# **IXL TRACKING LOG**

# Unit 9

# Two-Step Equations and Inequalities

Simplify Expressions with Rational Numbers

**Factor Expressions** 

Write and Solve Multi-Step Equations

Write, Solve, and Graph Multi-Step Inequalities

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

Math Teacher: \_\_\_\_\_

| <u>IXL Skill</u>                                      | <u>Your Score</u><br>(90 or<br>above) |
|---|---------------------------------------|
| Z.11 (Solve equations involving integers)             |                                       |
| 7th Grade IXL Standards:                              |                                       |
| R.11 (Multiply using the distributive property)       |                                       |
| R.14 (Add and subtract linear expressions)            |                                       |
| R.15 (Add and subtract like terms with exponents)     |                                       |
| R.17 (Identify equivalent linear expressions I)       |                                       |
| S.6 (Solve two-step equations)                        |                                       |
| S.8 (Solve equations involving like terms)            |                                       |
| S.9 (Solve equations: complete the solution)          |                                       |
| T.4 (Solve one-step inequalities)                     |                                       |
| <b>T.5</b> (Graph solutions to one-step inequalities) |                                       |
| T.6 (Solve two-step inequalities)                     |                                       |
| 1.7 (Graph solutions to two-step inequalities)        |                                       |

| Vocabulary<br>Term          | What does it mean?<br>Definition  | What does it look<br>like?<br>Picture/Example | Vocabulary<br>Term          | What does it mean?<br>Definition   | What does it look<br>like?<br>Picture/Example |
|-----------------------------|---|---|-----------------------------|--|---|
| Variable                    | A symbol, usually a letter, that represents a number  |   | Equation                    | A mathematical sentence<br>containing an equal sign, showing<br>that two expressions are equivalent            |   |
| Coefficient                 | A number that multiplies a variable   |   | Inverse                     | Opposite operations that "undo"  |   |
| Exponent                    | Tells how many times to multiply the base number by itself  |   | operations                  | each other   |   |
| Like terms                  | Terms that have the same variable and/or exponent   |   | Inequality                  | A statement showing that two<br>expressions are NOT equal, using<br>one of the following signs: >, <, $\geq$ , |   |
| Expression                  | A group of variable(s), operation(s),<br>and/or number(s) that represents a<br>quantity. Expressions do not<br>contain = signs. |   | Less than                   | ≤, or ≠<br><   |   |
| Simplify (an<br>expression) | To write an expression in simplest<br>form by removing parentheses and<br>unnecessary terms. This is typically                  |   | Less than or<br>equal to    | ≤  |   |
|                             | done by using distributive property<br>and combining like terms   |   | Greater than                | >  |   |
| Commutative<br>Property     | This states that numbers may be<br>added or multiplied together in any<br>order, and the solution will always<br>be the same    |   | Greater than<br>or equal to | 2  |   |
| Associative<br>property     | This states that no matter how<br>numbers are grouped, their sum or<br>product will always be the same                          |   | Not equal to                | Two quantities are NOT equal, ≠  |   |
| Distributive<br>property    | Multiplying a number is the same<br>as multiplying its addends by the<br>number, then adding the products                       |   | Solution set                | A set of answers to an inequality  |   |

#### Unit 9 Pre-requisite Skills Review

|                         | <u> </u>                                    |                                       |                       |  |                      | Solving Equations:                                      |                    |                |               |                               |
|-------------------------|---|---------------------------------------|-----------------------|--|----------------------|---|--------------------|----------------|---------------|-------------------------------|
| Simp<br>1) Circ         | lifying Expression<br>cle ALL of the follow | 15:<br>ing expressions that ar        | e equivalent to 24v + | 88. SHOW ALL W   | DRK BELOW.           | SHOW ALL WORK!!   |                    |                |               |                               |
| ,                       | a. 4(6y + 22)                               | b. 8(3y + 88)                         | с. 4(бу + 88)         | d. 24(y + 88)  | T-Rex hates pushups  | 18) x - 9 = -11   | 19) y + -4         | 1.5 = -13      |               | 20) -1.2m = -6                |
|                         | e. 2(44 + 12y)                              | f. 6y + 18 + 88                       | g. 112y               | h. 88 + 24y  |                      | $\begin{array}{c c} +9 +9 \\ \hline x = -2 \end{array}$ |                    |                |               |                               |
|                         |   |                                       |                       |  |                      | -2 - 9 = -11  |                    |                |               |                               |
| 2) Sim                  | nplify 6x² + 15x² + 4y                      | ² - бх²                               | 3) Simplify 7xys +    | 13x <sup>s</sup> y - x <sup>s</sup> y + 23x <sup>s</sup> y |                      | -2 + (-9)= -11  |                    |                |               |                               |
| 4) Sim                  | nplify 15(x² + 4x) + 3(                     | 2x² + 5x)                             | 5) Simplify 13(2xy    | <sup>2</sup> + 3y) + (2xy <sup>2</sup> + 5x                | γ²)                  | 21) $\frac{z}{-5} = -25$                                | 22) n - (-2        | 2.3) = 2       |               | 23) b + (-3) = $\frac{-1}{4}$ |
| <u>Ratio</u><br>6) Fill | onal Numbers Rev<br>in the table with at l  | <u>view</u><br>least 3 examples and n | on-examples of each   |  |                      |   |                    |                |               |                               |
|                         |   | Examples                              |                       | Non-examples   |                      |   |                    |                |               |                               |
|                         | Whole Numbers                               |                                       |                       |  |                      |   |                    |                |               |                               |
|                         | Integers                                    |                                       |                       |  |                      |   |                    |                |               |                               |
|                         | Rational Numbers                            |                                       |                       |  |                      | T. 0. 5. 1  |                    |                |               |                               |
| 7)8+                    | + (-19) + 14                                | 8) -41 - (-8)                         | 9) -6•-4              | • -2   | 10) -18 ÷ -4         | Using any method (substitutio                           | n or inverse opera | tions), determ | ine the value | e of each variable:           |
|                         |   |                                       |                       |  |                      | 24) -4x + 5 = 17  | a3                 | b. 3           | c5            | d. 12                         |
|                         |   |                                       |                       |  |                      | 25) 3b - 8 = -2   | a. 24              | b2             | c. 2          | d3.3                          |
| 11) -1                  | 9 + 11 + 8                                  | 12) 52 - 98                           | 13) 2.5 • (           | -4)  | 14) $\frac{-33}{11}$ | 26) 2x - 6 = 14   | a. 4               | b4             | c. 10         | d. 20                         |

#### Writing the Expressions and/or Equations:

15) -3 more than twice a number \_\_\_\_\_

16) 6 less than four times a number is 19 \_\_\_\_\_

17) the sum of 16 and half of x equals 4 \_\_\_\_\_

\_\_\_\_\_\_Inequalities: Graph each inequality on a number line, and list 3 possible solutions AND 3 non-solutions

|           | Graph on a Number Line: | Possible Solutions | Non-solutions |
|-----------|-------------------------|--------------------|---------------|
| 27) x>-11 | ← →                     |                    |               |
| 28) z ≤ ½ | <                       |                    |               |

Distributive Property (BABUI) B(A + = (MULTIPLU) Using the distributive property ... 4(30 + 6) = 4•30 4•6

#### LET'S DISTRIBUTE! (Distributive Property Practice)

ar (bre) (arb).

Draw a picture to represent the following problems. Then, write a problem using the distributive property. Finally, evaluate the problem.

- 1) There are 3 girls. Each girl has 1 blue bows and 4 pink bows. How many bows do they have in all? Picture: | Problem:
- 2) Ethan has 2 dogs. Each one has 3 bones and 2 leashes. How many bones do they have in all, and how many leashes do they have in all? Picture:
  Problem:

Apply the distributive property to write the following in simplest terms:

|   | HINT: Be careful when distributing negatives!! |              |              |  |  |
|---|--|--------------|--------------|--|--|
| 3 | ) 5(-2 + 8)                                    | 4) 10(x + 2) | 5) 14(a - b) |  |  |
|   |  |              |              |  |  |

| 6) 5(9 - 11) | 7) -12(x + 2) | 8) 9(-x + 3) |
|--------------|---------------|--------------|
|              |               |              |



#### In math, like terms have the

Mark the like terms by color-coding or putting different shapes around them:

 $4xy^2$  9  $2y^2$  -5 4x x -2.5 $y^2$ 

Simplify the following expressions:

| 1) $-4x + 5x$ | 2) $1 + 5v + v - 6$ |
|---------------|---------------------|
|---------------|---------------------|

4n + 4 + 1 + 3n
 11a + 11a

5) -2x - 8 - 7x + 2 6) 7v + 6v

- 7) -8x 10x 8) 6 7n 2n 8
- 9) 2k k 10) -p 11 + 3

11) 9n + 3n 12) 12x + 11 - 4

# **Mathematical Properties**

| 1. | Identity Property of Addition: $c + 0 =$                        |
|----|---|
| 2. | Identity Property of Multiplication: 22b · 1 =                  |
| 3. | Multiplicative Property of Zero: $40,286 \cdot 0 =$             |
| 4. | Commutative Property of Addition: $x + z =$                     |
| 5. | Commutative Property of Multiplication: $k \cdot 6 =$           |
| 6. | Associative Property of Addition: (1 + 3) + 9 =                 |
| 7. | Associative Property of Multiplication: $(w \cdot h) \cdot / =$ |

Name the property demonstrated by each statement.

| 8.  | $9 \cdot 7 = 7 \cdot 9$                     | First, use Distributive Property, then Combine Llike Terms to simplify each expr |                       |  |
|-----|---|--|-----------------------|--|
| 9.  | $2 \cdot (3 \cdot 4) = (2 \cdot 3) \cdot 4$ | 25) $-n + 4(n + 1)$  | 26) $-3(1-3x) + 2x$   |  |
| 10. | 37.0=0                                      | , , ,  |                       |  |
| 11. | 1.87 = 87                                   |  |                       |  |
| 12. | 14+6=6+14                                   | 27) -2(-3k+4) - 7  | 28) $-3p - (-8 + 4p)$ |  |
| 13. | $3(6a) = (3 \cdot 6)a$                      |  |                       |  |
| 14. | 2b + 0 = 2b                                 | 29) $-4 + 6(-4x + 3)$  | 30) $3n + 3(1 + 8n)$  |  |
| 15. | 55+6=6+55                                   |  |                       |  |
| 16. | 6 · 7 = 7 · 6                               | 21) -2 + 5(4 + 3v)   | (27) -1 + 2(m + 4)    |  |
| 17. | (x+3) + y = x + (3+y)                       | 51) -2 + 5(4 + 5r)   | 52) -1 + 5(m + 4)     |  |
| 18. | $1 \cdot mp = mp$                           |  |                       |  |
| 19. | 9+(5+35)=(9+5)+35                           | 33) $-(-n+2) - 2n$   | 34) $-3(5+2x) - 7$    |  |
| 20. | 6b + 0 = 6b                                 |  |                       |  |

# Simplifying Practice:

Use Distributive Property.

1

| 13) 3(-7 - 8n)        | 14) $-8(1+5m)$        |
|-----------------------|-----------------------|
| 15) 8(r+1)            | 16) 8(7 <i>x</i> + 8) |
| 17) 2(6n - 8)         | 18) –3(8 – <i>b</i> ) |
| 19) -5(8v - 2)        | 20) -2(x - 5)         |
| 21) –(3 <i>a</i> – 3) | 22) -2(7 - 2n)        |
| 23) -8(5-3v)          | 24) -7(6x - 3)        |

# ~ Translating Words to Math ~



In the REAL world, people aren't usually handed a set of equations, and told to "solve for x". However, we are often faced with problems for which writing an equation can be helpful.

#### **Examples:**

| The sum of x and -19                              | x + (-19)               |
|---|-------------------------|
| 4 less than the product of 5 and y                | 5y – 4                  |
| Twice the difference of 12 and x is 14            | 2(12 - x) = 14          |
| 8 less than the quotient of m and -3<br>equals -9 | $\frac{m}{-3} - 8 = -9$ |

#### more REAL-World Examples:

| Allison makes n dollars per hour, and her<br>boss gave her a raise of \$2 more per<br>hour. Write an expression how much she | $n + 2 \rightarrow$ her hourly rate with the raise |
|--|--|
| will make if she works for 40 hours.   | 40(n + 2) → how much she makes<br>in 40 hrs.       |
| Davis is donating 2/5 of his savings to his school. If he donates \$77.60, how much did he have in savings?                  | $\frac{2}{5}x = \$77.60$                           |
| Also, consider using properties of rational numbers. (fractions & decimals)  | 0.4x = \$77.60                                     |

## Translating Words to Math PRACTICE!

Translate each statement below to an expression or equation.

| Words                                   | Math! |
|---|-------|
| 1) the sum of m and -18                 |       |
| 2) x increased by -25                   |       |
| 3) twice the difference of x and -3     |       |
| 4) one-tenth of x is -12                |       |
| 5) 8 less than x divided by -2 equals 4 |       |
| 6) 25% of x is 55                       |       |

Let's also look at other ways of expressing math: Cobb County adds a 6% tax to most items sold. If an item costs x dollars, what will the price be after tax?



So, an "increase of 6%" is the SAME as multiplying by 1.06

original price tax total

#### You Gry!

7) Your bill at Red Lobster is y dollars. You decide to give server a 20% tip. Write an expression for the total cost.



- 8) There's a 30%-off sale on Falcons jerseys! Write an expression for the total cost.
- 9) Halloween candy, c, goes on a 75%-off sale in November. Write an expression for the cost.

# **Solving Two-Step Equations**

Two-step equations are like **having a party at your house**! YOU are the VARIABLE The operation FARTHEST from you will leave first, so undo that one FIRST. The operation CLOSEST to you is your BFF and will stay the LONGEST, so you undo that operation LAST. Eventually everyone goes home, and YOU, the VARIABLE, are left alone and ISOLATED!



#### EXAMPLE 1:

| 9y –           | 5 = 8            | $\rightarrow$ | This equation has multiplication <b>and</b> subtraction |
|----------------|------------------|---------------|---|
| +              | 5 +5             | $\rightarrow$ | Use the inverse of the farthest operation               |
| <u>9y</u><br>9 | $= \frac{13}{9}$ | $\rightarrow$ | Now, undo the BFF operation!                            |
| у              | $= 1\frac{4}{9}$ | $\rightarrow$ | The variable equals $1\frac{4}{9}$                      |

#### (Remember to ALWAYS check your answer with substitution!)

EXAMPLE 2: 
$$\frac{x-3}{4} = -2$$
  
 $4 \cdot (\frac{x-3}{4}) = (-2) \cdot 4$   
 $x-3 = -8$   
 $x-3+3 = -8+3$   
 $x = -5$   
EXAMPLE 3:  $-3x + 4 = 16$   
 $-4 -4$   
 $-3x = 12$   
 $-3$   
 $x = -4$ 

#### <u>VLet's Party!</u> Practice with Solving Two-Step Equations

First, let's make sure we know which step comes FIRST (that "just a friend" operation that's farthest from the variable), and which step comes LAST (your BFF operation that you will save for last).

| <u>Equation</u>       | First step (inverse of<br>farthest operation) | Last step (inverse<br>of BFF operation) |
|-----------------------|---|---|
| $\frac{x+8}{-2} = -6$ | Multiply both sides by -2                     | Subtract 8 from<br>both sides           |
| -3x+14 = 44           |   |   |
| 4x - (-3) = 15        |   |   |
| $\frac{x+5}{3} = 10$  |   |   |

#### Now, YOU practice. SHOW ALL STEPS.

1) 
$$3y - 10 = 8$$

2) -7a + 3 = -4

3) 
$$\frac{x-12}{-5} = -11$$
 4) 16x - (-11) = 43

5)  $\frac{1}{2}x + 18 = 24$  6)  $\frac{5x}{12} = 10$ 



Gino has \$48 to spend at the state fair. Admission is \$6, and tickets cost \$1.50 apiece. How many tickets can he purchase?

We can solve this conundrum with the equation,

*\$1.50* is the 71.50x + 6 = 48 the total \$ Gino can spend coefficient, since we must multiply the number of tickets, x, by their cost ? # of tickets add the admission price!

<u>Think it Through!</u> If Gino has \$48 to spend, he'll first spend \$6 to get in. Subtract that, and he has \$42 left to spend.

Tickets cost \$1.50 each. Gino has \$42 left. Divide 42 by 1.50

| <u>1.50x</u> | = | <u>42</u> | 1                       |
|--------------|---|-----------|-------------------------|
| 1.50         |   | 1.5       | So, Gino can buy 🚿      |
| х            | = | 28        | 28 tickets at the fair! |

Alexandra's rectangular room has a perimeter of 54 feet. She knows that the length of the room is 15 feet. What is the width?



# You Gry!

#### Write an Equation for each problem below. Then, solve!

 Rory made \$450 selling cookies. She made \$30 from donations. The rest of the money was made from selling cookies at \$3 per box. How many boxes of cookies did she sell?

2) Emily is in Athens for the weekend, and she has budgeted \$100 to spend on souvenirs for herself and 8 friends. If she spends \$36 on her souvenir, how much does she have left to spend on each friend (if all 8 friends <u>get</u> the same item)?

3) Ben is putting down carpet in 5 rectangular classrooms. The total area of all the carpet is 400 square yards. If the length of each classroom is 10 yards, what is the width?

4) A father made \$30 helping his neighbor, and he added that money to money he already had in his wallet. Then, he split that money evenly amongst his 3 kids. If each child received \$35, how much money did the father start out with?



#### Solving One-Step Inequalities with Addition & Subtraction

Solve for the variable just like you would do with an equation!



Now, YOU Try!

Solve the inequality, then graph the solution set.

1) x - 4 < -1 2)  $m + (-8) \ge 10$ 

# Solving One-Step Inequalities with Multiplication & Division

Solve for the variable just like you would do with an equation!

## BUT... IF YOU <u>MULTIPLY</u> OR <u>DIVIDE BY</u> A <u>NEGATIVE</u> NUMBER, YOU MUST <u>REVERSE</u> THE INEQUALITY <u>SYMBOL</u>!



Solve the inequality, then graph the solution set.

1) 
$$-3x \le 12$$
 2)  $\frac{y}{6} > -36$ 

3) 
$$z - (-1) \ge 1$$
  
4)  $k + 3 > 0$   
3)  $\frac{n}{-9} < -3$   
4)  $12x \ge 72$ 



#### Writing & Graphing Inequalities



First, make sure you know the symbols and their key words!

| Symbol      | Meaning                  | Key Words                      | On the Number Line |  |
|-------------|--------------------------|--------------------------------|--------------------|--|
| < Less than |                          | Less than, fewer than, below   | Open circle, O     |  |
| <           | Less than or equal to    | No more than, at most          | Closed circle, •   |  |
| >           | Greater than             | Greater than, more than, above | Open circle, O     |  |
| >           | Greater than or equal to | At least, no less than         | Closed circle, •   |  |
| ŧ           | Not equal to             | Not equal to                   | Open circle, O     |  |

TIP: Keep the variable on the LEFT! Then, the arrow at the end of your number line looks like your inequality symbol!

#### Examples:

 Flo the Salesgirl is paid \$200 per week, plus \$10 per sale. She wants to make at least \$480 this week. Write an inequality for the number of sales Flo needs to make. Solve and graph



2) Sam lost \$30. Then, he split his remaining cash evenly into two savings accounts. If he put fewer than \$12 into those accounts, how much money did he begin with?



You Try! Write an inequality for each situation, then solve. Lastly, graph the solution set on a number line.

4

 Penn wants to save at least \$160. He has \$16 already saved. If he earns \$24 per week, how many weeks will it take him to meet his goal? 2) There are 130 second-graders. Ten of them will not be going on a field trip. If the teachers want the kids to be in groups of no more than 8, how many groups should there be?

## Solving Two-Step Inequalities

This is SUPER-easy!! You already know how to solve one-step inequalities. You also know how to solve a two-step equation. Well, guess what?? This is just like putting both of those topics together! Easy, huh??

#### Let's try this one: $2x - 8 \ge 5$

| 2x-82                           | 5  |
|---------------------------------|--|
| 2x - 8 +                        | $8 \ge 5 + 8$ Step 1: Use inverse<br>of subtracting 8. |
| 2x≥13                           | er oar naemig er                                       |
| $\frac{2x}{2} \ge \frac{13}{2}$ | Step 2: Use inverse<br>of multiplying by 2.            |
| x≥6.5                           | Solution   |
| x ≥ 6.5                         | Solution   |

#### Also, don't forget this important rule!



reversed!

# Solving Caso-Step Inequalities Practice

#### **SHOW ALL STEPS HERE:**

|                                |   | 1) | 2) |
|--------------------------------|---|----|----|
| Solve and graph each ine       | equality below!   |    |    |
| 1) 10x - 3 < 37                | $<\!$                         |    |    |
| 2) -5x + 18 ≥ 3                | $\underbrace{\underbrace{\begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$ | 21 |    |
|                                |   | 3) | 4) |
| 3) $\frac{a}{-2} + 4 > -2$     | <pre>&lt;++++++++++++++++++++++++++++++++++++</pre>   |    |    |
| 4) $\frac{b}{4.5} - 2 < 2$     | <pre></pre>   |    |    |
|                                |   | 5) | 6) |
| 5) -9(x + 3) > -27             |   |    |    |
| 6) 40 $\leq \frac{1}{2}(c+70)$ |   |    |    |

#### Math 6/7 Unit 9 Post-Test REVIEW

1. Explain the difference between the solutions to 2x+50=100 and 2x+50>100

| 2  | Simplify: $-3(5a+2a)+5(3a+a)$         |                                |      |
|----|---------------------------------------|--------------------------------|------|
| 2. |                                       |                                | Atte |
| 3. | Simplify: 70+3(5x-2)+(-15x)           |                                |      |
| 4. | Solve: $2x + 10 = 80$                 | 5 Solve: -6x+5=-19             |      |
|    |                                       | 0.                             |      |
|    |                                       |                                |      |
| 6. | Solve and graph: $\frac{x}{5}$ +25≥27 | 7. Solve and graph: $-4x-5<55$ |      |

←

 $\leftarrow$ 



9. Determine the simplified area of the figure.

10. "Eight less than the product of a number and three is twenty-two."

- a. Write the statement below as an algebraic equation: \_\_\_\_\_
- b. What is that number? (Show steps)

#### 11. Six more than twenty times a number is 206.

- a. Write an equation to represent this problem:
- b. What is that number? (Show steps)

12. Which equation and solution represent this situation? Abbie and Ben ride their bikes each day for exercise. Ben rides two miles more than Abbie each day. If together they ride 9 miles, how many miles does Ben ride each day?

| A. 2(x + x) = 9, Ben rides 3.5 miles | C. $x^2 + x = 9$ , Ben rides 6 miles    |
|--------------------------------------|---|
| B. 2x + x = 9, Ben rides 5.5 miles   | D. x + (x + 2) = 9, Ben rides 5.5 miles |

- 13. James has spent \$20 of his \$35 video store gift card. He plans on using the remaining balance to rent video games. If the games cost \$2.50 each to rent, how many games can he rent? Write an equation AND solve.
- 14. Which of the following shows the solution to -2x+3<21?



- 15. Stephen owns a bicycle rental stand at the beach. He uses the equation c=3.50h+5 to determine c, how much he will charge to rent a bicycle for h hours. Which of the following is a reasonable amount someone would pay to rent a bicycle from morning to evening on one day?
  - A. \$3.50 B. \$5.00 C. \$15.50 D. \$47.00
- 16. A rectangle has 4 equivalent angles. Find the value of x in the diagram below.

| 90° | 90°      |
|-----|----------|
|     |          |
| 90° | 5(x+13)° |

- 17. Elijah is saving for a summer vacation in Florida that costs \$550. He has \$250 saved and hopes to lifeguard at \$20 per hour to earn the rest of the money. Which inequality below describes the number of hours, *h*, he must lifeguard to have enough money for the trip?
  - A.  $250+20h \le 550$  B.  $250+20h \ge 550$  C.  $250+20+h \le 550$  D.  $20h \le 550$
- 18. Which property is demonstrated by the equation shown?  $4 \times (3 \times 18) = (3 \times 18) \times 4$ 
  - A. distributive property B. commutative property C. associative property
- 19. Which expression is NOT equivalent to -8x 24?

A. -10x + 2x + 10 + (-34)B. 4(-2x - 6)C. -8(x + 3)D. -8(x - 3)