Sixth Grade Math with Confidence
Pilot Test, Unit 9B

Cumulative Current Memory Work

Unit 1	• **What do we call the result when we multiply two numbers?** *The product.* • **What do we call the numbers in a multiplication equation that we multiply together?** *Factors.* • **What do we call the number to be divided?** *The dividend.* • **What do we call the number we divide by?** *The divisor.* • **What do we call the result when we divide two numbers?** *The quotient.* • **What do we call an amount that is left over after division?** *The remainder.* • **What are the four basic operations?** *Addition, subtraction, multiplication, and division.* • **What is an equation?** *A number sentence with an equals sign.* • **What is an expression?** *Part of a number sentence without an equals sign.* • **What is the order of operations?** *Parentheses, exponents, multiply or divide from left to right, add or subtract from left to right.* • **How do you know if a number is divisible by 2?** *It is even. It has 0, 2, 4, 6, or 8 in the ones-place.* • **How do you know if a number is divisible by 3?** *The sum of its digits is divisible by 3.* • **How do you know if a number is divisible by 4?** *When you divide it by 2, the quotient is even.* • **How do you know if a number is divisible by 5?** *It has a 0 or 5 in the ones-place.* • **How do you know if a number is divisible by 6?** *It is even and divisible by 3.* • **How do you know if a number is divisible by 10?** *It has a 0 in the ones-place.* • **Name 4 factors of X.** (Replace X with any number from 1 to 50.) *Answers will vary. Some numbers do not have 4 factors.* • **Name 4 multiples of X.** (Replace X with any number from 1 to 10.) *Answers will vary.* • **What is a prime number?** *A number with exactly 2 factors.* • **What is a composite number?** *A number with more than 2 factors.* • **What are the prime numbers less than 20?** *2, 3, 5, 7, 11, 13, 17, 19.* • **What does perimeter measure?** *The distance around the outside edge of a shape.* • **What does area measure?** *The amount of space that a shape covers.*

	• **What does volume measure?** *The amount of space a solid occupies.* • **What is the formula for the volume of a rectangular prism?** *Length times width times height.*
Unit 2	• **What's zero times any number?** *Zero.* • **What's zero divided by any other number?** *Zero.* • **What's any number divided by zero?** *Undefined.* • **What do we call the top number in a fraction?** *The numerator.* • **What do we call the bottom number in a fraction?** *The denominator.* • **What do we call fractions that look different but have the same value?** *Equivalent fractions.* • **What do we call numbers that have a whole number and a fraction?** *Mixed numbers.* • **What does LCM stand for?** *Least common multiple.* • **What does GCF stand for?** *Greatest common factor.* • **How many millimeters equal 1 centimeter?** *10.* • **How many centimeters equal 1 meter?** *100.* • **How many meters equal 1 kilometer?** *1,000.* • **How many grams equal 1 kilogram?** *1,000.* • **How many milliliters equal 1 liter?** *1,000.*
Unit 3	• **What is the formula for the area of a rectangle?** *Length times width. Base times height.** • **What is the formula for the area of a parallelogram?** *Base times height.* • **What is the formula for the area of a triangle?** *Base times height, divided by 2.* • **What do we call an angle with a measure less than 90 degrees?** *Acute.* • **What do we call an angle with a measure equal to 90 degrees?** *Right.* • **What do we call an angle with a measure greater than 90 degrees and less than 180 degrees?** *Obtuse.* • **What do we call an angle with a measure equal to 180 degrees?** *Straight.* • **What is an acute triangle?** *A triangle with 3 acute angles.* • **What is a right triangle?** *A triangle with a right angle.* • **What is an obtuse triangle?** *A triangle with an obtuse angle.* • **What do we call a quadrilateral with 4 right angles?** *A rectangle.* • **What do we call a quadrilateral with 4 right angles and 4 equal sides?** *A square.* • **What do we call a quadrilateral with 4 equal sides?** *A rhombus.*

	• **What do we call a quadrilateral with 2 pairs of parallel sides?** *A parallelogram.* • **What do we call a quadrilateral with exactly 1 pair of parallel sides?** *A trapezoid.*
Unit 4	• **What do we call a fraction where the numerator is greater than or equal to the denominator?** *An improper fraction.* • **What's 1 times any number?** *The number.* • **What's any number divided by 1?** *The number.* • **What's any number divided by itself?** *1.* • **What is the product of a number and its reciprocal?** *1.* • **How do you find the reciprocal of a fraction?** *Flip its numerator and denominator.*
Unit 5	• **How many inches equal 1 foot?** *12.* • **How many feet equal 1 yard?** *3.* • **How many inches equal 1 yard?** *36.* • **How many feet equal 1 mile?** *5,280.* • **How many ounces equal 1 pound?** *16.* • **How many fluid ounces equal 1 cup?** *8.*
Unit 6	• **What is the absolute value of a number?** *The number's distance from 0 on the number line.* • **What is the opposite of a positive number?** *The negative number with the same distance from 0 (or the same absolute value).* • **What is the opposite of a negative number?** *The positive number with the same distance from 0 (or the same absolute value).* • **What is the opposite of 0?** *0.* • **What is an inequality?** *A number sentence that compares quantities.* • **What do we call the point (0,0) on the coordinate plane?** *The origin.* • **What do we call the first number in an ordered pair?** *The x-coordinate.* • **What does the x-coordinate tell?** *The horizontal distance from the origin.* • **What do we call the second number in an ordered pair?** *The y-coordinate.* • **What does the y-coordinate tell?** *The vertical distance from the origin.* • **What do we call the four sections of the coordinate plane?** *Quadrants.*
Unit 8	• **What decimal is equivalent to one-half?** *0.5.* • **What decimal is equivalent to one-fourth?** *0.25.* • **What decimal is equivalent to three-fourths?** *0.75.*

	• **What decimal is equivalent to one-fifth?** *0.2.* • **What decimal is equivalent to two-fifths?** *0.4.* • **What decimal is equivalent to three-fifths?** *0.6.* • **What decimal is equivalent to four-fifths?** *0.8.*
Unit 9	• **What do we call a letter that stands for a number?** *A variable.* • **What do we call a number multiplied by a variable?** *A coefficient.* • **What do we call the parts of an expression that are added or subtracted?** *Terms.* • **What do we call a term with only a number and no variable part?** *A constant.* • **What is a solution to an equation?** *A value for the variable that makes the equation true.* • **What is an independent variable?** *A variable that stands for the quantity that changes or can be controlled.* • **What is a dependent variable?** *A variable that depends on the independent variable and can't be changed on its own.*

*Your child may use either base and height or length and width to describe the dimensions of a rectangle.

Unit 9B: Expressions and Equations

Overview

In Unit 9A, your child learned how to use variables to write expressions to match real-world situations. She learned how to evaluate expressions for a given value of the variable, and she learned how to use the four operations to simplify expressions.

In Unit 9B, your child will extend these skills to equations. She'll learn how to use the four operations to solve one-step equations. She'll also learn how to make a table to find solutions to equations with two variables and graph these equations on the coordinate plane.

What Your Child Will Learn

In this unit, your child will learn to:

- Write equations with variables to match real-world situations
- Use substitution to check whether a value of a variable is a solution to an equation
- Add, subtract, multiply, or divide to solve one-step equations with one variable
- Write equations to show relationships between independent and dependent variables
- Create a chart that shows solutions to an equation with two variables and use the chart to graph the equation on the coordinate plane
- Use the graph of an equation to find solutions to an equation

Lesson List

*Lesson 9.1	Introduce Variables
*Lesson 9.2	Coefficients and Order of Operations
*Lesson 9.3	Multiply or Divide to Simplify Expressions
*Lesson 9.4	Combine Terms to Simplify Expressions
Lesson 9.5	Expressions with Two Variables
Lesson 9.6	Equations
Lesson 9.7	Add or Subtract to Solve Equations
Lesson 9.8	Multiply or Divide to Solve Equations
Lesson 9.9	Independent and Dependent Variables
Lesson 9.10	Graph Equations on the Coordinate Plane
Lesson 9.11	Enrichment (Optional)

**Lessons 9.1-9.4 are included in pilot Unit 9A.*

Extra Materials Needed for Unit 9B

- Highlighter
- 2 pieces of paper
- For optional Enrichment Lesson:
    - *What's the Point of Math?* DK Publishing, 2020.

Teaching Math with Confidence: 3 Ways to Understand Variables

In this “pre-pre-algebra” unit, you’ll use concrete, real-life situations to gently introduce your child to variables. Your child will learn that variables are simply letters that stand for numbers in mathematical expressions and equations. She’ll learn that she can manipulate variables just like numbers, and that the usual properties of numbers apply to variables as well.

Variables allow us to “zoom out” from the specifics of a situation so that we can draw conclusions or apply the same mathematical principles to a wider variety of situations. You’ll introduce your child to three different ways to use variables in this unit: as a place-holder in a formula, as an unknown value in an equation, and as quantities that vary in relation to each other.

First, you’ll teach your child to use variables to write simple formulas for real-life problems. Using variables in this way allows us to describe a general rule in a concise and easy-to-understand way. For example, if a bike rental costs $15 per hour and h stands for the number of hours, the formula 15h tells the total cost. The variable is a place-holder for the number of hours. We can substitute any number of hours for h to find the total cost.

Second, you’ll introduce your child to equations in which a variable stands for an unknown value. Your child will learn that equations are like scales where both sides of the scale are equal to each other. She’ll learn how to “keep the scale balanced” as she changes both sides in the same way to solve the equation and find a value of the equation that makes the equation true.

$$x + 18 = 37$$
$$x + 18 - 18 = 37 - 18$$
$$x = 19$$

Last, you’ll introduce your child to simple equations with two variables. In these equations, the variables stand for two quantities that vary in relation to each other. Your child will learn to use charts and graphs to find solutions for these equations.

Isabella’s family’s minivan takes 1 gallon of gas to drive 30 miles.

Ex. Use *g* to stand for the number of gallons of gas and *m* to stand for the number of miles they can drive. Write an equation that shows the relationship between g and m.

$$30g = m$$

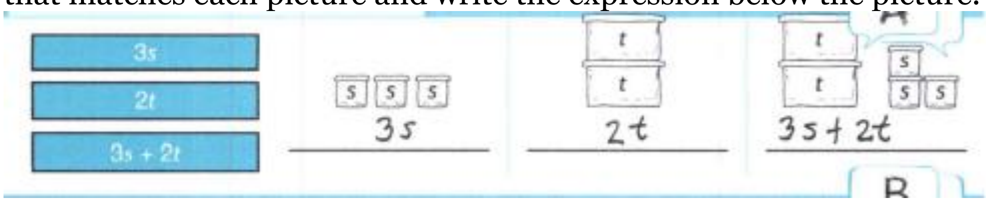
Your child will likely find the arithmetic in this unit quite easy, but she may find these new concepts quite challenging. If so, don't worry! This unit is meant as an introduction to variables, and some children's brains simply need more time to mature before they're capable of the abstract reasoning needed to feel comfortable with manipulating these abstract quantities. Your child will have many more opportunities to grapple with expressions and equations in her future pre-algebra and algebra courses.

Lesson 9.5 – Expressions with Two Variables

<table>
<tr><th>PURPOSE</th><th>MATERIALS</th></tr>
<tr><td>• Write expressions to match small and large boxes of marbles
• Write and simplify expressions with two variables</td><td>• None</td></tr>
<tr><td colspan="2">• What do we call the parts of an expression that are added or subtracted? Terms.
• What do we call a term with only a number and no variable part? A constant.</td></tr>
</table>

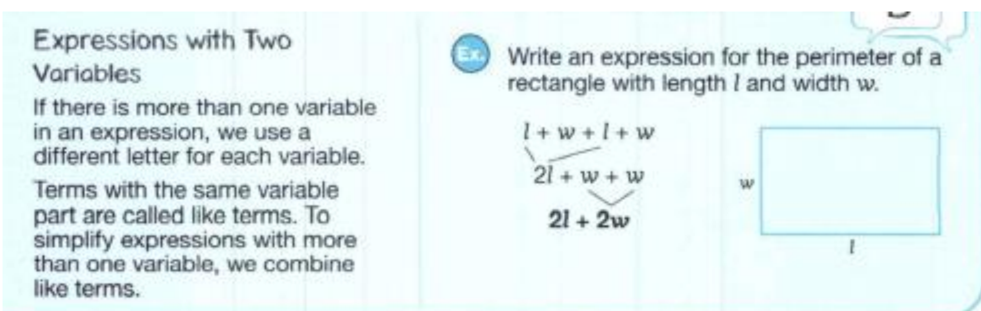
Warm-up (A): Use Small and Large Boxes of Marbles to Represent Two Variables

In this warm-up, every small box has the same number of marbles, and every large box has the same number of marbles. We'll use *s* for the number of marbles in each small box and *t* for the number of marbles in each large box. Have your child choose the expression that matches each picture and write the expression below the picture.



Activity (B): Combine Terms to Simplify Expressions with Two Variables

Today, you'll learn how to simplify expressions with two variables. Have your child read the text box aloud.


Expressions with Two Variables

If there is more than one variable in an expression, we use a different letter for each variable.

Terms with the same variable part are called like terms. To simplify expressions with more than one variable, we combine like terms.

Ex. Write an expression for the perimeter of a rectangle with length l and width w.

$l + w + l + w$

$2l + w + w$

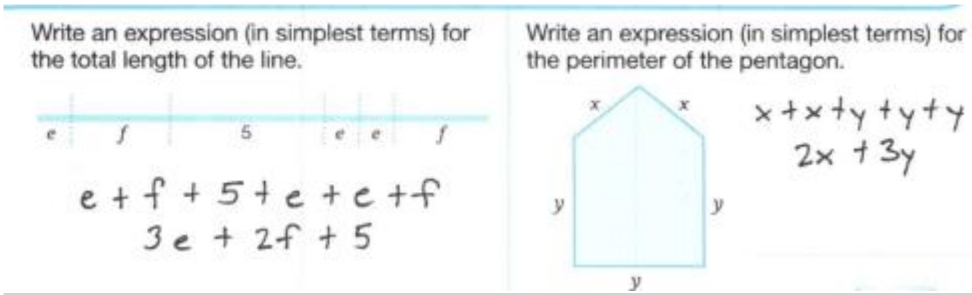
$2l + 2w$

The example shows how to write and simplify an expression for the perimeter of the rectangle. We combine the terms with the same variable part. Read aloud the expression: ***l* plus *w* plus *l* plus *w*.**

- **How many terms are in this expression?** *4.*
- **Two of the terms have *l* as their variable part. The terms are added together, so we add their coefficients.**
- **When a variable doesn't have a coefficient, what do we understand its coefficient to be?** *1.* **1 plus 1 equals 2, so *l* plus *l* equals 2*l*.**
- **Two of the terms have *w* as their variable part. We understand their coefficients to be 1, so *w* plus *w* equals 2*w*.**

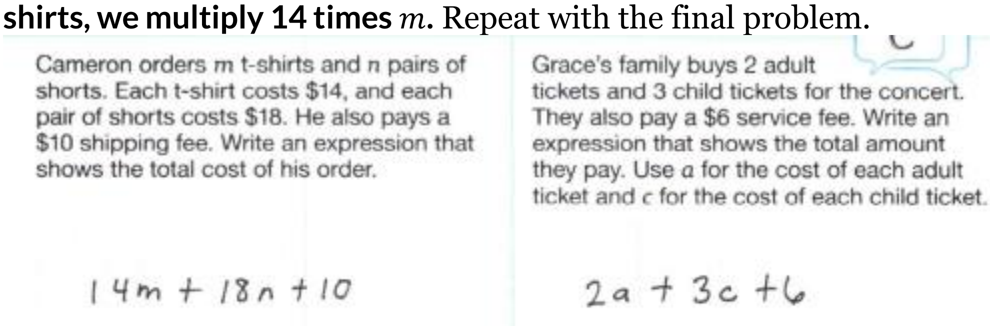
- **Simplifying the expression gives us a simpler way to find the perimeter of a rectangle. We can multiply the length times 2, multiply the width times 2, and then add the products.**

Read aloud the first practice problem. Have your child write an addition expression to show the total length of the line. Then, have her simplify the expression. Repeat with the second exercise.



If your child gets confused when simplifying the expressions, have her use colored pencils or highlighters to color-code the terms in the expression. For example, for the first problem, have her highlight the e's in one color, the f's in a different color, and the constant in a third color.

Read aloud the third word problem. **Tell me in words how to solve this problem.** *Sample answer: Multiply 14 times the number of t-shirts, and multiply 18 times the number of shorts. Then, add the products together and add on the 10.* Then, help your child translate each phrase into mathematical symbols. For example: **You said we should first multiply 14 times the number of t-shirts. The variable** m **stands for the number of t-shirts, we multiply 14 times** m. Repeat with the final problem.



Independent Practice and Review

Have your child complete the Lesson 9.5 Practice and Review workbook pages.

Lesson 9.6 – Equations

PURPOSE	MATERIALS
• Preview the concept of keeping equations balanced • Write equations with variables to match scales • Understand that a solution to an equation is a value for the variable that makes the equation true • Use substitution to check whether a value of a variable is a solution to the equation	• Playing cards • 2 pieces of paper
• **What is an expression?** *Part of a number sentence without an equals sign.* • **What is an equation?** *A number sentence with an equals sign.*	

In this lesson, your child will focus on checking whether a given number is a solution to an equation. Your child will learn how to find solutions in Lessons 9.7 and 9.8.

Warm-up: Play Balance the Scale

Today, you're going to learn about equations. In equations, the two sides equal each other, just like a scale that's in balance. To warm up, we'll play a game about balancing two sides of a scale. Play Balance the Scale.

<u>Balance the Scale</u>

Materials: Deck of playing cards with jacks, queens, and kings removed (40 cards total); 2 pieces of paper

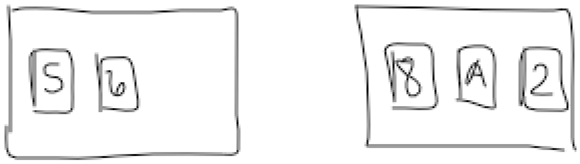
Object of the Game: Win the most cards by playing cards that balance the scale.

How to Play: Shuffle the cards and place them in a face-down pile. Deal 3 cards to each person.

Place 2 pieces of paper on the table. Each piece of paper represents one side of a scale.

On your turn, place 1 card on either piece of paper. Then, take a new card to replenish your hand.

Take turns until the sum of the cards on one piece of paper equals the sum of the cards on the other piece of paper. (There must be at least 2 cards on each piece of paper. Aces equal 1.) Whoever played the last card takes all of the cards and puts them in his "Won" pile. These cards are now out of the game.



Caption: 5 + 6 = 8 + 1 + 2. The sums are equal, so whoever played the last card takes all of the cards on both pieces of paper.

The player who won the cards then plays a new card to start the next round.

Continue playing until you have used all of the cards in the draw pile. Whoever has won more cards wins the game.

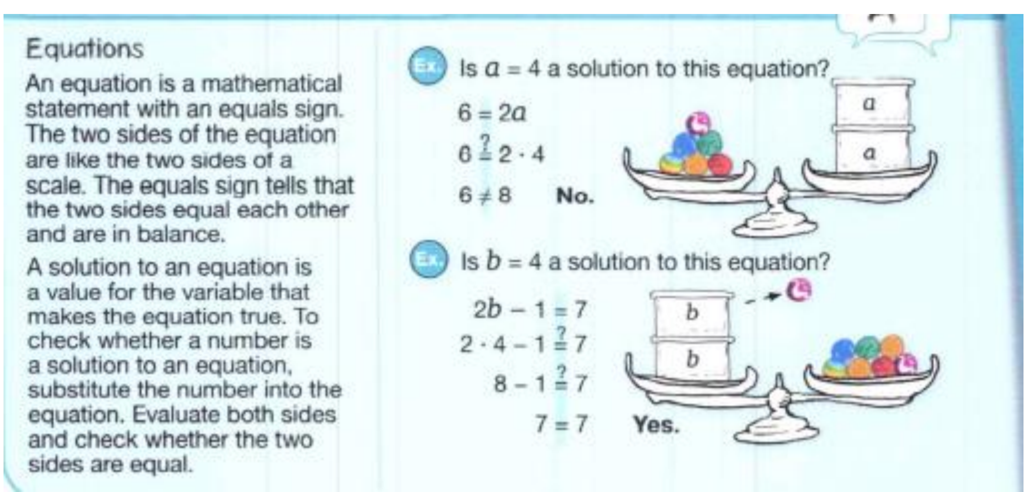
Activity (A): Check Whether Numbers are Solutions to Equations

In the first part of this unit, you learned about expressions. When you evaluate an expression, you can choose any value for the variable. Then, you substitute the value into the expression and evaluate.

In the second part of this unit, you'll learn about equations. We don't evaluate equations. Instead, we *solve* equations. That means that we find values for the variable that make the equation true. Some equations have one solution, some have many solutions, and some have zero solutions.

Today, you'll learn how to check whether a value for a variable is solution to an equation. When you substitute the solution into the equation, both sides of the equation equal each other and are in balance.

Have your child read the text box aloud.



The first example shows how to check whether 4 is a solution to the equation.

- Read aloud the equation: ***6 equals 2a.***
- **We substitute the 4 into the equation in place of** a**. The question mark over the equals sign means that we're not sure yet whether the two sides of the equation are equal to each other.**
- **2 times 4 equals 8. Does 6 equals 8?** *No.* **6 is not equal to 8, so 4 is not a solution to the equation. The equals sign with a line through it is called the not-equals sign. It means the two sides are not equal to each other.**

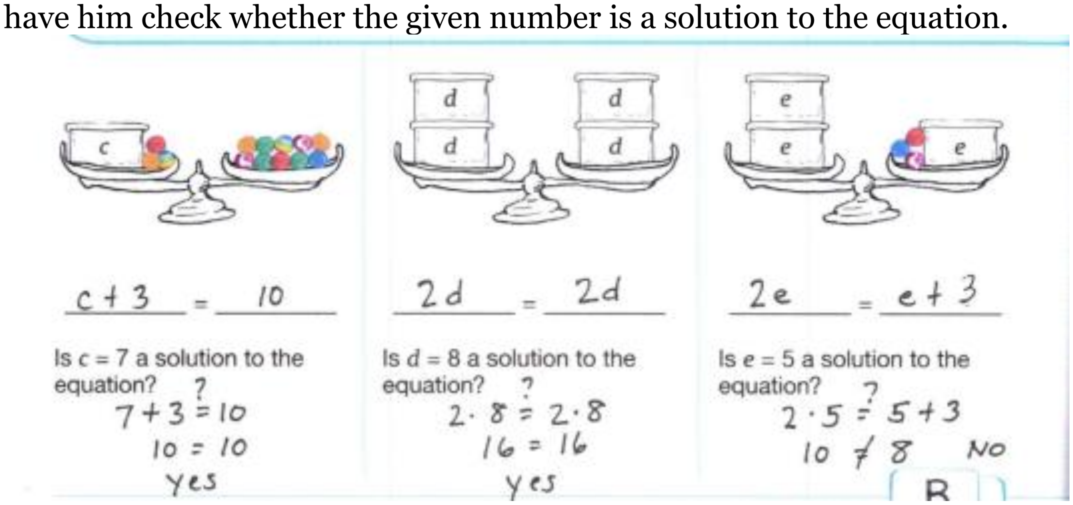
Point to the scale next to the problem. **The scale helps us visualize the problem.**

- **There are 6 marbles on the left side of the scale, and 2 boxes on the right side of the scale. The two sides are in balance.**
- **If we put 4 marbles in each box, there would be 8 marbles on the right side and 6 marbles on the left side, so the scale wouldn't be in balance any more.**
- **Can you tell what the solution to the equation is?** *3*. If your child's not sure, suggest he divide 6 by 2 (so that the 6 marbles are evenly divided between the 2 boxes).

The second example shows how to check whether 4 is a solution to a different equation.

- Read aloud the equation: ***2b minus 1 equals 7.***
- **We substitute the 4 into the equation in place of b.**
- **2 times 4 equals 8. 8 minus 1 equals 7. Does 7 equal 7?** *Yes.* **The two sides of the equation equal each other, so 4 is a solution to the equation.**
- Point to the scale next to the problem. **Imagine you put 4 marbles in each box and then take 1 away. That leaves 7 marbles on the left side of the scale. There are 7 marbles on the right side, so the scale is in balance.**

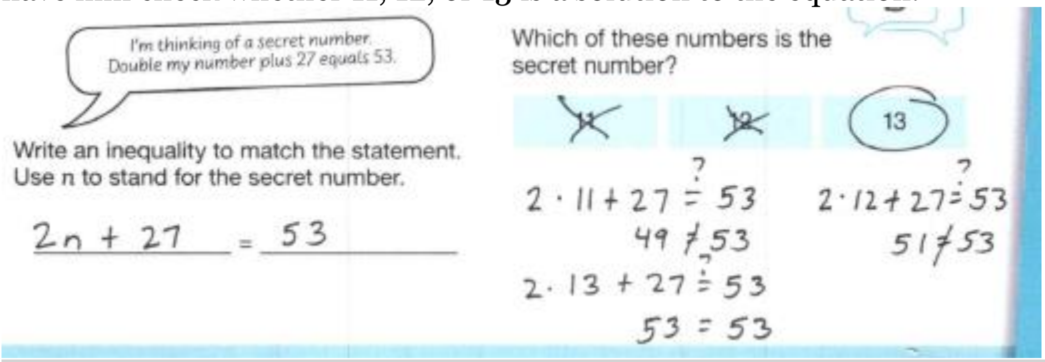
Have your child write an equation to match each scale in the practice problems. Then, have him check whether the given number is a solution to the equation.



The first and third problem have only 1 solution. The second problem has infinitely many solutions, since both sides of the scale have the same number of boxes. You could put any number of marbles in each box, and the boxes would remain in balance.

Activity (B): Check Solutions to a Secret Number Problem

We can write equations to match secret number clues. Have your child translate the words of the clue into mathematical symbols and write the matching equation. Then, have him check whether 11, 12, or 13 is a solution to the equation.



If your child enjoys number puzzles, have him make up a similar secret number problem. Have him choose a secret number and make up a clue about it. Also have him give you 3 possible solutions to the problem (and require him to include the actual solution as one of the possibilities!) Write an equation to match his problem and then check whether each number is a solution to the problem.

> I'm thinking of a secret number.
> If you add 8 to my number and then divide by 5, you get 20.
> Is 90, 92, or 95 my secret number?

Independent Practice and Review

Have your child complete the Lesson 9.6 Practice and Review workbook pages.

Lesson 9.7 – Add or Subtract to Solve Equations

<table>
<tr><th>PURPOSE</th><th>MATERIALS</th></tr>
<tr><td>• Preview the concept of changing both sides of an equation in the same way
• Add or subtract to solve equations
• Use substitution to check solutions to equations</td><td>• Die
• Highlighter</td></tr>
<tr><td colspan="2">• What is the absolute value of a number? The number’s distance from 0 on the number line.
• What is the opposite of a positive number? The negative number with the same distance from 0 (or the same absolute value).
• What is the opposite of a negative number? The positive number with the same distance from 0 (or the same absolute value).
• What is the opposite of 0? 0.</td></tr>
</table>

Warm-up (A): Play Keep It Balanced!

Today, we’re going to add or subtract numbers from both sides of an equation. Our goal will be to keep the two sides of the equation balanced, just like a scale.

To warm up, we’ll play a game where we keep two sides of a scale in balance. We’ll pretend we each have a scale like this one. One side of the scale has a box with x marbles in it and a bag with 18 marbles. The other side of the scale has a bag with 37 marbles.

To play, we roll the die and subtract the number of marbles from both sides of the scale. Whoever subtracts all 18 marbles from the left side of the scale first wins. Play Keep It Balanced!

<u>Keep It Balanced!</u>

Materials: Die

Object of the Game: Be the first player to subtract 18 marbles from each side of the scale (so that x is by itself on the left side of the scale).

How to Play: Each player starts a simple score card like the following on a separate piece of paper. Each column stands for one side of the scale.

Player 1	
$x + 18$	37

Player 2	
$x + 18$	37

On your turn, roll the die. The number on the die represents the number of marbles you remove from each side of the scale. Subtract the number from the expression in the previous row and write a new expression for each side of the scale.

For example, if you roll a 5 on your first turn, you remove 5 marbles from each side of the scale. 18 – 5 = 13, so the left side of the scale now has $x + 13$ marbles. 37 – 5 = 32, so the right side now has 32 marbles.

<die showing 5 >

Player 1	
$x + 18$	37
$x + 13$	32

Caption: Sample first play if you roll a 5.

Continue playing until you remove all of the marbles from the left side of the scale and have *x* by itself on the left side of the scorecard. You must remove the final marbles with an exact roll. For example, if your score card has x + 2 on the left side, you cannot remove the final 2 marbles if your roll a number greater than 2.

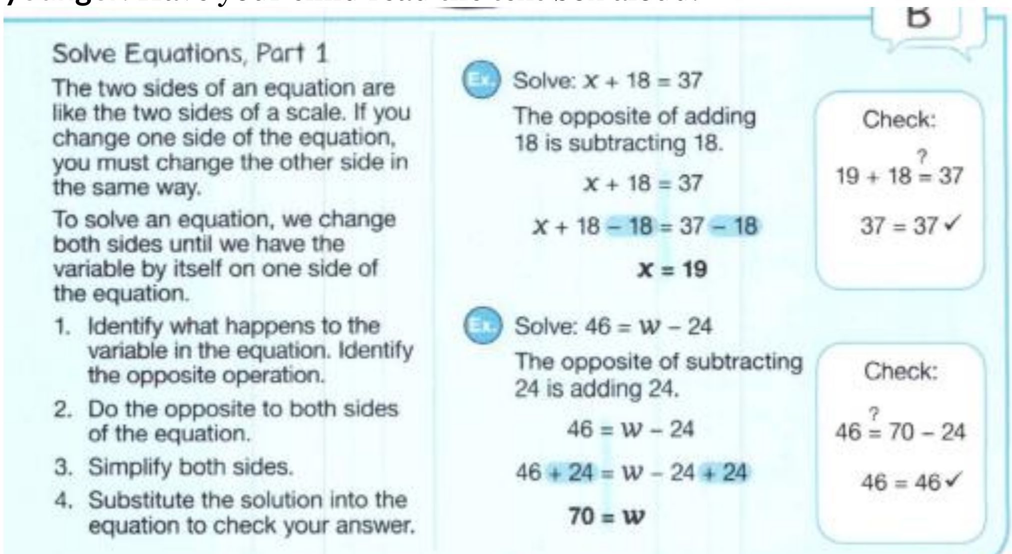
The first player who removes all the marbles from the left side and has *x* by itself on the left side of the scorecard wins the game. The final row on the scorecard should have *x* by itself on the left side and 19 on the right side.

After you complete the game, ask: **How many marbles are in the box labeled *x*?** *19 marbles.* **How do you know?** *Sample answer: The box balances with the 19 marbles on the right side of the scale. The final equation says that x equals 19.*

Activity (B): Add or Subtract to Solve Equations

In the last lesson, you learned how to check whether a number is a solution to an equation. You substituted the number into the equation and checked whether the two sides of the equation were equal to each other.

Today, you'll learn how to add or subtract to find the solution to an equation. It's a lot like how you added and subtracted to find missing numbers in equations when you were younger. Have your child read the text box aloud.


B

Solve Equations, Part 1

The two sides of an equation are like the two sides of a scale. If you change one side of the equation, you must change the other side in the same way.

To solve an equation, we change both sides until we have the variable by itself on one side of the equation.

1. Identify what happens to the variable in the equation. Identify the opposite operation.
2. Do the opposite to both sides of the equation.
3. Simplify both sides.
4. Substitute the solution into the equation to check your answer.

Ex. Solve: $x + 18 = 37$

The opposite of adding 18 is subtracting 18.

$x + 18 = 37$

$x + 18 - 18 = 37 - 18$

$\mathbf{x = 19}$

Check:

$19 + 18 \stackrel{?}{=} 37$

$37 = 37$ ✓

Ex. Solve: $46 = w - 24$

The opposite of subtracting 24 is adding 24.

$46 = w - 24$

$46 + 24 = w - 24 + 24$

$\mathbf{70 = w}$

Check:

$46 \stackrel{?}{=} 70 - 24$

$46 = 46$ ✓

The first example shows how to find the solution to the equation we used in the warm-up game. The line down the middle of the equals signs helps us visually separate the two sides of the equation from each other.

- Read aloud the equation: ***x plus 18 equals 37.***
- **What happens to the variable in this equation?** *We add 18 to it.*
- **What's the opposite of adding 18 to a number?** *Subtracting 18 from the number.*
- **So, we subtract 18 from both sides of the equation. We recopy the equation and write "minus 18" to both sides.**
- **Then, we simplify both sides. What's x plus 18 minus 18?** *x.* **What's 37 minus 18?** *19.* **So, x equals 19.**
- **Last, we substitute 19 back into the equation to check that it's a solution. 19 plus 18 equals 37, so 19 is the solution to the equation.**
- Point to the scale in part A. **If you put 19 marbles in the box labeled *x*, the scale is in balance. If you put any other number of marbles in the box, the scale won't be balanced.**

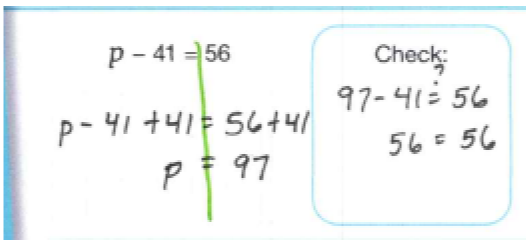
In Lesson 9.6, some of the equations had more than one solution. For the rest of the unit, every equation has only one solution.

Discuss the second example in the same way.

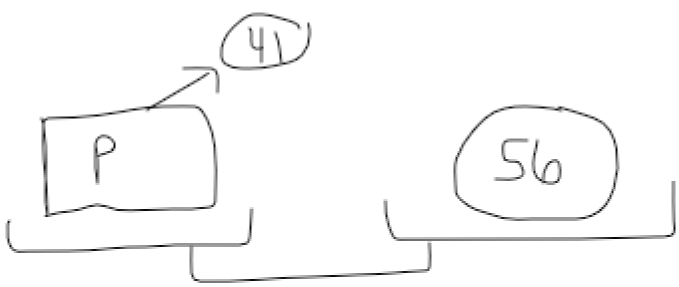
Demonstrate how to solve the first practice problem.

- Read aloud the equation: ***p minus 41 equals 56.***
- **First, I use a highlighter to draw a vertical line through the equals sign. I'll write all my equals signs on this line so that it's easy to see the two sides of the equation.** Draw a vertical line through the equals sign as shown.
- **What happens to the variable in this equation?** *We subtract 41 from it.*

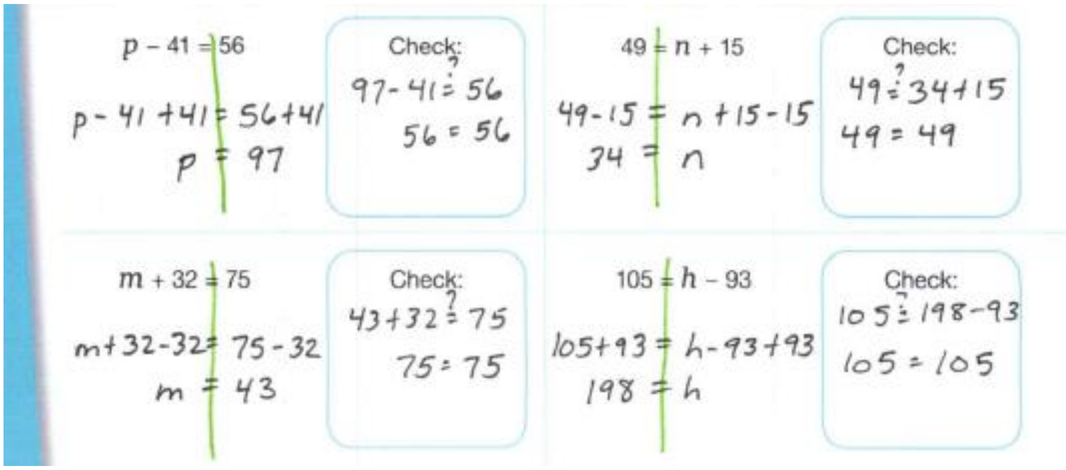
- **What's the opposite of subtracting 41 from a number?** *Adding 41 to the number.*
- **So, we add 41 to both sides of the equation. I recopy the problem and write "plus 41" on either side of the equation.** Write "p – 41 + 41 = 56 + 41" as shown. Write the equals sign on top of the highlighter line.
- **Then, we simplify both sides. What's p minus 41 plus 41?** *p.* **What's 41 plus 56?** *97.* **So, p equals 97.** Write "p = 97" as shown. Write the equals sign on top of the highlighter line.
- **Last, we substitute 97 back into the equation to check that it's a solution. I recopy the original equation and write 97 in place of the variable. What's 97 minus 41?** *56.* **97 minus 41 equals 56, so 91 is the solution to the equation.**



If your child needs a more concrete way to visualize the problem, draw a quick scale sketch. **Imagine you have a box with p marbles on one side of the equation. You take 41 marbles out of the box, and then the box balances with 56 marbles on the other side. If you add 41 marbles to each side of the equation, the box has p marbles again, and the right side of the scale has 97 marbles.**



Have your child find solutions for the rest of the equations in the same way. Have her use a highlighter to draw a vertical line through the equals sign before she begins solving.



If your child resists writing out the steps, make sure you insist on it anyway. Explain that learning how to write out the steps prepares her to solve more complex problems in the future. As the equations grow in complexity over the next few years, your child will find math much easier if she's already developed the essential habit of showing every step and organizing her written work.

Independent Practice and Review

Have your child complete the Lesson 9.7 Practice and Review workbook pages.

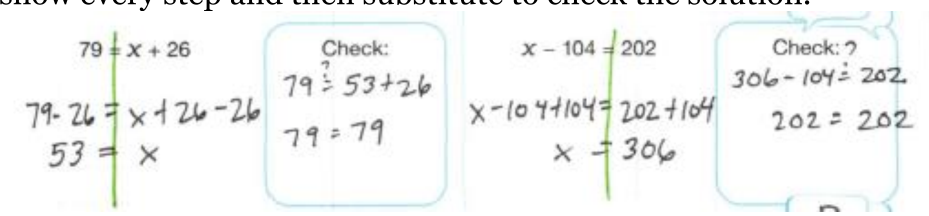
Lesson 9.8 – Multiply or Divide to Solve Equations

PURPOSE	MATERIALS
• Practice adding or subtracting to solve equations • Multiply or divide to solve equations • Use substitution to check solutions to equations	• Highlighter

- **What do we call a letter that stands for a number?** *A variable.*
- **What do we call a number multiplied by a variable?** *A coefficient.*

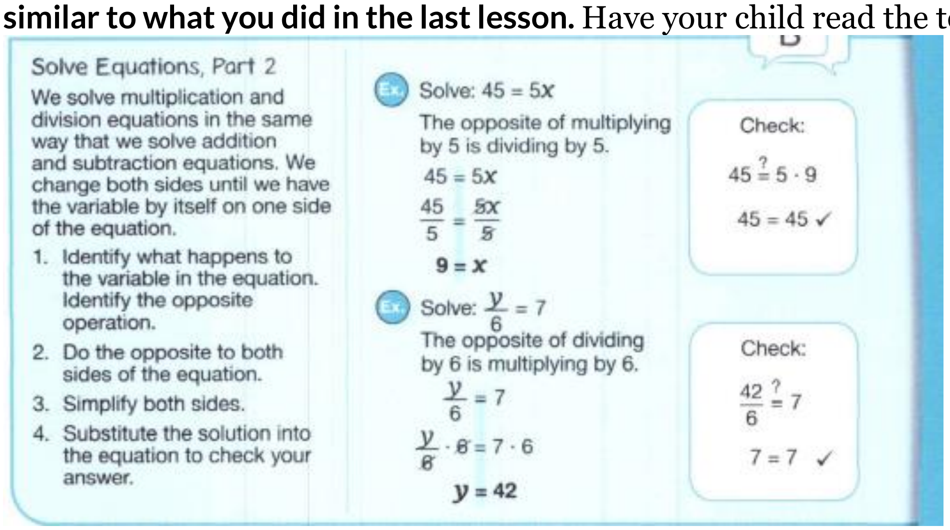
Warm-up (A): Practice Adding or Subtracting to Solve Equations

In the last lesson, you learned how to add or subtract to find the solution to an equation. Have your child add or subtract to find the solution to the equations. Remind him to show every step and then substitute to check the solution.



Activity (B): Multiply or Divide to Solve Equations

Today, you'll learn how to multiply or divide to find the solution to an equation. It's very similar to what you did in the last lesson. Have your child read the text box aloud.



Solve Equations, Part 2

We solve multiplication and division equations in the same way that we solve addition and subtraction equations. We change both sides until we have the variable by itself on one side of the equation.

1. Identify what happens to the variable in the equation. Identify the opposite operation.
2. Do the opposite to both sides of the equation.
3. Simplify both sides.
4. Substitute the solution into the equation to check your answer.

Ex. Solve: $45 = 5x$

The opposite of multiplying by 5 is dividing by 5.

$45 = 5x$

$\frac{45}{5} = \frac{5x}{5}$

$9 = x$

Check:

$45 \stackrel{?}{=} 5 \cdot 9$

$45 = 45$ ✓

Ex. Solve: $\frac{y}{6} = 7$

The opposite of dividing by 6 is multiplying by 6.

$\frac{y}{6} = 7$

$\frac{y}{6} \cdot 6 = 7 \cdot 6$

$y = 42$

Check:

$\frac{42}{6} \stackrel{?}{=} 7$

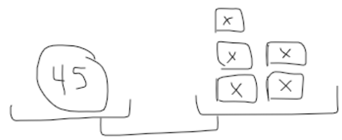
$7 = 7$ ✓

The first example shows how to find the solution to 45 equals 5x.

- **What happens to the variable in this equation?** *We multiply it by 5.*
- **What's the opposite of multiplying a number by 5?** *Dividing the number by 5.*
- **So, we divide both sides by 5. We draw a bar below each side of the equation and write 5 below the bar.**
- **Then, we simplify both sides. 45 divided by 5 equals 9, so the left side simplifies to 9.**
- **For 5x over 5, we cancel the 5s. 5x divided by 5 equals x. So, 9 equals x.**

- **Last, we substitute 9 back into the equation to check that it's a solution. 45 equals 5 times 9, so 9 is the solution to the equation.**

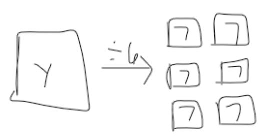
If your child needs a more concrete way to visualize the problem, draw a quick scale sketch. **Imagine you have 45 marbles on one side of the scale, and you have 5 boxes with *x* marbles each on the other side of the scale. If you put 9 marbles in each box, the scale balances.**



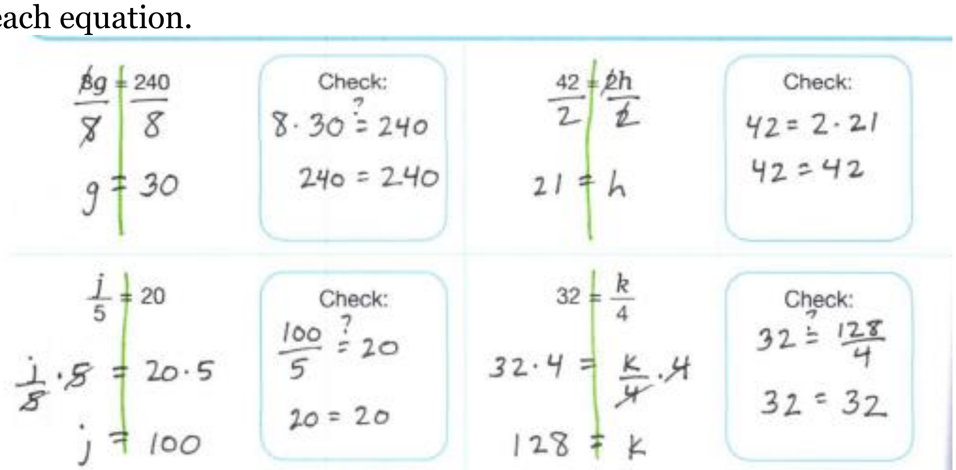
The second example shows how to find the solution to y over 6 equals 7.

- **What happens to the variable in this equation?** *We divide it by 6.*
- **What's the opposite of dividing a number by 6?** *Multiplying it by 6.*
- **So, we multiply both sides by 6 and then simplify.**
- **y divided by 6 times 6 equals y. We cancel the 6s, just like in a fraction multiplication problem.**
- **7 times 6 equals 42. So, y equals 42.**
- **Last, we substitute 42 back into the equation to check that it's a solution. 42 divided by 6 equals 7, so 42 is the solution to the equation.**

Division equations don't lend themselves well to visualizing with a scale. If your child needs a more concrete way to visualize the problem, say: **Imagine you have a box with y marbles. You split the marbles in the box into 6 equal groups, and there are 7 marbles in each group.**



Have your child follow the steps to find solutions for the practice equations. Have him use a highlighter to draw a vertical line through the equals sign before he begins solving each equation.



Independent Practice and Review

Have your child complete the Lesson 9.8 Practice and Review workbook pages.

Lesson 9.9 – Independent and Dependent Variables

PURPOSE	MATERIALS
• Understand that independent variables can be controlled or changed, and that dependent variables depend on an independent variable • Write equations to show relationships between independent and dependent variables • Use equations to solve problems about independent and dependent variables	• None

- **What do we call the parts of an expression that are added or subtracted?** *Terms.*
- **What do we call a term with only a number and no variable part?** *A constant.*

Warm-up (A): Complete a Mileage Chart

Have you ever heard people talk about the gas mileage for a car? *Answers will vary.* **The gas mileage for a car tells how far the car can go on one gallon of gas. Some cars can go very far on one gallon of gas, but others can only go a short distance.** Have your child complete the chart to match the information about Isabella's family's minivan.

Isabella's family's minivan takes 1 gallon of gas to drive 30 miles.

Gallons	1	2	3	4	5	6
Miles	30	60	90	120	150	180

Activity (B): Identify Independent and Dependent Variables

Today, you'll learn about equations with two variables. In these equations, one variable is independent and the other variable is dependent.

What does the word independent mean? *Sample answer: Not relying on other people. Not needing help.* **What does the word dependent mean?** *Sample answer: Depending on other people. Needing help.* **Dependent variables depend on independent variables. If the independent variable changes, the dependent variable changes, too.** Have your child read the top part of the text box aloud.

Independent and Dependent Variables

Variable can be independent or dependent. An independent variable stands for the quantity that changes or can be controlled in the situation.

A dependent variable stands for a quantity that depends on an independent variable. It can't be changed or controlled on its own.

Ex. Isabella's family's minivan takes 1 gallon of gas to drive 30 miles. What is the independent variable? What is the dependent variable?

The independent variable is the amount of gas, because Isabella's family can choose how much gas to put in the tank.

The dependent variable is the number of miles Isabella's family can drive, because this distance depends on how much gas is in the tank.

Activity (B): Write Equations to Show Relationships Between Independent and Dependent Variables

Have your child read the bottom part of the text box aloud.

We can write an equation to show the relationship between an independent variable and a dependent variable. We usually write the dependent variable on its own on one side of the equation.

Ex. Use g to stand for the number of gallons of gas and m to stand for the number of miles they can drive. Write an equation that shows the relationship between g and m.

$$30g = m$$

The problem says to use g for the number of gallons of gas and m for the number of miles. We multiply the number of gallons times 30 to find how many miles the minivan can go. So, the matching equation is 30 times $g$equals m, or 30g equals m.

When we solve equations with two variables, we find a value of both variables that makes the equation true. Point at the chart in part A. **Each pair of numbers in the chart is a solution to the equation 30g equals m. For example, if g equals 4, m equals 120. So, the pair of numbers 4 and 120 are a solution to the equation.**

Your child will learn how to graph solutions as ordered pairs in Lesson 9.10.

Activity (C): Solve Problems about Independent and Dependent Variables

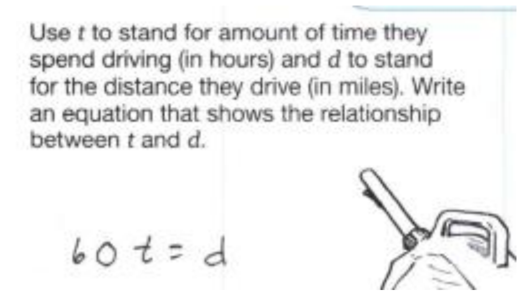
Now, we'll use an equation to understand the relationship between how many hours Isabella's family drives and how far they travel. The number of hours is the independent variable, because they can decide how many hours to drive each day. The distance is the dependent variable, since it depends on how many hours they drive. Have your child use the information to complete the chart.

Isabella's family goes on a road trip and drives an average of 60 miles per hour.

Time (hours)	1	2	3	4	5	6
Distance (miles)	60	120	180	240	300	360

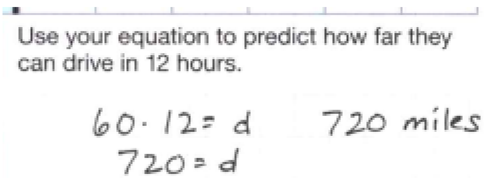
Your child will learn more about the relationship between speed, time, and distance in Unit X.

Have your child read aloud the first word problem and write an equation to match. If your child has trouble with this question, ask: **When you completed the chart, what did you do to the number of hours to find the distance?** *Multiplied the number of hours by 60.* **The variable t stands for the number of hours, so multiply t by 60 to find the distance.**


Use t to stand for amount of time they spend driving (in hours) and d to stand for the distance they drive (in miles). Write an equation that shows the relationship between t and d.

$60t = d$

Read aloud the second word problem. **We want to find how far they can drive in 12 hours. So, we substitute 12 in for *t* in our equation.** Have your child substitute 12 for *t* and solve the equation. **How far can they drive in 12 hours?** *720 miles.*

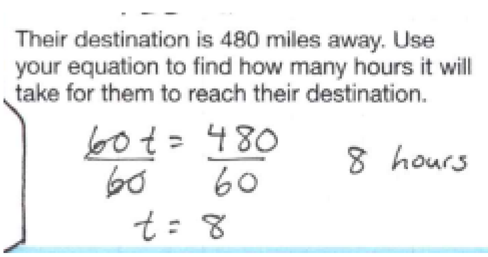

Use your equation to predict how far they can drive in 12 hours.

$60 \cdot 12 = d$

$720 = d$

720 miles

Read aloud the second word problem. **We want to find how many hours it will take for them to drive 480 miles. 480 miles is the distance, so we substitute 480 for *d* in our equation.** Have your child substitute 480 for *d* and solve the equation. **How long will it take for them to drive 480 miles?** *8 hours.*


Their destination is 480 miles away. Use your equation to find how many hours it will take for them to reach their destination.

$\frac{60t}{60} = \frac{480}{60}$

$t = 8$

8 hours

Independent Practice and Review

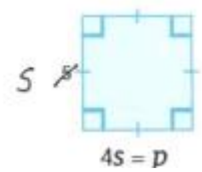
Have your child complete the Lesson 9.9 Practice and Review workbook pages.

Lesson 9.10 – Graph Equations on the Coordinate Plane

PURPOSE	MATERIALS
• Understand that pairs of numbers that make an equation true are solutions to the equation • Graph equations on the coordinate plane to show relationships between independent and dependent variables • Use the graph of an equation to find solutions to an equation	• None
• **What's 1 times any number?** *The number.* • **What's any number divided by 1?** *The number.* • **What's any number divided by itself?** *1.*	

Warm-up (A): Find Solutions to an Equation with Two Variables

This chart shows the relationship between the length of a side of the square and the square's perimeter. We'll use this chart in part B. Have your child complete the chart.

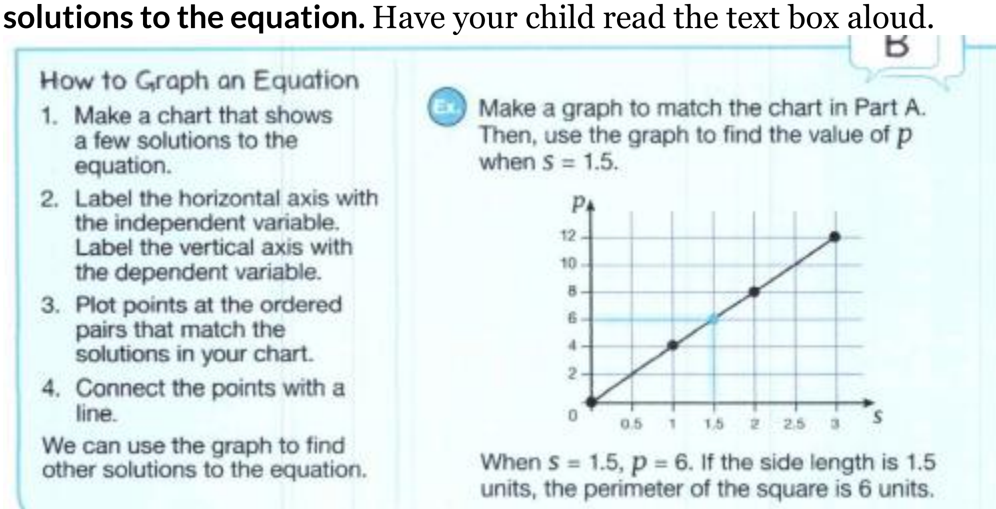


Side length (s)	0	1	2	3
Perimeter (p)	0	4	8	12

When we solve an equation with two variables, we find a value of both variables that makes the equation true. Each pair of numbers in the chart is a solution to the equation 4 s equals p. There are many more possible solutions! We'll use a graph to find some of them in the next section.

Activity (B): Graph an Equation with Two Variables on the Coordinate Plane

In the last lesson, you learned how to write equations with independent and dependent variables. Today, you'll learn how to graph these equations and use the graph to find solutions to the equation. Have your child read the text box aloud.



The example shows how to make a graph to match the equation in part A.

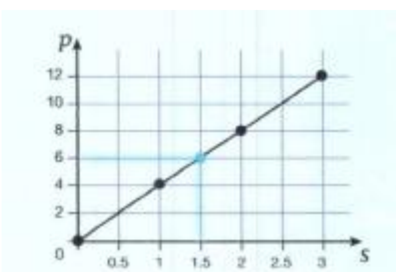
- **First, we make a chart that shows a few solutions to the equation. You already did that in part A.**
- **Then, we label the axes. In this equation, s is our independent variable, so it goes on the horizontal axis. Our dependent variable is p, so it goes on the vertical axis.**
- **Next, we plot points at the ordered pairs that match the solutions in the chart. The first column in the chart shows the solution s equals 0 and p equals 0. So, there's a point plotted at (0,0).** Point to each column in the chart and have your child identify the matching point on the graph.
- **Finally, we connect the points with a straight line.**

Activity (B): Use the Graph of an Equation to Find Solutions to the Equation

When we make a chart to graph an equation, the chart shows just a few possible solutions to the equation. Graphing the equation shows us more possible solutions. Many equations have an infinite number of solutions!

Each point on the graph represents one possible solution to the equation. The matching ordered pair tells the value of each variable for that solution.

The example shows how to find the value of p when s equals 1.5. We look for the point on the graph where s equals 1.5. The vertical coordinate for that point is 6, so p equals 6 at that point.



Let's substitute those values of the variable into the equation to check that they are a solution. Write the following on a piece of scrap paper:

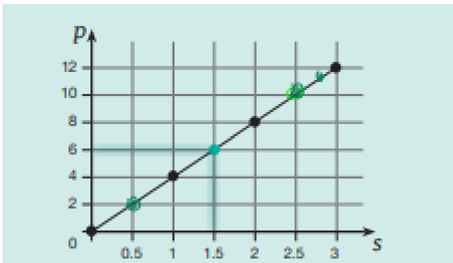
$$4s = p$$
$$4 \cdot 1.5 \stackrel{?}{=} 6$$
$$6 = 6$$

These values of the variable make the equation true, so we can be sure that they are a solution to the equation.

Have your child use the graph to answer the following questions:

- **If s equals 2.5, what is the value of p?** *10.*
- **If p equals 2, what is the value of s?** *0.5.*

- **If the exact value for a variable isn't on a grid line, we can use the grid lines to approximate the answer. If s equals 2.8, what is the approximate value of p?** *Sample answer: About 11.*

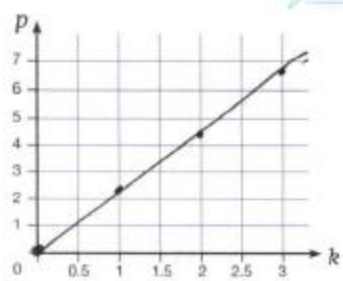


Activity (C): Graph an Equation with Two Variables and Use the Graph to Find Solutions to the Equation

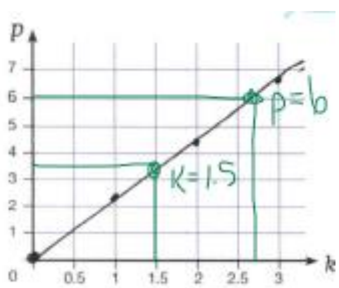
To convert kilograms to pounds, we multiply the number of kilograms by 2.2. This tells the approximate number of pounds. Have your child use this information to complete the table. He can mentally add 2.2 to the previous number of pounds or write multiplication problems on scrap paper. Then, have your child plot points and draw a line to graph the equation.

1 kg ≈ 2.2 lb.

Kilograms (k)	Pounds (p)
0	0
1	2.2
2	4.4
3	6.6



Help your child draw additional points on the graph to match the directions. Then, help him use the graph to answer the questions and complete the conversions.



Draw a point on the graph where k = 1.5. What is the approximate value of p for this point? 3.5

Use your answer to complete the blank.

1.5 kg ≈ 3.5 lb.

Draw a point on the graph where p = 6. What is the approximate value of k for this point? 2.7

Use your answer to complete the blank.

2.7 kg ≈ 6 lb.

Independent Practice and Review

Have your child complete the Lesson 9.10 Practice and Review workbook pages.

Lesson 9.11 – Enrichment (Optional)

PURPOSE	MATERIALS
• Review memory work • Appreciate how math can be used in real-life situations • Use variables to understand a secret number trick • Summarize what your child has learned and assess your child's progress	• *What's the Point of Math?*

Warm-up: Review Memory Work

Quiz your child on any of the memory work items that she struggled with during this unit.

Math Book: *What's the Point of Math?*

Read pages 34-35 and pages 66-73 in *What's the Point of Math?*

Enrichment Activity: Use Variables to Understand a Secret Number Trick

In this unit, you used variables to solve equations. Today, we'll use variables to figure out why a secret number trick works. Give your child the following instructions (in order). After each instruction, have your child secretly write down her response.

- **Choose a number greater than 0 and less than 20.** *Sample response: Child chooses 13.*
- **Multiply your number by 3.** *Sample: 3 times 13 is 39.*
- **Add 60 to your new number.** *Sample: 39 plus 60 equals 99.*
- **Divide your new number by 3.** *Sample: 99 divided by 3 equals 33.*
- **Tell me this number.** *Sample: 33.*

Subtract 20 from your child's final number to find her secret number. For example, if her final number is 33, subtract 20 from 33 to find that her secret number is 13. **Your secret number is 13!**

The directions specify a number between 0 and 20 to keep the arithmetic simple. This trick works for any number.

To find your secret number, all I had to do was subtract 20 from the number you told me. Let's use variables to see why this works.

- **Let's use n to represent your secret number.** Write n on a piece of paper.
- **First, you multiplied your number by 3.** Draw an arrow as shown and label it "×3." Write $3n$ after the arrow.
- **Next, you added 60.** Draw an arrow and label it "+60." Write $3n + 60$ after the arrow.
- **Then, you divided the new number by 3.** Draw an arrow and label it "÷3." **We can divide in parts, just like we can multiply in parts. 3n divided by 3 equals n. 60 divided by 3 equals 20.** Write $n + 20$ after the arrow.

- **No matter what number you start with, your final number will always be 20 more than the secret number. So, I can subtract 20 from the final number to find the secret number.**

$$n \xrightarrow{\times 3} 3n \xrightarrow{+60} 3n+60 \xrightarrow{\div 3} n+20$$

Repeat the process with a few different secret numbers to confirm that the process works for any secret number.

If your child would like to create her own guess-my-number trick, help her use this script to create one.

1. *Choose a number.*
2. *Multiply your number by* ______. (The number in the blank can be any number.)
3. *Add* ____ *to your new number.* (The number in this blank should be divisible by the number from step 2.)
4. *Divide your number by* ______. (This number should be the same as the number in step 2.)
5. *Tell me your number.*

Then, your child can use this formula to find the secret number:

$$\text{final number} - \frac{\text{number from step 3}}{\text{number from step 4}} = \text{secret number}$$

Unit Wrap-Up

Have your child complete the Unit 9 Wrap-Up.

Unit 9 Checkpoint

What to Expect at the End of Unit 9

By the end of Unit 9, most children will be able to do the following:

- Write and evaluate expressions with variables that describe real-life situations.
- Identify terms, coefficients, variables, and constants in expressions. Some children will still be working on memorizing these terms.
- Simplify expressions by removing parentheses, cancelling, and combining terms. Many children will still be developing fluency with this skill.
- Write equations with one variable to match real-world situations, and use substitution to check whether a given value of the variable is a solution to the equation.
- Add, subtract, multiply, or divide to solve one-step equations with one variable.
- Write equations to show relationships between independent and dependent variables.
- Create a chart that shows solutions to an equation with two variables and use the chart to graph the equation on the coordinate plane.
- Use the graph of an equation to find solutions to an equation. Many children will still not fully understand the idea that every point on the graph is a solution to the equation.

Is Your Child Ready to Move on?

In Unit 10, your child will solve problems about perimeter, area, and volume. She will also learn how to find the surface area of solids. She does not need to have mastered expressions and equations before moving on to Unit 10.

If your child struggled with this unit, don't worry! It's simply meant as a preview to algebraic concepts, and some children's brains simply need more time to mature before they're capable of the abstract reasoning needed to fully understand expressions and equations. She'll revisit these skills in pre-algebra and algebra.