North Penn School District

Elementary Math Parent Letter

Grade 6

Unit 3 – Chapter 8: Algebra: Equations and Inequalities

Examples for each lesson:

Lesson 8.1

Exponents

An **exponent** tells how many times a number is used as a factor.

The **base** is the number being multiplied repeatedly.

For example, in 2^5, 5 is the exponent and 2 is the base.
$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

Write the expression 4^5 using equal factors. Then find the value.

Step 1 Identify the base. | The base is 4.

Step 2 Identify the exponent. | The exponent is 5.

Step 3 Write the base as many times as the exponent tells you. Place a multiplication symbol between the bases. | $4 \times 4 \times 4 \times 4 \times 4$

You should have one less multiplication symbol than the value of the exponent.

Step 4 Multiply. | $4 \times 4 \times 4 \times 4 \times 4 = 1{,}024$

So, $4^5 = 1{,}024$.

Lesson 8.2

Write Equations

To write an equation for a word sentence, write the words as mathematical expressions and write = for "equals" or "is."

Write an equation for the word sentence.

Example 1 6 fewer than a number is $12\frac{2}{3}$.

Step 1 Choose a variable.
6 fewer than a number is $12\frac{2}{3}$.
Let n represent a number.

Step 2 Identify the operation.

6 fewer than n is $12\frac{2}{3}$.

"Fewer than" means subtract.

Step 3 Write an equation.

6 fewer than a number is $12\frac{2}{3}$.

$n - 6 \qquad = 12\frac{2}{3}$

So, the equation is $n - 6 = 12\frac{2}{3}$.

Example 2

The quotient of 20.7 gallons and a number is 9 gallons.

$20.7 \div p \qquad = 9$

So, the equation is $20.7 \div p = 9$.

More information on this strategy is available on Animated Math Model #23.

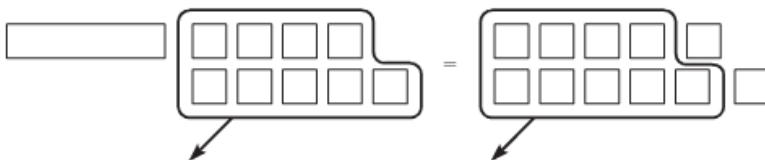**Lesson 8.3**

Model and Solve Addition Equations

You can use algebra tiles to model and solve equations. Use a long rectangle to represent the variable, and a square to represent 1.

Model and solve the equation $x + 9 = 11$.

Step 1 Model the equation using algebra tiles.

Step 2 Get the variable by itself on one side of the equation. Remove the same number of tiles from each side.

Step 3 Write the solution.

$x = 2$

Lesson 8.4

Solve Addition and Subtraction Equations

To solve an equation, you must isolate the variable on one side of the equal sign. You can use **inverse operations**: undoing addition with subtraction or subtraction with addition. These actions are made possible by the **Addition and Subtraction Properties of Equality.**

Solve and check.

Example 1: $y + 6.7 = 9.8$ **Example 2:** $57 = x - 8$

Step 1 Look at the side with the variable. Subtract the number that is added to the variable, or add the number that is subtracted from the variable. Be sure to perform the <u>same</u> operation on <u>both</u> sides of the equation.

$y + 6.7 = 9.8$ $57 = x - 8$

$y + 6.7 - 6.7 = 9.8 - 6.7$ Subtract 6.7 from $57 + 8 = x - 8 + 8$ Add 8 to
both sides.   both sides.

Step 2 Simplify both sides of the equation.

$y + 6.7 = 9.8$ $57 = x - 8$

$y + 6.7 - 6.7 = 9.8 - 6.7$ $57 + 8 = x - 8 + 8$

$y + 0 = 3.1$ $65 = x + 0$

$y = 3.1$ $65 = x$

Step 3 Check your answer in the original equation.

$y + 6.7 = 9.8$ $57 = x - 8$

$3.1 + 6.7 \stackrel{?}{=} 9.8$ $57 \stackrel{?}{=} 65 - 8$

$9.8 = 9.8$ $57 = 57$

So, $y = 3.1$ is the solution.   So, $x = 65$ is the solution.

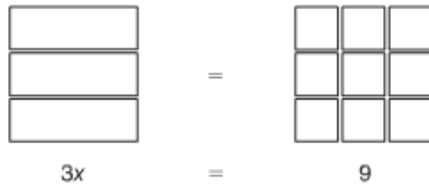More information on this strategy is available on Animated Math Models #24, 25.
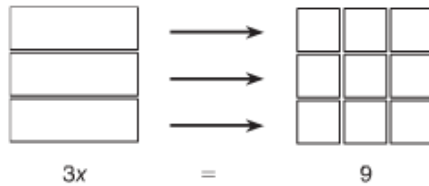
Lesson 8.5

Model and Solve Multiplication Equations

You can use algebra tiles or a drawing to model and solve equations.
Use a rectangle to represent the variable and a square to represent 1.

Model and solve the equation 3x = 9.

Step 1 Model the equation using rectangles and squares.

$$3x \quad = \quad 9$$

Step 2 Divide the squares into equal groups. The number of groups should be the same as the number of rectangles.

$$3x \quad = \quad 9$$

Step 3 Find the number of squares in each group.

$$x \quad = \quad 3$$

So, $x = 3$ is the solution.

Solve Multiplication and Division Equations

A multiplication equation shows a variable multiplied by a number.
A division equation shows a variable divided by a number. To solve a
multiplication equation, you use the **Division Property of Equality**.
To solve a division equation, you use the **Multiplication Property of
Equality**. These properties state that both sides of an equation remain
equal when you multiply or divide both sides by the same number.

Solve and check.

Example 1: $\frac{a}{5} = 6$ **Example 2:** $2.5x = 10$

Step 1 Look at the side with the variable. Use the inverse operation to get the variable by itself.

$\frac{a}{5} = 6$ a is divided by 5. $2.5x = 10$ x is multiplied by 2.5.

$5 \times \frac{a}{5} = 6 \times 5$ Multiply both sides by 5. $\frac{2.5x}{2.5} = \frac{10}{2.5}$ Divide both sides by 2.5.

Step 2 Simplify both sides of the equation.

$\frac{a}{5} = 6$ $2.5x = 10$

$5 \times \frac{a}{5} = 6 \times 5$ $\frac{2.5x}{2.5} = \frac{10}{2.5}$

$a = 30$ $x = 4$

Step 3 Check your answer in the original equation.

$\frac{a}{5} = 6$ $2.5x = 10$

$\frac{30}{5} \overset{?}{=} 6$ $2.5 \times 4 \overset{?}{=} 10$

$6 = 6$ $10 = 10$

So, $a = 30$ is the solution.   So, $x = 4$ is the solution.

More information on this strategy is available on Animated Math Model #22.

Lesson 8.7

Problem Solving • Equations with Fractions

After driving 25 miles, Kevin has traveled $\frac{2}{3}$ of the distance from his house to his friend's house. Use the equation $25 = \frac{2}{3}d$ to find the total distance d in miles to his friend's house.

Read the Problem		
What do I need to find?	**What information do I need to use?**	**How will I use the information?**
I need to find the _____ _____ from Kevin's house to _____ _____.	I need to use the equation _____.	I can use multiplication to change the equation to an equation with only _____, not fractions. Then I can _____ the new equation.

Solve the Problem	
Step 1 Write the original equation.	$25 = \frac{2}{3}d$
Step 2 Write a simpler equation without fractions. Multiply both sides by the denominator of the fraction.	$3 \times 25 = (3 \times \frac{2}{3})d$ $75 = \frac{6}{3}d$ $75 = 2d$
Step 3 Solve the simpler equation. Use the Division Property of Equality.	$\frac{75}{2} = \frac{2d}{2}$ $37.5 = d$

So, the total distance is 37.5 miles.

Lesson 8.8

Solutions of Inequalities

An **inequality** is a mathematical sentence that compares expressions. A **solution of an inequality** is a value for a variable that makes the inequality true.

For the inequality $a < 3$ (a is less than 3), $a = 1$ is a solution because 1 is less than 3. $a = 3$ is *not* a solution because 3 is *not* less than 3.

Inequalities use these symbols: $<$ (less than), $>$ (greater than), $\leq$ (less than or equal to), and $\geq$ (greater than or equal to).

	For the inequality $x \leq 5$, is $x = 3$ a solution?	**For the inequality $y > 8$, is $y = 3$ a solution?**
Step 1 Understand the inequality.	$x \leq 5$ means "x is less than or equal to 5." Any value that is equal to 5 or less than 5 is a solution.	$y > 8$ means "y is greater than 8." Any value that is greater than 8 is a solution.
Step 2 Decide whether the value is a solution.	3 is less than 5, so $x = 3$ is a solution.	3 is not greater than 8, so $y = 3$ is not a solution.

More information on this strategy is available on Animated Math Model #26.

Lesson 8.9

Write Inequalities

Here are some ways to express each inequality symbol in words:

<	less than	under	not as much as		>	greater than	over	more than
≤	less than or equal to	at most	no more than		≥	greater than or equal to	at least	no less than

Passengers at least 12 years old pay full price for train tickets.
Write an inequality to represent the situation.

Step 1 Choose a variable. Use *a* to represent "age."   *a*

Step 2 Choose an inequality symbol. "at least 12 years old" means "greater than or equal to 12."   ≥

Step 3 Write the inequality. $a \geq 12$

Write two word sentences to represent y < 9.

Step 1 Identify the inequality symbol.   < means "less than."

Step 2 Write a word sentence that uses the variable and integer.   *y* is less than 9.

Step 3 Write another word sentence with the same meaning.   *y* is under 9.
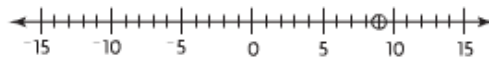
Lesson 8.10

Graph Inequalities

You can graph the solutions of an inequality on a number line.

Graph the inequality n ≥ 9.

Step 1 Determine the meaning of the inequality.
$n \geq 9$ means "*n* is greater than or equal to 9."

**Step 2** Draw a number line and circle the number given in the inequality.

Step 3 Decide whether to fill in the circle. For ≤ or ≥, fill in the circle to show "or equal to." For < or >, do not fill in the circle.

Since the inequality uses ≥, 9 is a possible solution. So, fill in the circle.
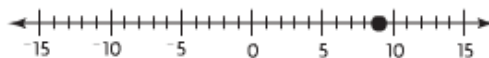
Step 4 Shade from the circle in the direction of the remaining solutions.

Since the inequality symbol is ≥, the shading covers all numbers greater than 9.
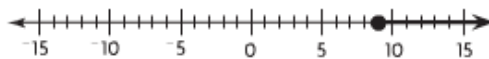
More information on this strategy is available on Animated Math Model #27.

Vocabulary

Addition Property of Equality – the property that states that if you add the same number to both sides of an equation, the sides remain equal

Equation – an algebraic or numerical sentence that shows that two quantities are equal

Inequality – a mathematical sentence that compares two expressions using the symbol <, >, $\geq$, $\leq$, or ≠

Inverse operations – operations that undo each other; multiplication and division are inverse operations

Multiplication Property of Equality – the property that states that if you multiply both sides of an equation by the same number, the sides remain equal

Solution of an equation – a value of a variable that makes an equation true

Solution of an inequality – a value of a variable that makes an inequality true