check and sketch a graph.

<p>1.</p> $2(-3x + 1) < -5x + 14$ $-6x + 2 < -5x + 14$ $\frac{-x}{-1} < \frac{12}{-1}$ <p>flip!</p> $x > -12$	<p>2.</p> $19 + 9x \leq -(x - 41)$ $19 + 9x \leq -x + 41$ $9x \leq -x + 22$ $+x \quad +x$ $10x \leq 22$ $x \leq 2.2$	<p>3.</p> $-4(3 + 3x) > 6(4 - x)$ $-12 - 12x > 24 - 6x$ $-12 - 6x > 24$ $\frac{-6x}{-6} > \frac{36}{-6}$ $x < -6$
<p>✓ CHECK:</p> <p>divide by -1 because you can't have a negative variable</p> 	<p>✓ CHECK:</p> 	<p>✓ CHECK:</p> 

Solve each of the inequalities. Be sure to show all work.

4.

$$55.2x - 75 > 29.7x + 52.5$$

$$\begin{array}{r} 55.2x \\ + 29.7x \\ \hline 25.5x - 75 > 52.5 \end{array}$$

$$\begin{array}{r} +75 \quad +75 \\ 25.5x > 127.5 \\ x > 5 \end{array}$$

5.

$$22 - 3(3x + 1) \geq -x + 45$$

$$\begin{array}{r} 22 - 9x - 3 \geq -x + 45 \\ +x \quad +x \\ 19 - 8x \geq 45 \end{array}$$

$$\begin{array}{r} -19 \quad -19 \\ -8x \geq 26 \\ -8 \quad -8 \\ x \leq -3.25 \end{array}$$

6.

$$\frac{3}{7}(-21 + 14x) < 18x + 10.5 + x$$

$$\begin{array}{r} -9 + 6x < 19x + 10.5 \\ -19x \quad -19x \end{array}$$

$$\begin{array}{r} -9 - 13x < 10.5 + 9 \\ -13x < 19.5 \\ -13 \quad -13 \\ x > -1.5 \end{array}$$

7. Preston is playing a game where he must solve the inequality below and then throw a dart at the board. If his dart lands on a square with a value that is a solution to the inequality, he wins. Shade in any square that Preston could land on to win.

$$5(4 - x) > 2(-4x + 7)$$

10	-12	-3
-1	-2	-5
6	4	0

Write an inequality to solve each question below.

8. Jan needs to buy a backpack and several folders for school. If she shops at Smart Supply, the backpack will cost \$45 and folders cost \$0.45 each. If she shops at The Supply Guys, the backpack will cost \$50.40 and folders cost \$0.15 each. Write and solve an inequality to find the number of folders Jan would need to buy for The Supply Guys to be the cheaper option.

$$\text{Inequality: } 15x + 50.4 < 45x + 45$$

$$\text{Solution: } x > 18$$

9. Luna opened an account with \$50 and plans to deposit \$15 each week. On the same day, Mason opened an account with \$10 and plans to deposit \$25 each week. Write and solve an inequality to represent the number of weeks that Luna's account balance will be greater than or equal to Mason's.

$$\text{Inequality: } 15x + 50 \geq 25x + 10$$

$$\text{Solution: } x \leq 4$$

10. Jill's plant is 15 inches tall and grows 0.25 inches each week. Max's plant is 18 inches tall and grows 0.25 inches each week. At this rate, will Jill's plant ever be taller than Max's? Explain.

What am I Comparing??

$w = \# \text{ of weeks of growth}$

Height of Jill's plant + Height of Max's Plant

$$15 + .25w > 18 + .25w$$

Summarize today's lesson:

Since  $15 > 18$  Jill's plant will never be taller.

$$15 > 18$$

Use handout #7 as a reference.

## INEQUALITIES WITH VARIABLES ON BOTH SIDES

Contestants on a game show are given an inequality to solve. After solving, the contestant spins the spinner. If the spinner lands on a solution to the inequality, the contestant wins a prize.

SARA

$$-4(2x + 4) > 8x + 64$$

ALEJANDRO

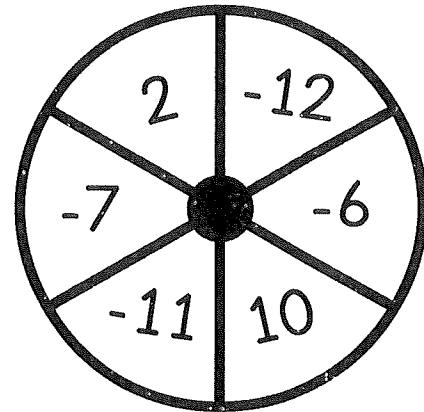
$$7x + 20 \geq 2(x - 15)$$

DARIA

$$3(x - 17) < 9(1 - 3x)$$

JAMAL

$$5(x + 11) > -4(-x - 12)$$



In 1-4, solve the contestant's inequality. Use the solutions to answer 5-10.

1. Sara:

\_\_\_\_\_

2. Alejandro:

\_\_\_\_\_

3. Daria:

\_\_\_\_\_

4. Jamal:

\_\_\_\_\_

5. Sara solves her inequality and then spins a -12. Does Sara win a prize? Explain.

\_\_\_\_\_

6. Alejandro solves his inequality and is about to spin the spinner. List all the possible values that would result in Alejandro winning a prize.

\_\_\_\_\_

7. Daria solves her inequality and then spins a 2. Does Daria win a prize? Explain.

\_\_\_\_\_

8. Jamal solves his inequality and is about to spin the spinner. List all the possible values that would result in Jamal NOT winning a prize.

\_\_\_\_\_

9. Which value from the spinner is the largest value that Sara could land on and still win a prize?

\_\_\_\_\_

10. Which value from the spinner would allow all four contestants to win a prize?

## Changing between Fractions and Decimals

To change a fraction to a decimal, divide the numerator by the denominator.

$$\frac{3}{5} \quad \text{Think: } 3 \div 5$$

$$\begin{array}{r} 0.6 \\ 5) 3.0 \\ -30 \\ \hline 0 \end{array}$$

$$\frac{3}{5} = 0.6$$

To change a decimal to a fraction:

- ① Read the decimal to find the denominator.  
Write the decimal digits over 10, 100, or 1,000.

- ② 0.65 is 65 *hundredths*  $\rightarrow \frac{65}{100}$

Use the GCF to write the fraction in simplest form.

The GCF of 65 and 100 is 5.

$$\frac{65}{100} = \frac{65 \div 5}{100 \div 5} = \frac{13}{20}$$

Write each fraction as a decimal.

1.  $\frac{4}{5} = \underline{\hspace{2cm}}$

2.  $\frac{3}{4} = \underline{\hspace{2cm}}$

3.  $\frac{1}{6} = \underline{\hspace{2cm}}$

Write each decimal as a mixed number or fraction in simplest form.

10.  $0.4 = \underline{\hspace{2cm}}$

11.  $0.75 = \underline{\hspace{2cm}}$

12.  $1.5 = \underline{\hspace{2cm}}$

## Evaluating and Writing Expressions

To evaluate an *expression*, substitute a value for the *variable* and compute.

Evaluate  $5y - 8$  for  $y = 7$ .

$$\begin{array}{r} 5y - 8 \\ 5 \times 7 - 8 \quad \leftarrow \text{Substitute } y \text{ with } 7. \\ 35 - 8 = 27 \quad \leftarrow \text{Compute.} \end{array}$$

You can use key words to write a word phrase for an algebraic expression.

$a + 5$	$\rightarrow$	$a$ plus 5
	or	$a$ increased by 5
$2n$	$\rightarrow$	the product of 2 and $n$
	or	2 times $n$

Evaluate each expression using the values  $y = 4$ ,  $z = 8$ , and  $p = 10$ .

5.  $3y + 6 = \underline{\hspace{2cm}}$

6.  $4z - 2 = \underline{\hspace{2cm}}$

7.  $p + 2p = \underline{\hspace{2cm}}$

8.  $3z \times z = \underline{\hspace{2cm}}$

Write an algebraic expression for each word phrase.

13.  $x$  newspapers plus 10

14. 4 less than  $x$  teabags

15. 3 more than  $x$  envelopes

16. 6 times  $x$  school buses

## Dividing Decimals and Fractions

Divide: $38.25 \div 1.5$ .	Divide: $3\frac{3}{4} \div 1\frac{2}{5}$ .
1. Rewrite the problem with a whole number divisor. $1.5)38.25$	1. Rewrite mixed numbers as improper fractions as needed. $\frac{15}{4} \div \frac{7}{5}$
2. Place the decimal point in the quotient. $1.5)38.25$	2. Multiply by the reciprocal of the divisor. $\frac{15}{4} \cdot \frac{5}{7}$
3. Divide. Then check. $\begin{array}{r} 25.5 \\ 15)382.5 \\ \underline{-30} \\ 82 \\ \underline{-75} \\ 75 \\ \underline{-75} \\ 0 \end{array}$	3. Multiply numerators. $\frac{15 \cdot 5}{4 \cdot 7} = \frac{75}{28}$ Multiply denominators. 4. Simplify. $\frac{75}{28} = 2\frac{19}{28}$

Find each quotient. Simplify your answers.

1.  $1\frac{5}{8} \div \frac{5}{8}$   
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2.  $-43.55 \div 6.5$   
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3.  $-\frac{2}{5} \div \frac{4}{25}$   
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## Multiplying and Dividing Integers

### To multiply integers:

- If the signs are alike, the product is positive.

$$\begin{array}{r} 2 \cdot 3 = 6 \\ -2 \cdot -3 = 6 \end{array}$$

- If the signs are different, the product is negative.

$$\begin{array}{r} 2 \cdot -3 = -6 \\ -2 \cdot 3 = -6 \end{array}$$

### To divide integers:

- If the signs are alike, the quotient is positive.

$$\begin{array}{r} 6 \div 3 = 2 \\ -6 \div -3 = 2 \end{array}$$

- If the signs are different, the quotient is negative.

$$\begin{array}{r} 6 \div -3 = -2 \\ -6 \div 3 = -2 \end{array}$$

Tell whether each product or quotient will be *positive* or *negative*.

7.  $4 \cdot 7$

8.  $-4 \cdot 7$

9.  $-4 \cdot -7$

10.  $4 \cdot -7$

11.  $10 \cdot -4$

12.  $-25 \div 5$

13.  $-2 \cdot -2$

14.  $100 \div 10$

## Multiplying Decimals and Fractions

Remember these rules when multiplying rational numbers.

1. When both factors are positive, the product is positive.

$$\text{Multiply: } \left(2\frac{2}{3}\right) \left(1\frac{5}{8}\right) = \left(\frac{8}{3}\right) \left(\frac{13}{8}\right) = \frac{104}{24} = 4\frac{1}{3}$$

2. When both factors are negative, the product is positive.

$$\text{Multiply: } (-4.35)(-2.44) = 10.614$$

3. When both factors have different signs, the product is negative.

$$\text{Multiply: } -\frac{3}{4} \times \frac{2}{5} = \frac{-3 \times 2}{4 \times 5} = \frac{-6}{20} = -\frac{6}{20} = -\frac{3}{10}$$

Find each product. Write the product in simplest form.

1.  $2.8 \times 0.05$

2.  $\frac{5}{8} \cdot \frac{2}{5}$

3.  $1.45 \cdot 0.7$

4.  $2\frac{3}{5} \cdot \frac{7}{8}$

5.  $(-2.07)(-4.9)$

6.  $\frac{5}{12} \cdot \left(-\frac{3}{10}\right)$

## Adding and Subtracting Decimals and Fractions

Use these rules to add and subtract rational numbers.

### Adding and Subtracting Integers

#### Same Sign

#### Different Signs

- The sum of two positive rational numbers is positive.

Example:  $15.6 + 4.5 = 20.1$

Example:  $\frac{2}{9} + \frac{8}{9} = 1\frac{1}{9}$

- The sum of two negative rational numbers is negative.

Example:  $-3.42 + (-5.74) = -9.16$

Example:  $-1\frac{3}{4} + \left(-4\frac{3}{4}\right) = -6\frac{1}{2}$

- First find the absolute values of each addend.
- Then subtract the lesser absolute value from the greater.
- The sum has the sign of the addend with the greater absolute value.

Example:  $-25.8 + 17.3 = -8.5$

Example:  $-2\frac{1}{2} + 1\frac{1}{4} = -1\frac{1}{4}$

### Subtracting Rational Numbers

- To subtract rational numbers, add the opposite.
- Then following the rules for adding rational numbers.

Example:  $-9.25 - (-3.4) = -9.25 + 3.4 = -5.85$

Example:  $4 - \left(-2\frac{3}{10}\right) = 4 + \left(2\frac{3}{10}\right) = 6\frac{3}{10}$

**Find each sum.**

1.  $43.2 + 26.7$

2.  $-81.22 + 14.9$

3.  $-4.8 + (-53.5)$

4.  $2\frac{5}{9} + 3\frac{4}{9}$

5.  $-2\frac{3}{5} + 1\frac{1}{5}$

6.  $-6\frac{1}{3} + \left(-7\frac{1}{3}\right)$

**Find each difference.**

7.  $15.64 - 8.5$

8.  $-0.392 - 0.26$

9.  $-5.4 - (-1.6)$

10.  $6 - 5\frac{5}{6}$

11.  $-4\frac{3}{4} - 2\frac{1}{4}$

12.  $-7\frac{4}{5} - \left(-3\frac{3}{5}\right)$

### Writing Equations for Word Problems

You can change a word expression into an algebraic expression by converting the words to variables, numbers, and operation symbols.

To write a two-step algebraic expression for *seven more than three times a number*, follow these steps.

① Define the variable.	Let $n$ represent the number.
② Ask yourself if there are any key words.	“More than” means add and “times” means multiply.
③ Write an algebraic expression.	$7 + 3 \cdot n$
④ Simplify.	$7 + 3n$

#### **Solve.**

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4. Three friends pay \$4 per hour to rent a paddleboat plus \$5 for snacks. Write an expression for the total cost of rental and snacks. Then evaluate the expression for 2 hours.
  

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5. A lawn care service charges \$10 plus \$15 per hour to mow and fertilize lawns. Write an expression for the total cost of having your lawn mowed and fertilized. Then evaluate the expression for 4 hours.

## Solving Proportions

*Solving* a proportion means finding a missing part of the proportion. You can use unit rates to solve a proportion. First find the unit rate. Then multiply to solve the proportion.

Shawn filled 8 bags of leaves in 2 hours. At this rate, how many bags would he fill in 6 hours?

① Find a unit rate for the number of bags per hour. Divide by the denominator.

$$\frac{8 \text{ bags}}{2 \text{ hours}} = \frac{8 \text{ bags} \div 2}{2 \text{ hours} \div 2} = \frac{4 \text{ bags}}{1 \text{ hour}}$$

The unit rate is 4 bags per hour.

② Multiply the unit rate by 6 to find the number of bags he will fill in 6 hours.

Unit rate	Number of hours	Total
↓	↓	↓
4	×	6 = 24

At this rate, Shawn can fill 24 bags in 6 hours.

If two ratios form a proportion, the **cross products** are equal.

$$\text{Solve. } \frac{5}{15} = \frac{n}{3}$$

① Write the cross products.  $5 \cdot 3 = 15 \cdot n$   
② Simplify.  $15 = 15n$   
③ Solve the equation.  $n = 1$

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### **Solve.**

1. The bookstore advertises 5 notebooks for \$7.75. At this rate, how much will 7 notebooks cost?

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### **Solve each proportion.**

6.  $\frac{4}{10} = \frac{n}{15}$       7.  $\frac{4}{200} = \frac{n}{100}$       8.  $\frac{6}{n} = \frac{5}{10}$

### Is it Proportional?

Compare the ratios to see if there is a proportional relationship.

Hours	2	4	5
Pages	12	24	30

Hours	2	3	4
Pages	10	14	24

$$\frac{12}{2} = \frac{24}{4} = \frac{30}{5} \leftarrow \text{There is a proportional relationship between pages and hours.}$$

$$\frac{10}{2} \neq \frac{14}{3} \neq \frac{24}{4} \leftarrow \text{There is not a proportional relationship between pages and hours.}$$

**Determine whether each table represents a proportional relationship. If so, find the constant of proportionality.**

1.

$x$	4	5	7
$y$	\$10.40	\$13.00	\$17.50

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## Percents

To write a percent as a fraction, write a fraction with 100 as the denominator.

$$45\% = \frac{45}{100} \leftarrow \text{Denominator 100}$$

$$= \frac{45 \div 5}{100 \div 5} = \frac{9}{20} \leftarrow \text{Simplify.}$$

$$45\% = \frac{9}{20}$$

To write a decimal as a percent, multiply by 100.

Write 0.85 as a percent.

$$0.85 \cdot 100 = 85$$

$$0.85 = 85\%$$

To write a percent as a decimal, divide by 100.

Write 46% as a decimal.

$$46 \div 100 = 0.46$$

$$46\% = 0.46$$

**Write each fraction as a percent.**

1.  $\frac{3}{4}$

2.  $\frac{12}{25}$

3.  $\frac{4}{5}$

4.  $\frac{23}{4}$

**Write each percent as a fraction in simplest form.**

5. 45%

6. 60%

7. 16%

8. 25%

## Solving Percent Problems

You can use proportions to solve percent problems. Remember, the percent is compared to 100.

Finding the part:

$$10\% \text{ of } 40 \text{ is } ?.$$
$$\frac{10}{100} = \frac{n}{40}$$

$$100 \cdot n = 10 \cdot 40$$
$$n = 4$$

10% of 40 is 4.

Finding the whole:

$$20\% \text{ of } ? \text{ is } 8.$$
$$\frac{20}{100} = \frac{8}{n}$$

$$20 \cdot n = 100 \cdot 8$$
$$n = 40$$

20% of 40 is 8.

Finding the percent:

$$? \% \text{ of } 25 \text{ is } 20.$$
$$\frac{n}{100} = \frac{20}{25}$$

$$25 \cdot n = 100 \cdot 20$$
$$n = 80$$

80% of 25 is 20.

**Complete to solve for  $n$ .**

1. 75% of  $?$  is 12.

$$\frac{75}{100} = \frac{12}{n}$$

2. 20% of  $?$  is 82.

$$\frac{20}{100} = \frac{82}{n}$$

3. 5% of  $?$  is 9.

$$\frac{5}{100} = \frac{\square}{n}$$

$$75 \cdot \underline{\hspace{2cm}} = 100 \cdot \underline{\hspace{2cm}} \quad 20 \cdot \underline{\hspace{2cm}} = 100 \cdot \underline{\hspace{2cm}} \quad \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$n = \underline{\hspace{2cm}}$$

$$n = \underline{\hspace{2cm}}$$

$$n = \underline{\hspace{2cm}}$$

4. 60 is 5% of  $n$ .

$$\frac{5}{100} = \frac{\square}{n}$$

5. 6% of  $n$  is 4.8.

$$\frac{6}{100} = \frac{\square}{n}$$

6. 51 is 170% of  $n$ .

$$\frac{170}{100} = \frac{\square}{n}$$

$$5n = 100 \cdot \underline{\hspace{2cm}}$$

$$6n = \underline{\hspace{2cm}} \cdot 4.8$$

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$n = \underline{\hspace{2cm}}$$

$$n = \underline{\hspace{2cm}}$$

$$n = \underline{\hspace{2cm}}$$