CHAPTER 3 • SOLVE EQUATIONS

Chapter 3 deals with the solving of equations and finding the values of variables. It addresses the following standards:

CCSS.MATH.CONTENT.6.EE.A.2 *Write, read, and evaluate expressions in which letters stand for numbers.*

CCSS.MATH.CONTENT.6.EE.B.5 *Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.*

CCSS.MATH.CONTENT.6.EE.B.6 *Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.*

CCSS.MATH.CONTENT.6.EE.B.7 *Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.*

CCSS.MATH.CONTENT.6.EE.B.8 *Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.*

CCSS.MATH.CONTENT.7.EE.B.3 *Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional ⅒ of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9¾ inches long in the center of a door that is 27½ inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*

CCSS.MATH.CONTENT.7.EE.B.4 *Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.*

CCSS.MATH.CONTENT.8.EE.C.7 *Solve linear equations in one variable.*

GETTING STARTED LESSON

INTRODUCTION TO SOLVE EQUATIONS

PRE-TEACH

I CAN STATEMENT(S)

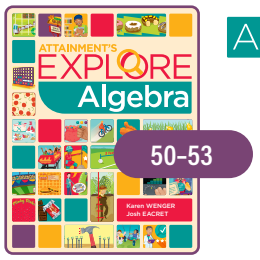
1 • I can demonstrate an understanding of at least two topics.

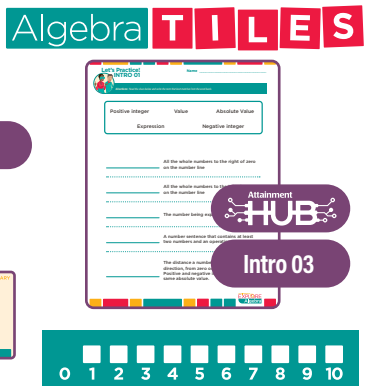
2 • I can identify operations needed to solve an equation.

A I can select the topic illustration that depicts the big idea of the lesson.

MATERIALS LIST

- **Explore Algebra Student Book** pgs. 50–53
- Algebra tiles
- Any number line
- UDL chart for lesson preparation
- **Explore Algebra .pdf files** from the HUB: Intro 03
- Lesson vocabulary cards: *equation, reciprocal, variable, coefficient, substitution*
- Time-Delay Script Card





ALIGNMENT

Chapter 3 deals with steps and procedures to solving equations. It addresses the following standards:

CCSS.MATH.CONTENT.6.EE.A.2 *Write, read, and evaluate expressions in which letters stand for numbers.*

CCSS.MATH.CONTENT.6.EE.B.5 *Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.*

CCSS.MATH.CONTENT.6.EE.B.6 *Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.*

CCSS.MATH.CONTENT.6.EE.B.7 *Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.*

CCSS.MATH.CONTENT.6.EE.B.8 *Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.*

CCSS.MATH.CONTENT.7.EE.B.3 *Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50.*

CCSS.MATH.CONTENT.7.EE.B.4 *Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.*

CCSS.MATH.CONTENT.8.EE.C.7 *Solve linear equations in one variable.*

FOUNDATIONAL CONCEPTS

Students understand there is an order to follow for executing operations in solving equations. For students with emerging numeracy skills, continue practicing number identification, math sign identification, and single-digit math operations (*e.g., 1+3, 4-2, 2×2, 3÷1*). Math function can be practiced (or modeled, if needed) using number lines and/or algebra tiles. Focus on the fact that there is an order to follow to solve problems correctly. Emphasize that order of operations are applied in real life, too. When students get dressed, make their breakfast, travel to school, or play games, they must follow a plan/order to be successful.

UNIVERSAL DESIGN FOR LEARNING (UDL) FRAMEWORK

ENGAGEMENT

- Discuss the idea of solving equations with your students; how do they feel when they hear the phrase *solving equations*? Are they excited, anxious, overwhelmed, or ready to tackle the topic?
- Show students a few simple, single-digit addition problems (*e.g., 2+1*) with your fingers or tallies on a whiteboard. Ask them if they know the answer. Then, take one of the numbers away and make it a variable. Ask them if they know the value (or number) of that variable.
- Have students share their experiences with substitutions, whether it was a food, sports, or teacher substitution. What does the word *substitution* mean to them?

REPRESENTATION

- Act out a routine or sequence that should not be done out of order so students understand the importance of the order of operations in real life (*e.g., making a sandwich, cooking recipes*)
- Have each student solve an equation using either a number line or the algebra tiles provided.
- Provide more examples of when substitution is used in real life (*e.g., cost of concert tickets for a group of 4, number of candies needed to give two to each of your friends, cost of gas needed for a 12-gallon tank*).

EXPRESSION

- Give each student the opportunity to share something that cannot be done out of order with a verbal presentation, drawing, skit, or an AAC step-by-step device.
- Have students come up with different words, or *synonyms*, for the vocabulary term, *variable*. Answers may consist of words like *changing*, *unknown*, and *uncertain*.
- Preprogram an AAC device with the chapter vocabulary terms and their corresponding definitions.

TEACH

ATTENTION GETTER / INTRODUCE THE LESSON

There are certain steps or rules that we follow for almost everything, aren't there? Would you start to brush your teeth *before* you put toothpaste on your toothbrush? No way! In this chapter, we're going to learn about the correct order for solving different types of algebra problems. We need to do certain operations in a specific order. Who can tell me an operation in math?

Let's take a look at pg. 50 in our Student Books. What do you see? A path! To get across the pond, you have to take one step at a time. We have to complete the steps in order to solve an equation, too. What would happen if you started on the last stepping stone? You'd fall in! What are some other things that require you to work in steps?

Have students respond with their answers. Answers may be tying your shoes, getting dressed, driving, etc. After hearing their answers, move on to the chapter vocabulary on pgs. 52–53.

TOPIC VOCABULARY

Throughout this chapter, we'll be working with new vocabulary words that some of you haven't seen before. Today, I'll be providing a quick overview of these new words, but we will explore them in more detail as we move through the lesson topics.

For subsequent lessons, you will be asked to choose the best strategy for your students when teaching the vocabulary (*Time-Delay* or *Model-Lead-Test*). For the vocabulary overview, use the *Model-Lead-Test* strategy to introduce the new words to your students.

Model-Lead-Test

Model: **The term [*equation*] means [*a mathematical statement in which two expressions are equal to each other*].**

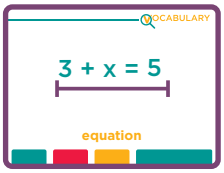
Lead: **Say it with me. [*Equation*] means [*a mathematical statement in which two expressions are equal to each other*].**

Test: **What term means [*a mathematical statement in which two expressions are equal to each other*]?**

Student indicates correct vocabulary word. Continue with any additional vocabulary words.

Time-Delay

Write out the vocabulary so that it can be easily displayed. Follow the Time-Delay procedure. Repeat the procedure for all vocabulary words in the lesson.



LESSON WALK THROUGH

Choose between the printed and the alternate version of the lesson. Begin the lesson by asking students to turn to pg. 51 in their Student Books. Before introducing the topics, ask students, **What do you think Chapter 3 is about?** Have students give predictions on what they think topics will be while looking at the overview on pg. 51. Remind students, **Remember, there are no right or wrong answers with prediction. What do YOU think we are going to cover in this chapter.** Allow for varied responses from students.

Did any of you predict that this chapter is about solving equations? You were right; we are going to learn a lot about the different steps to solving equations. Today, I'm going to give you a brief overview of the topics we will explore in this chapter on solving equations.

Earlier, we looked at the Big Picture and talked about their being different steps to follow for different equations. With this first lesson, we'll solve equations that use addition. What operations do you think we'll use in other lessons? Have students suggest operations. **Yes, addition and subtraction will both be used to help solve these equations!**

Tips for Teachers

Give each student an opportunity to share where they see steps in their everyday life. Answers can be shared verbally or by pointing to real-world examples.

VOCABULARY

Equation
A mathematical statement in which two expressions are equal to each other that uses an equal sign (=)

Reciprocal
When you flip a number (the numerator becomes the denominator and vice versa), you have the number's reciprocal. also called the inverse.

Variable
A quantity that may change within a mathematical problem; typically, we use a single letter to represent a variable.

Coefficient
The number or constant multiplied by a variable in a mathematical term

Substitution
Inserting a known value in the place of a variable

LESSON WALK THROUGH CONTINUED

In the next lesson, we'll be using some more operations. Who can name two more operations? Allow students time to suggest more operations. **Yes, we'll use multiplication and division! We're also going to learn about reciprocals—that's the *inverse* of a number. The reciprocal of three is one-third. The reciprocal of one-half is two. It's just the number flipped! Who can give me another pair of reciprocals?** Have students suggest reciprocals.

For the third topic, we'll learn about *substitution*. That's where we find the *value* of a *variable* and insert it into the equation so that we can solve it. For example, if four quarters equals one dollar, how many dollars is eight quarters worth? Have students answer. **That's right, two dollars!**

Review the first two topics. **In the last topic, we'll use the other methods we just discussed to solve equations that are a little more complicated. We'll also talk about *legal moves*. Who can guess what a legal move is?** Have students give answers. **A legal move is step that we take to solve an equation that follows the rules. In our last topic, we'll talk about balancing an equation while making sure we make only legal moves in solving it. Everything we do on one side of the equals sign, we will need to do on the other.**

Today, we're just talking about what's coming up. Pretty soon, we'll be able to solve algebra equations on our own!

REINFORCEMENT • REMEMBER!

Read the *Big Picture* text and have students read along with you: **There are specific steps to take when solving an equation.** Ask questions to check student understanding. Reinforce and confirm correct responses. If needed, go back to the *Big Picture* to review.

DISCUSSION

To start discussion, have students create small posters showcasing a method that has been discussed to solve equations. Students may need to look through the chapter to remember. Students may use the topic illustrations as part of their methods. Posters/methods may include:

Additive property *A large cake with slices making it whole*

Substitution *A pack of markers/crayons representing a number of markers or crayons*

Reciprocals *Divide up carrots amongst rabbits using reciprocals*

Legal moves/balancing *A scale below an equation with the same operation on both sides of the equal sign*

LANGUAGE BUILDER

Have students present their methods of solving posters to the group. Encourage the use of new vocabulary, like *equation, reciprocal, or substitution*, while presenting.

APPLY

USE TILES AS INTEGERS

1

To help us understand how to solve an equation, we are going to use algebra tiles. Let's watch these quick videos to see how these tiles can help us to solve different types of equations!

Watch the *Solve Simple Equations Using Addition, Subtraction, and Multiplication/Division* videos with your students. After watching the videos, write a few, low-numbered equations on the whiteboard. Have students create the equations from the whiteboard with algebra tiles. Reinforce and confirm correct answers. Model the correct answer, if needed.

09 Solve Simple Equations Using Addition
https://player.attainmentcompany.com/?v=kYghviSh

TILE-A-VISION! A quick guide to using algebra tiles

10 Solve Simple Equations Using Subtraction
https://player.attainmentcompany.com/?v=9PQdVjJ0

TILE-A-VISION! A quick guide to using algebra tiles

11 Ax=c; Multiplication/Division
https://player.attainmentcompany.com/?v=Hkg78Wwr

TILE-A-VISION! A quick guide to using algebra tiles

REMEMBER!

There are specific steps to take when solving an equation.

Tips for Teachers

Giving students an opportunity to present examples is a great way to build language skills for your students with disabilities, as well as English learners in the classroom. It is also another form of student expression tied to the UDL framework.

WHICH OPERATION?

Write a few simple equations on the whiteboard, then say, **When I point to an equation, tell me which operation I should use to balance the equation: *addition*, *subtraction*, *multiplication*, or *division*. Let me know when you think you know and I'll call on you to give us the answer!**

Give each student a chance to identify the correct operation using their preferred mode of communication. Give praise for correct responses and model correct answers, if needed.

CLOSING

Review the *Big Picture* by doing one or more of the following:

- Read the text from the *Big Picture* page;
- Have students read or follow along with the *Big Picture* text;
- Select the *Big Picture* text from a group of distractors;
- Select the unit *Big Picture* image from a group of other *Big Picture* images.




For students accessing the Level A lessons, have them show what they know by choosing the *Big Picture* image that best depicts the chapter's big idea.

EXTENDED PRACTICE

Create a list of different types of equations. Have the students work together in pairs to sort the different equations into groups. After students have had time to identify the equations, have them tell which type of operation each equation requires (addition, subtraction, multiplication, or division).

LANGUAGE BUILDER

Have students present one thing they have learned from the lesson, whether it's about balancing or a brief summary of any of the four topics. If possible, students should use content vocabulary to share with the group. Not only are you building opportunities to enhance language skills through these mini-presentations, but by presenting in front of the group, you will also build students' overall confidence.

EXTEND

CHALLENGE EXTENSIONS

In preparation for the next four topics, provide a sampling of the types of problems students will see in later lessons. This is also a good opportunity to evaluate students' present level of performance.

$3 + x = 7$; $x=4$

$2 + x + 8 = 14$; $x=4$

$10 - x = 10$; $x=0$

$x - 3 + 6 = 7$; $x=4$

$2x = 6$; $x=3$

$3x = 3$; $x=1$

$14/x = 7$; $x=2$

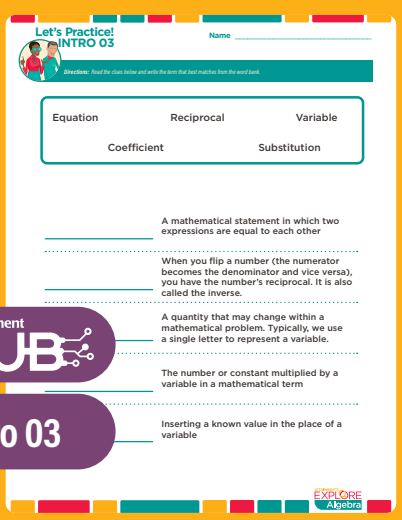
$x/9 = 2$; $x=18$

Additional practice sheets may be accessed and printed from the HUB.

Tips for Teachers

Give each student an opportunity to show what they know. If a student doesn't know the answer, help to narrow the choices by saying something like, **Well, it's definitely addition.**

Make sure to have AAC devices programmed with responses so that nonverbal students may also answer.



Attainment HUB

Intro 03

LESSON 09

SOLVE X + B = C

PRE-TEACH

I CAN STATEMENT(S)

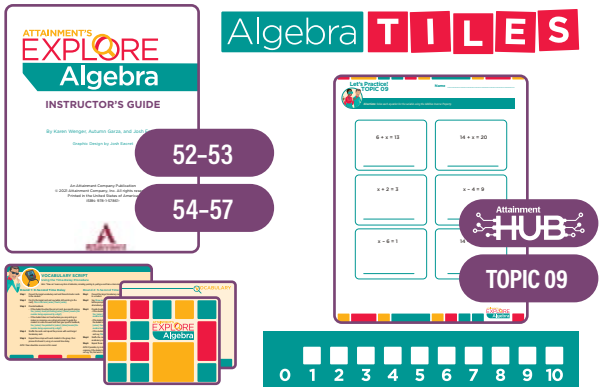
1 ▪ I can solve one-step equations using addition or subtraction.

2 ▪ I can use the Additive Inverse Property to solve equations.

I can select the topic illustration that depicts the big idea of the lesson.

MATERIALS LIST

- **Explore Algebra Student Book** pgs. 52–53; 54–57
- Algebra tile set
- A small box (shoe box or similar)
- Any number line
- **Explore Algebra .pdf files** from the HUB: Topic 09
- Lesson vocabulary cards: *equation, variable*
- Time-Delay Script Card



ALIGNMENT

Apply and extend previous understandings of arithmetic to algebraic expressions.

CCSS.MATH.CONTENT.6.EE.A.2 *Write, read, and evaluate expressions in which letters stand for numbers.*

Reason about and solve one-variable equations and inequalities.

CCSS.MATH.CONTENT.6.EE.B.6 *Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.*

Reason about and solve one-variable equations and inequalities.

CCSS.MATH.CONTENT.6.EE.B.7 *Solve real-world and mathematical problems by writing and solving equations of the form x + p = q and px = q for cases in which p, q and x are all nonnegative rational numbers.*

09 Solve Simple Equations using Addition
https://player.attainmentcompany.com/?v=kYghviSh

TILE-A-VISION! *A quick guide to using algebra tiles*

FOUNDATIONAL CONCEPTS

Students need to understand the meaning of an equal sign. Equal means the values are worth the same amount. Having students use a scale (see-saw) to balance tiles or to draw out the equal number of tiles on each side of the balance (or equal sign).

Students must have an understanding of positive and negative integers for solving the equations. Students should work on mastery of this skill prior to exploring equations. Setting up math workstations for students to build up foundational skills is a strategy for managing student needs. For students with emerging skills, practice addition and subtraction of values using tiles. Then, use tiles and ask questions like, **If I have 4, but I want to have 6, how many more tiles do I need?** Count tiles with student for the correct answer.

UNIVERSAL DESIGN FOR LEARNING (UDL) FRAMEWORK

ENGAGEMENT

- Watch the video titled *Solve Simple Equations Using Addition* to show how to use tiles to solve simple addition problems.
- Engage students in a discussion about identity and what identity is. Have students share what they think an additive identity means in math.
- Discuss real-life examples of the Additive Inverse Property, starting with temperatures above/below 0° C. Have students share their own examples (*e.g., credits and debits, positive and negative charges, elevation above and below sea level*).

REPRESENTATION

- Show opposites as reflections across zero on a number line; use positive and negative number lines to show the relationship between positive and negative integers and their distance from zero.
- Use the Additive Inverse Property with real-world examples (*e.g., you have $5; the sub costs you $5, you are ready to dive off a diving board that is 6 feet high; when you dive in, you go 6 feet underwater*).
- Give students the chance to use the algebra tiles to understand that a red tile added to a teal tile of equal value is 0 (the tiles balance each other out).

EXPRESSION

- Discuss the meaning of the word *opposite*. *Opposite* means having a position on the reverse side of something. In math, every number (besides 0) has an *opposite*. Have students share an example of a number and its opposite by writing them, saying them, pointing them out on a number line, or choosing opposites from a group of tiles.
- Preprogram AAC devices with the vocabulary terms *equation* and *variable*.
- Use synonyms to highlight important nouns or verbs (*e.g., inverse = opposite, reverse, flip side*).

TEACH

ATTENTION GETTER / INTRODUCE THE LESSON

What does it mean to *balance*? Students may need a sketch of a balance/see-saw with an example. **For instance, if there are 4 lbs. on one side of a scale, what amount will bring the scale into balance?** Discuss until the concept is understood.

Next, ask, **Does anyone know what a *variable* is?** This term may be new for most students, so the Mystery Box game* *(see **Tips for Teacher**s to the side for details)* may be a way to demonstrate the concept to students. Briefly explain what a variable is (it will be covered in the Topic Vocabulary exercise). **Let's play a game to see if we can figure out how variables work in math.**

Mystery Box game—set up a problem where a known value is added or subtracted from a mystery box. The two values are equal to a total amount. Example: 4 + ____ = 9. Play the game until the concept has been sufficiently covered.

Have the students turn to pg. 54 in the Student Book. **Today, we will begin Chapter 3, Topic 9: *Solve x + b = c*.**

Professor Fern is asking, "How do we solve an equation using addition?" What do you think that means? Have students make suggestions.

TOPIC VOCABULARY

Choose the best strategy for your students:

Model-Lead-Test

Model: **The term [*equation*] means [*a mathematical statement in which two expressions are equal to each other*].**

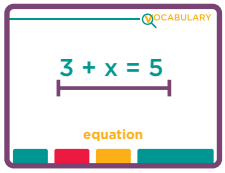
Lead: **Say it with me. [*Equation*] means [*a mathematical statement in which two expressions are equal to each other*].**

Test: **What term means [*a mathematical statement in which two expressions are equal to each other*]?**

Student indicates correct vocabulary word.
Continue with any additional vocabulary words.

Time-Delay

Write out the vocabulary so that it can be easily displayed. Follow the Time-Delay procedure. Repeat the procedure for all vocabulary words in the lesson.



LESSON WALK THROUGH

Choose between the printed or the alternate version of the lesson. **Let's start reading about today's topic.**

An *equation* can be solved using the *Additive Inverse Property*. This means a plus or a minus value is added to BOTH SIDES of the equation to make the integers add to zero on the left side of the equation and isolate the variable (x) term.

The goal is to determine the value for the variable that will make the equation true all of the time.

Look at my cake! How many pieces did I start with if each guest had a piece and I have 5 pieces leftover? I started with 8 pieces of cake.

How can we use the Additive Inverse Property to balance the equation: 4 + x = 10? We want to isolate x, so we subtract four from each side of the equation. This leaves x on the left side, and ten minus four (10 –4) on the right side. By simplifying, we find that x equals six (x = 6).

Tips for Teachers

***Mystery Box game**

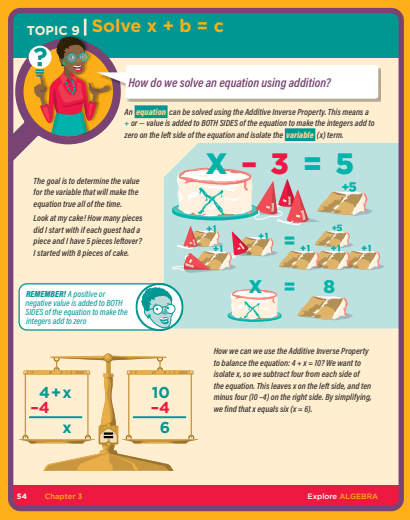
Students can use a number line or can count out tiles that will help them to find the "mystery value".

The students using tiles could have a pile of four tiles with a box covering up the mystery number of tiles. Those items can be made equal to nine tiles. If the students organize the nine tiles, they may see a group of four within the nine tiles and that the other group would have five tiles in it. Students may then look to balance the tile piles and notice that five tiles are needed to make the sides equal to each other. Lifting up the box reveals the "mystery value."

VOCABULARY

Equation
A mathematical statement in which two expressions are equal to each other. Uses an equal sign (=)

Variable
A quantity that may change within a mathematical problem. Typically, we use a single letter to represent a variable.



LESSON WALK THROUGH CONTINUED

Present the Fun Fact. **Here's a Fun Fact: The Additive Inverse Property means that any number added to its opposite will equal zero. (x) + (–x) = 0. By adding back what was removed, we get the whole amount.** Encourage anticipatory discussion based on the Fun Fact.

The Additive Inverse Property doesn't just apply to whole numbers. Let's look at some fractions.

Fractions and their opposites work the same as whole numbers and their opposites. Whatever will make an expression equal to zero when added is the inverse. Sometimes, you have to convert a fraction into a decimal to see it. Let's try some more examples.

Let's work on this next job together. We need to match the numbers on the left with their inverses on the right in order to fill in the holes in the wall.

REINFORCEMENT • REMEMBER!

Read the Remember! text aloud and have students read along with you: **A positive or negative value is added to BOTH SIDES of the equation to make the integers add to zero.** Ask comprehension questions. Reinforce and confirm correct responses. If needed, re-read portions of the text to emphasize the correct answer.

Students should continue to practice writing the steps out that they are using to solve the equations. For example, they should show how they are adding or subtracting values to both sides. *If students practice the habit of writing the steps at this point, then those steps will be clear when students face more difficult problems that require even more steps later on.* Continue to practice the equation solving with additional examples and problems.

Another way to present the concept of solving for the variable in the one-step equation is to think about *undoing* the operation on both sides of the equation. *(See **Tips for Teachers** to the side for details.)* Sample problem: x + 4 = 9; *x=5.*

DISCUSSION

As a discussion/group activity, have students create their own problem with variables and then solve. Some examples might be: x + 1 = 5; x + 7 = 0; 9 – x = 6; etc. You may prefer to write each problem in a visible space and solve aloud as a group, or you may have each student solve their respective problems. Offer prompts as needed.

LANGUAGE BUILDER

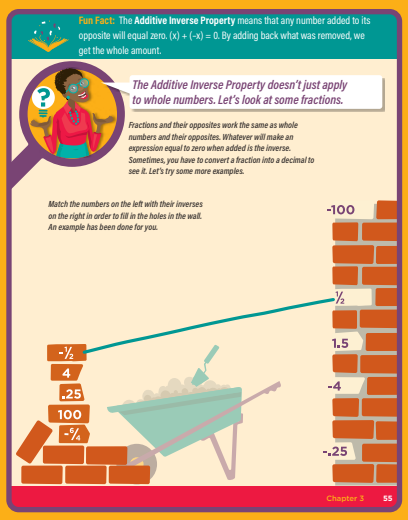
Students may explain the steps of their process to show mastery. As the student explains their process, they may use words like *balance*, *variable*, *undoing*, *add/subtract opposites,* and *checking the solution*.

APPLY

MORE SOLVING X + B = C

1 **On the next page, we're going to try and solve some equations in steps. Let's read the directions and complete our first activity.**

Once the page has been completed, have students present their answers to each other or to you in front of their peers. Reinforce and confirm correct answers. For any correction, discuss the answer aloud as a group. If students are struggling, provide more problems on the whiteboard and solve them as a group.



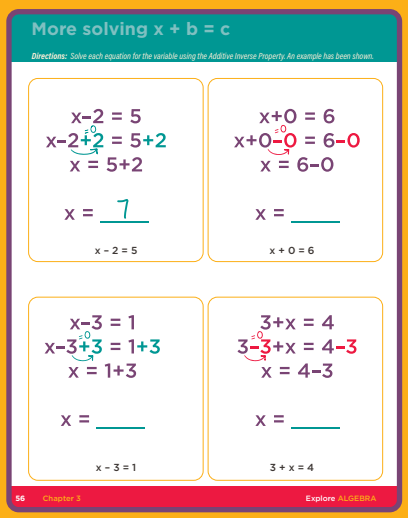
REMEMBER!

A positive or negative value is added to BOTH SIDES of the equation to make the integers add to zero.

Tips for Teachers

Undoing

To isolate the variable (x), the opposite operation of adding 4 is to subtract 4. Doing this operation on both sides of the equation will isolate the variable on the left side and reduce the value on the right side to the value that the variable is worth.



TILE IT IN!

On the last page of this topic, we're going to use our algebra tiles to help us. Let's read the directions and complete our second activity.

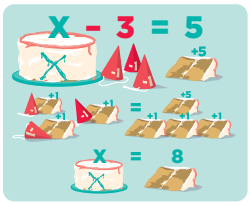
You may choose to review the example problem and give an explanation of each step of the procedure.

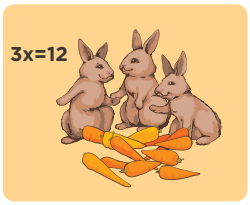
Once the page has been completed either as a group or individually, have students present their answers to each other or to you in front of the group as another language-building exercise.

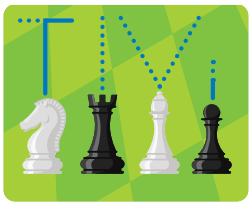
CLOSING

Review the topic by doing one or more of the following:

- Read the topic from the first page;
- Have students read or follow along with the Remember! text;
- Select the current topic from a group of topics;
- Select the topic illustration from a group of illustrations.







For students accessing the Level A lessons, have them show what they know by choosing the topic illustration that best depicts the lesson's big idea.

EXTENDED PRACTICE

Have students create and share their own story problems for other students to solve. Some examples might be:

Distance *Find the distance needed to move an object. People on the 10th floor have a meeting on the 4th floor. How many floors do they need to move? Which direction?*

Collections *Elle has collected 7 shells on the beach; her friend collected some as well. Altogether, the pair has collected 12 shells. How many did her friend collect?*

Exercise *A student looks at their fitness app at 8 a.m. and sees they have been active for 87 minutes. When they check the app again at 10 a.m., the record says 118 minutes. What is the change in active minutes?*

LANGUAGE BUILDER

Have students lead the group through the steps for solving the problem they created. Students should use vocabulary, when possible, to explain the solution. Each student should be able to justify their answer to the group; students should give evidence as to why their solution is correct.

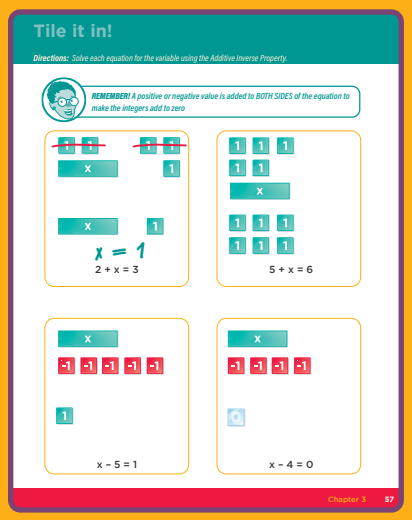
EXTEND

CHALLENGE EXTENSIONS

Give students word problems to transform into equations.

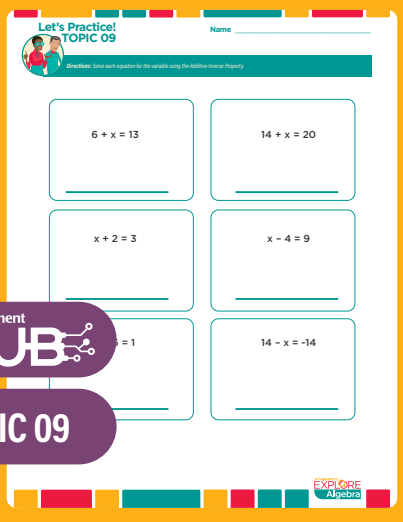
Students can work with solving equations that contain fraction or decimal values.

Additional practice sheets may be accessed and printed from the HUB.



Tips for Teachers

Give each student an opportunity to create and solve at least one problem. Students may use tiles or hands-on manipulatives to represent integers and explain their answers.



Attainment HUB

TOPIC 09

LESSON 10

SOLVE AX = C

PRE-TEACH

I CAN STATEMENT(S)

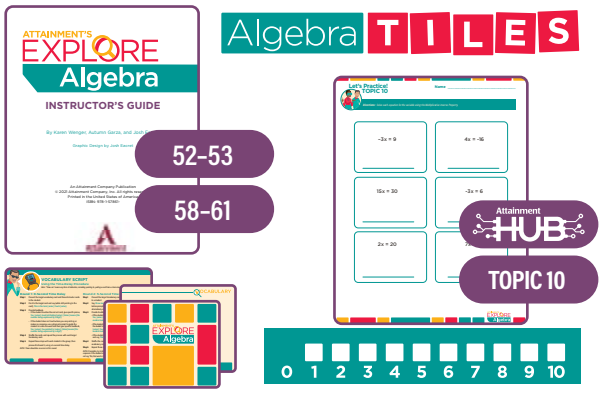
1 ▪ I can solve one-step equations using multiplication or division.

2 ▪ I can use the Multiplicative Inverse Property to solve equations.

A I can select the topic illustration that depicts the big idea of the lesson.

MATERIALS LIST

- **Explore Algebra Student Book**
  pgs. 52–53; 58–61
- Algebra tile set
- Any number line
- **Explore Algebra .pdf files**
  from the HUB: Topic 10
- Lesson vocabulary cards:
  coefficient, reciprocal
- Time-Delay Script Card



ALIGNMENT

Apply and extend previous understandings of arithmetic to algebraic expressions.

CCSS.MATH.CONTENT.6.EE.A.2 *Write, read, and evaluate expressions in which letters stand for numbers.*

Reason about and solve one-variable equations and inequalities.

CCSS.MATH.CONTENT.6.EE.B.6 *Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.*

Reason about and solve one-variable equations and inequalities.

CCSS.MATH.CONTENT.6.EE.B.7 *Solve real-world and mathematical problems by writing and solving equations of the form x + p = q and px = q for cases in which p, q and x are all nonnegative rational numbers.*

11 ax=c; Multiplication/Division
https://player.attainmentcompany.com/?v=Hkg78Wwr

TILE-A-VISION! *A quick guide to using algebra tiles*

FOUNDATIONAL CONCEPTS

Working with reciprocals of values is a core idea for understanding Multiplicative Inverse Property.

If students struggle with the concept, using inverse operations might be a more tangible method for students to use. Students can focus on the idea of doing division to undo the multiplication in the equation. By doing the inverse operation, the students will isolate the variable and determine the solution.

Again, students will have to understand the idea of equality and the meaning of the equal (=) sign. Students must also have mastered the ideas of multiplying and dividing positive and negative integers. For students with emerging skills, continue practicing identification of symbols and numbers, as well addition and subtraction using tiles. If possible, group tiles to initiate the concept of multiplication.

UNIVERSAL DESIGN FOR LEARNING (UDL) FRAMEWORK

ENGAGEMENT

- As a group, create a Frayer model graphic organizer to develop student understanding of the vocabulary words: *reciprocal* and *coefficient*. Discuss the definitions, characteristics, and examples/non-examples for each word.
- Show students the video titled *ax = c; Multiplication/Division* for a better understanding of how to use the algebra tiles for solving the equations with the Multiplicative Inverse Property.
- Provide a task analysis or checklist that students can use to solve simple, one-step equations.

REPRESENTATION

- Use the algebra tiles to demonstrate the Multiplicative Inverse Property for students; give each student the opportunity to solve one equation using the tiles independently.
- When teaching the concept of reciprocal, be sure to write several examples of whole numbers on the whiteboard. Remind students that whole numbers are that number over one. Then, provide several representations of whole numbers (showing those numbers over one) and have students find their reciprocal.
- Enter *Multiplicative Inverse Property* into your search engine for videos to highlight examples of this property.

EXPRESSION

- Create an array of response options so students can either point or eye gaze to their choice (*e.g., include both whole numbers and their reciprocals to test student comprehension*).
- Have students record a video (or have a peer record a video) of how to use the tiles step-by-step to solve an equation using the Multiplicative Inverse Property.
- Ask students to create a declarative statement on why a number is or is not a reciprocal.

TEACH

ATTENTION GETTER / INTRODUCE THE LESSON

Briefly review the concepts of balancing and variables from the previous lesson. **In our last lesson, we learned how to solve an equation that adds or subtracts with a variable by balancing the equation.** Review problems, if necessary.

Here's another problem. There are eight teams in a basketball tournament. If each team is "paired up" to play (two teams in each game), how many games will there be in the first round of the tournament? Can addition or subtraction be used to solve this problem? In a visible space, consider drawing a tournament bracket to assist students in assigning teams to games.

Is there another method we could use to solve this type of problem? Have students make suggestions. **I think we could use multiplication!** Have the students turn to pg. 58 in the Student Book. **Today, we will begin Chapter 3, Topic 10: *Solve ax = c*.**

Professor Júlio says, :What do we do when an equation contains multiplication?" What do you think? Have students make suggestions.

TOPIC VOCABULARY

Choose the best strategy for your students:

Model-Lead-Test

Model: **The term [*reciprocal*] means *when you flip a number so that the numerator becomes the denominator and vice versa*].**

Lead: **Say it with me. [*Reciprocal*] means [*when you flip a number so that the numerator becomes the denominator and vice versa*].**

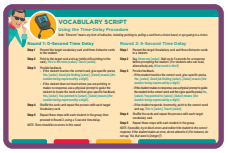
Test: **What term means [*when you flip a number so that the numerator becomes the denominator and vice versa*]?**

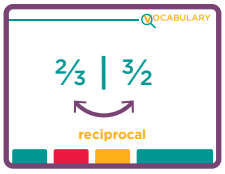
Student indicates correct vocabulary word.
Continue with any additional vocabulary words.

Time-Delay

Using the vocabulary card(s) and Time-Delay Procedure card, teach vocabulary from the lesson topic.

Repeat the procedure for all vocabulary words in the lesson.





LESSON WALK THROUGH

Choose between the printed or the alternate version of the lesson. **Let's start reading about today's topic.**

Any number multiplied by its inverse, or *reciprocal*, will equal one. The *reciprocal* is multiplied to each side of the equation to make the integers multiply, and to isolate the variable (x) term. The goal is to determine the value for the variable that will make the equation true all the time.

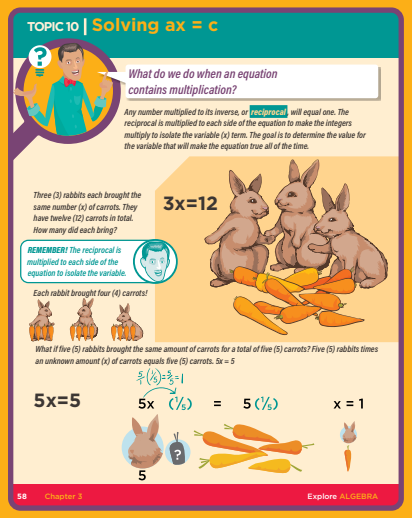
Three rabbits each brought the same number (x) of carrots. They have twelve carrots in total. How many did each bring? We can make that into an algebra problem. We know there are three rabbits. We DON'T know how many carrots each brought (that will be our unknown variable), but we DO know the total is twelve carrots. Let's write that as three times x equals twelve. To isolate the variable, we multiply by the reciprocal. What's the reciprocal of three (or, three over one)? Accept answers. **Flip three over one and we get one over three, or one-third! Multiply each side, and we are left with x equal to four. Each rabbit brought four carrots!** Continue with the next problem in the book: Five rabbits have five carrots.

Tips for Teachers

VOCABULARY

Coefficient
The number or constant multiplied by a variable in a mathematical term

Reciprocal
When you flip a number so that the numerator becomes the denominator and vice versa.
It is also called the inverse.



LESSON WALK THROUGH CONTINUED

Present the Fun Fact: **Here's another Fun Fact: The Multiplicative Inverse Property means that any number multiplied by its inverse (reciprocal) will equal one; (a)(1/a) = 1. This property is very helpful in solving equations.** Encourage discussion based on the Fun Fact.

Professor Júlio says, "Finding the reciprocal of a number is easy. We just flip the numbers!"

Every whole number is that number OVER one. For example, ten is also ten over one, six is six over one, and negative 159 is negative 159 over one!

Multiplying by the inverse is the same as dividing by the *coefficient*. When using tiles, we can't really show a fraction of a tile, but we CAN divide by the coefficient.

REINFORCEMENT • REMEMBER!

Read the Remember! text aloud and have students read along with you: **The reciprocal is multiplied to each side of the equation to isolate the variable.** Ask comprehension questions. Reinforce and confirm correct responses. If needed, re-read portions of the text to emphasize the correct answer.

Students need to practice writing the steps out that they are using to solve the equations. For example, they should show they are multiplying or dividing values to both sides. If students practice the habit of writing the steps at this point, then those steps or methods will be clear when students face more difficult problems that require multiple steps later on.

Another way to present the concept of solving for the variable in the one-step equation is to think about *undoing* the operation on both sides of the equation. *(See **Tips for Teachers** to the side for details).* Sample problem: 3x = 9.

DISCUSSION

As a discussion/group activity, have students create their own problem with variables and then solve. Some examples might be: 2x = 10; 4x = 8; ½x = 6; etc. You may prefer to write each problem in a visible space and solve aloud as a group, or you may have each student solve their respective problems. Offer prompts as needed. Remind students about sign changes that occur with positive and negative values.

LANGUAGE BUILDER

Students may explain the steps of the process to the instructor to show mastery. As the student explains their process, they may use words like *balance*, *variable*, *reciprocals*, *undoing*, *multiply/divide opposites,* and *checking the solution*. Have students give a declarative statement on what a *reciprocal* is.

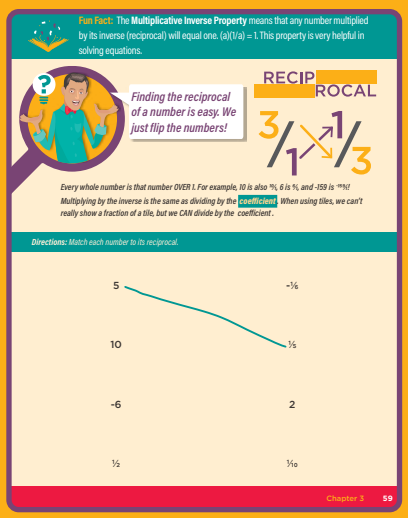
APPLY

MORE SOLVING AX = C

1

On the next page, we're going to practice solving some equations involving multiplication. Let's read the directions and complete our first activity.

Once the page has been completed, have students present their answers to each other or to you in front of their peers. Reinforce and confirm correct answers. For any correction, discuss the answer aloud as a group. If students are still struggling with solving the simple equations, create more examples by changing the numbers used in the equations on page 60 of the Student Book.



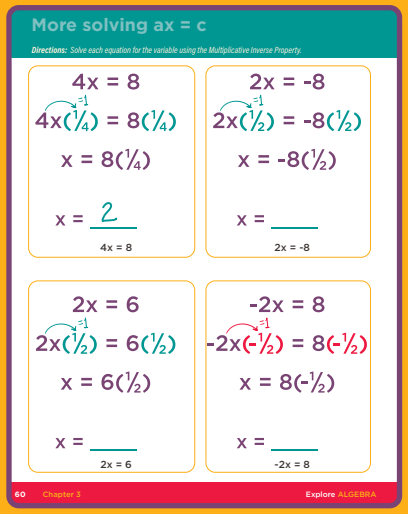
REMEMBER!

The reciprocal is multiplied to each side of the equation to isolate the variable.

Tips for Teachers

Undoing

To isolate the variable (x), the opposite operation of multiplying by 3 is to divide by 3. Doing this operation on both sides of the equation will isolate the variable on the left side and reduce the value on the right side to the value that the variable is worth.



TILE IT UP!

On the last page of this topic, we're going to use tiles to solve equations with multiplication. Let's read the directions and complete our second activity.

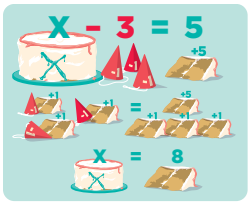
You may choose to review the example problem and give an explanation of each step of the procedure.

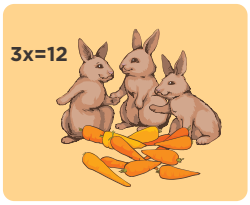
Once the page has been completed either as a group or individually, have students present their answers to each other or to you in front of the group as another language-building exercise.

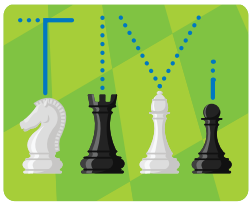
CLOSING

Review the topic by doing one or more of the following:

- Read the topic from the first page;
- Have students read or follow along with the Remember! text;
- Select the current topic from a group of topics;
- Select the topic illustration from a group of illustrations.







For students accessing the Level A lessons, have them show what they know by choosing the topic illustration that best depicts the lesson's big idea.

EXTENDED PRACTICE

Have students create and share their own problems for other students to solve. Some possible examples:

Groups *There are 12 students in gym class and the teacher wants 3 students in each group. How many groups will be in the class?*

Sharing *A pizza is divided into slices. Each person gets 2 pieces on their plate. The result is to have 4 plates filled. How many slices of pizza were cut?*

Travel *A car drives at a rate (r) of 25 mph. If the car has to travel a distance (d) of 100 miles, how long will the trip take?*
*Use d = r*t.*

LANGUAGE BUILDER

Have students lead the group through the steps for solving the problem they created. Students should use vocabulary, when possible, to explain the solution. Each student should be able to justify their answer to the group; students should give evidence as to why their solution is correct. As a challenge, give different definitions for the word *reciprocal*, specifically when the word is a noun versus an adjective. Explain the definition of *reciprocal* in this context. *She was hoping for a reciprocal response.* Have students come up with another sentence using the same definition of *reciprocal*.

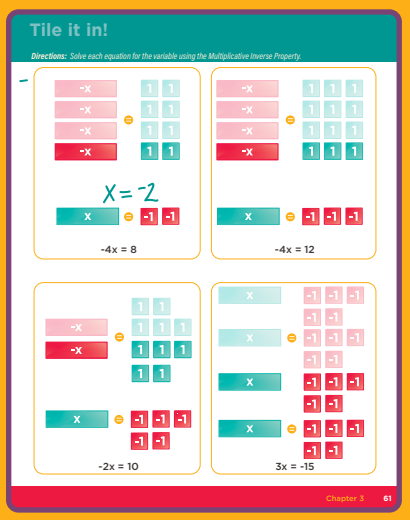
EXTEND

CHALLENGE EXTENSIONS

Students can be challenged by taking word problems and transforming them into equations.

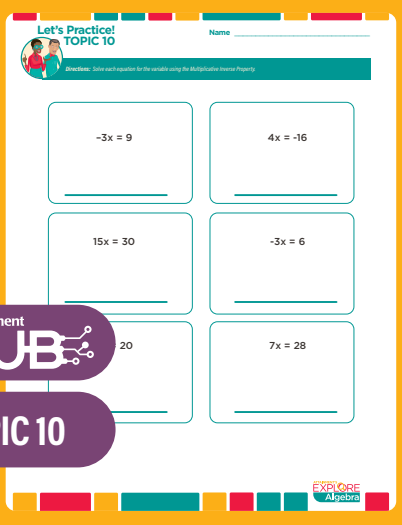
Students can work with solving equations that contain fraction or decimal values.

Additional practice sheets may be accessed and printed from the HUB.



Tips for Teachers

Give each student an opportunity to create and solve at least one problem. Students may use tiles or other hands-on manipulatives to represent integers and explain their answers.



Attainment HUB

TOPIC 10

LESSON 11

SIMPLE SUBSTITUTION

PRE-TEACH

I CAN STATEMENT(S)

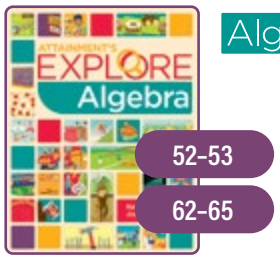
1 ▪ I can simplify expressions using substitution.

2 ▪ I can use order of operations to simplify algebraic expressions.

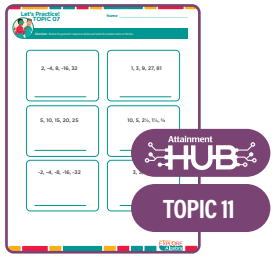
A I can select the topic illustration that depicts the big idea of the lesson.

MATERIALS LIST

- **Explore Algebra Student Book**
  pgs. 52–53; 62–65
- Algebra tile set
- **Explore Algebra .pdf files**
  from the HUB: Topic 11
- Lesson vocabulary card:
  substitution
- Time-Delay Script Card



Algebra TILES



ALIGNMENT

Apply and extend previous understandings of arithmetic to algebraic expressions.

CCSS.MATH.CONTENT.6.EE.A.1 *Write and evaluate numerical expressions involving whole-number exponents.*

CCSS.MATH.CONTENT.6.EE.A.2 *Write, read, and evaluate expressions in which letters stand for numbers.*

CCSS.MATH.CONTENT.6.EE.A.4 *Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.*

12 Substitution
https://player.attainmentcompany.com/?v=28y7aohL

TILE-A-VISION!
A quick guide to using algebra tiles

FOUNDATIONAL CONCEPTS

Students should understand that a term is a part of an expression that is separated from other parts usually by a + or – sign. An expression is like a mathematical phrase or description where several terms might be linked together.

Students need to understand order of operations to simplify expressions. If not mastered, students can make the substitutions and have assistance with the simplifications. For students with emerging skills, explore the concept of substitution. Have classroom items equal to other amounts, for instance, a Student Book is equal to 5 algebra tiles, etc. Continue to explore math identification. Set up number problems with a missing value replaced with a picture of an animal (*e.g., 5 + (lion picture) = 6*).

UNIVERSAL DESIGN FOR LEARNING (UDL) FRAMEWORK

ENGAGEMENT

- Start the lesson with a discussion about what substitution means in real life. In math, substitutions apply to real-life decisions like choosing the best phone plan, the best deal for a vacation, best interest rate for a loan, and the best job for the money.
- Share the video titled *Substitution* to show students how to use the algebra tiles to simplify an expression.
- Provide students with a list of vocabulary or key words that are used in the lesson. Have students point to/circle/check off the vocabulary as it is read within the activities (*e.g., substitution, variable, expression*).

REPRESENTATION

- Provide various examples using the algebra tiles to simplify the expression when you have the value of x. Give each student an opportunity to use the tiles to simplify an expression.
- Bring in real examples of substitutions so students can understand the term in both mathematical and non-mathematical instances (*e.g., have another teacher substitute for a small chunk of your class, show Greek yogurt as a substitute for mayonnaise, avocado as a substitute for butter*).
- Enter *free color by number activities* into your search engine as a simple substitution demonstration. Review the key to see the color assigned to each number value.

EXPRESSION

- Preprogram different number options into an AAC device so students can simplify expressions with x values provided.
- Create response cards with different number choices so students can point to or eye gaze toward their response when simplifying expressions.
- Have students present a real-life example of simple substitution to the group; have them walk through each step of their problem-solving process.

TEACH

ATTENTION GETTER / INTRODUCE THE LESSON

Start by discussing *substitution* or *substitute*. ***Substitution* is when you use one thing in place of another. Can anyone tell me something that you might *substitute*?** If students do not mention examples, give suggestions: a substitute teacher, subbing in a game for another player, or replacing an ingredient in a recipe with an equivalent item (*e.g., tofu for meat, honey for sugar, different flour if you have a gluten allergy*).

Have the students turn to pg. 62 in the Student Book. **Today, we will begin Chapter 3, Topic 11: *Simple substitution*.**

Professor Fern says, "Once we know the value of x, we can solve for other integers." What do you think that means? Do you think it has to do with substitution? Have students make suggestions.

TOPIC VOCABULARY

Choose the best strategy for your students:

Model-Lead-Test

Model: The term [*substitution*] means [*inserting a known value in the place of a variable*].

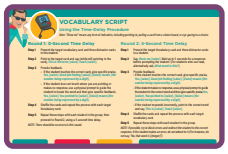
Lead: Say it with me. [*Substitution*] means [*inserting a known value in the place of a variable*].

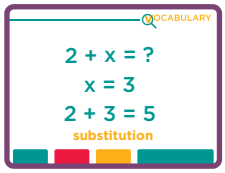
Test: What term means [*inserting a known value in the place of a variable*]?

Student indicates correct vocabulary word. Continue with any additional vocabulary words.

Time-Delay

Write out the vocabulary so that it can be easily displayed. Follow the Time-Delay procedure. Repeat the procedure for all vocabulary words in the lesson.





LESSON WALK THROUGH

Choose between the printed or the alternate version of the lesson. **Let's start reading about today's topic.**

Thinking back to what Professor Fern said, what was she describing? Have students make suggestions. **That's right! We call this substitution. We can insert the value of the variable into an equation and solve for any equations in the same set.**

Raj has five packs of markers. Each pack holds eight markers. How many markers does Raj have in total? The total number of markers is five packs times the number of each marker in a pack (x). 5x = ? The number of markers in each pack (x) is eight, so x equals eight. We substitute in the value for x and find that the total is five times eight, or forty!

We substitute words for values all of the time. A *dozen* eggs is equal to twelve eggs. A *week* is equal to seven days. A *couple* of dogs is two dogs. How many cookies do we need for a bake sale if we need to bring *three dozen*? The equations would be written: 3x = ? and x = 12. 3 (12) = 36 cookies. Write the previous equations in a visible space.

Tips for Teachers

Give each student an opportunity to create and solve at least one problem. Students may use tiles or hands-on manipulatives to represent integers.

VOCABULARY

Substitution
Inserting a known value in the place of a variable

LESSON WALK THROUGH CONTINUED

Here's another Fun Fact for us! The letter *x* is commonly used as a variable in algebra; however, *any* letter can be used as a variable (especially when there is more than one variable). Encourage anticipatory discussion, then continue with the lesson.

Professor Fern asks, "What do we do if there is more than one variable? Isn't that harder?" Not at all! We just do what we've learned to any extra variables. Substitute values for more than one variable and follow the order of operations to simplify the expression.

Look at the equations on page 63 and see if we can solve them together.

Write the sample equations in a visible space. Walk through each problem. For example, **What is the value of 2xy, if x equal three and y equals negative one? We *substitute* three for x, and then we *substitute* negative one for y. Two times three is six. Six times negative one is negative six. So, 2xy is equal to negative six!** Continue with additional variables until the concept is understood.

REINFORCEMENT • REMEMBER!

Read the Remember! text aloud and have students read along with you. Ask comprehension questions. Reinforce and confirm correct responses. If needed, re-read portions of the text to emphasize the correct answer.

Students can work on procedural fluency with the concepts in this chapter. Students should work on recognizing mistakes in their work and the work of others. Finding and explaining possible errors in student work is a strategy that will strengthen a student's understanding.

To reinforce the concept of substituting a variable for a value, have students play the Substitution Game**. Cut out symbol cards and assign a value to each image. Create a key to decipher problems. Then, create simple equations for students to match and solve.

Example: 2(rocket)(star) If rocket = 2, star = -1, planet = 3, telescope = 1
2(rocket)(star) = 2(2)(-1) = -4

DISCUSSION

As a discussion/group activity, have students create their own problem with variables and then solve. Some examples might be: 2x when x = 4, 3 + y when y = 7, etc. You may prefer to write each problem in a visible space and solve aloud as a group, or you may have each student solve their respective problems. Offer prompts as needed.

LANGUAGE BUILDER

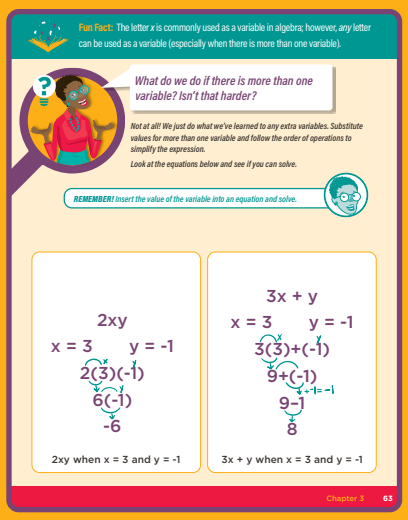
Give different definitions for the word *expression*. Explain the definition of the word *expression* outside of mathematics. An *expression* is a statement or the process of declaring one's thoughts or feelings. Then, compare that to a mathematical *expression*, a sentence with a minimum of two numbers and at least one math operation. Have students use both definitions in a sentence.

APPLY

MORE SIMPLE SUBSTITUTION

On the next page, we're going to practice working with some more substitution. Let's read the directions and complete our first activity.

Once the page has been completed, have students present their answers to each other or to you in front of their peers. Reinforce and confirm correct answers. For any correction, discuss the answer aloud as a group. If students are struggling, provide more problems on the whiteboard and solve them as a group.



REMEMBER!

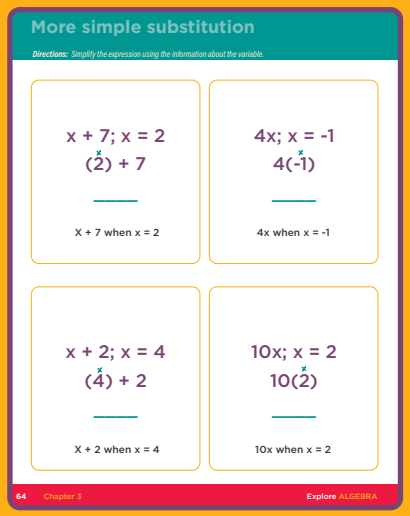
Insert the value of the variable into an equation and solve.

Tips for Teachers

Substitution Game**

Attainment HUB

See digital resources for symbol cards.



TILE IT IN!

On the last page of this topic, we're going to practice substitution with the help of our algebra tiles! Let's read the directions and complete our second activity.

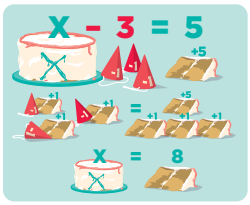
You may choose to review the example problem and give an explanation of each step of the procedure.

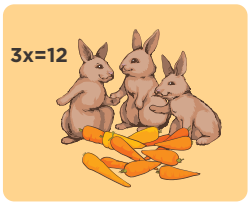
Once the page has been completed either as a group or individually, have students present their answers to each other or to you in front of the group as another language-building exercise.

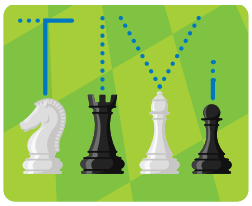
CLOSING

Review the topic by doing one or more of the following:

- Read the topic from the first page;
- Have students read or follow along with the Remember! text;
- Select the current topic from a group of topics;
- Select the topic illustration from a group of illustrations.







A For students accessing the Level A lessons, have them show what they know by choosing the topic illustration that best depicts the lesson's big idea.

EXTENDED PRACTICE

Have students create and share their own problems for other students to solve. Some examples:

Baking *4 Tablespoons of butter = ½ stick of butter (equivalent values that can be substituted for each other)*

Money *4 quarters = 1 dollar (equivalent values)- making change when some bills or coins are not available in the cash drawer of the cash register*

Architecture *Scale factor on blueprints converted to building size. Example: 1 inch = 6 feet; if the wall were 4 inches long, how many feet would it be?*

LANGUAGE BUILDER

Have students lead the group through problem-solving for the example they provided. Students should use vocabulary, when possible, to explain the solution. Each student should be able to justify their answer to the group; students should give evidence as to why their solution is correct. Review the topic vocabulary, *substitution*, for this lesson. Have students share other words that accurately convey *substitution* with the group. Answers may include *replacement*, *exchange*, *change*, *switch*, *trade*, or *swap*.

EXTEND

CHALLENGE EXTENSIONS

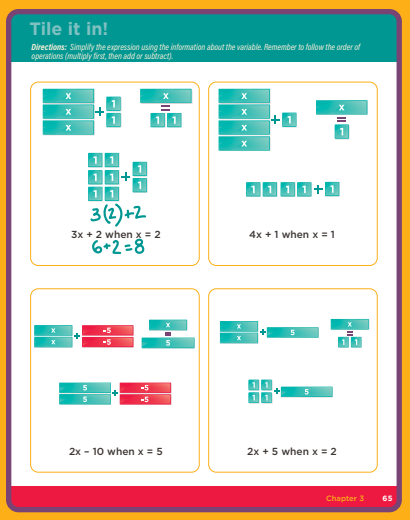
Substitute values for more than one variable and follow order of operations to simplify the expression: 2xy when x = 3 and y = -1; 3x + y when x = 3 and y = -1

Fraction values can be substituted in for variables and when simplifying expressions:
3x + 4 when x = ⅓; *-6* -2x + 5 when x = -½; *5*

Students can simplify expressions involving exponents: $2x^2$; $-3x^3$

By using substitution, the student can justify and explain equivalent expressions
y + y = 2y; m × m × m = m^3

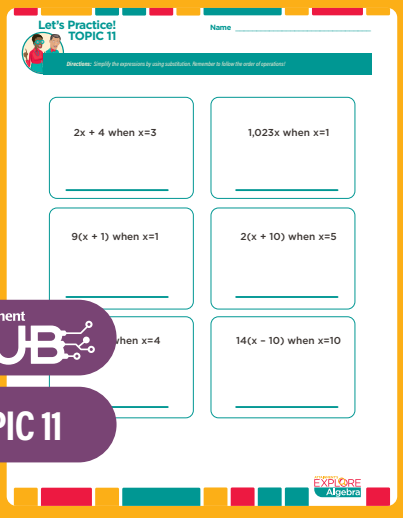
Additional practice sheets may be accessed and printed from the HUB.



Tips for Teachers

Give each student an opportunity to create and solve at least one problem.

You may be able to show real-life examples for substitution: *money, food ingredients, etc.*



Attainment HUB
TOPIC 11

LESSON 12

SOLVE EQUATIONS WITH VARIABLES ON ONE SIDE OF THE EQUAL SIGN

PRE-TEACH

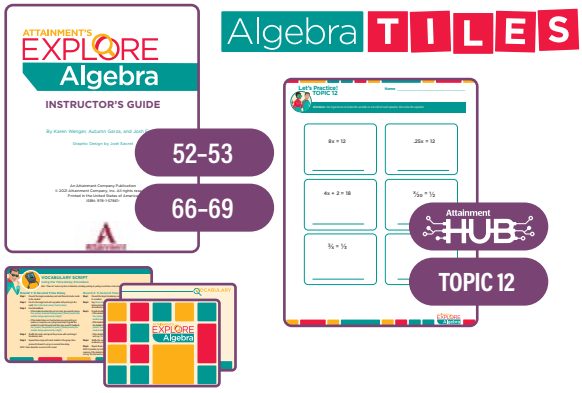
I CAN STATEMENT(S)

1 ▪ I can use legal algebra moves to solve two-step equations (with variables on one side of = sign).

A I can select the topic illustration that depicts the big idea of the lesson.

MATERIALS LIST

- **Explore Algebra Student Book** pgs. 52–53; 66–69
- Algebra tiles
- **Explore Algebra .pdf files** from the HUB: Topic 12
- Lesson vocabulary cards *legal moves*
- Time-Delay Script Card



ALIGNMENT

Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

CCSS.MATH.CONTENT.7.EE.B.3 *Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9¾ inches long in the center of a door that is 27½ inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*

CCSS.MATH.CONTENT.7.EE.B.4 *Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.*

Analyze and solve linear equations and pairs of simultaneous linear equations.

CCSS.MATH.CONTENT.8.EE.C.7 *Solve linear equations in one variable.*

09 Solving Simple Equations Using Addition
https://player.attainmentcompany.com/?v=kYghviSh

TILE-A-VISION! *A quick guide to using algebra tiles*

FOUNDATIONAL CONCEPTS

Students must have an understanding of one-step equations and the legal moves needed to find those solutions. Extra fluency practice may bolster skills.

Order of operations should be understood and reversing the process of those operations in order to solve equations. Students may use practice to support understanding.

Students must understand the ideas of additive inverse and multiplicative inverse to make sense of problem-solving methods (alternatively - using inverse operations to solve). For students with emerging skills, emphasize that math operations needs to be done in order. If possible, have students practice solving expression with two parts. Guide students through, step at a time, but focus on the concept of an order being required to solve.

UNIVERSAL DESIGN FOR LEARNING (UDL) FRAMEWORK

ENGAGEMENT

- Generate a discussion on what students think *legal moves* are. What does the word *legal* mean to students? Students may use words like *acceptable, allowed, correct, right,* and *valid.* Introduce what legal moves are in math.
- Enter *legal moves in chess videos* into your search engine to highlight how there are legal/illegal moves in real-life situations like games of chess. If possible, bring in a chess board to demonstrate.
- Talk about ways following steps correctly is important in our everyday lives (*e.g., following directions, cooking with a recipe*)

REPRESENTATION

- Use the algebra tiles to solve equations for x. Feel free to review the videos on *Solving Simple Equations Using Addition* to show students how to isolate the variable and solve. Give each student an opportunity to use the tiles independently.
- Enlarge the illustration of the candy bar and bring in candy bars, if possible, for real-life examples of solving for x when x is the weight or cost of each piece.
- Have students bring in something that can be divided into pieces (*e.g., similar to candy*) to make real-life story problems where students solve for x where x is the cost of each piece. Make sure students know the cost of their item, (*e.g., cookies, markers, cupcakes*).

EXPRESSION

- Integrate the use of a checklist into this lesson so students can check off each legal move to solve the equations.
- Have students give a declarative statement about legal moves verbally or with their voice-output device.
- Offer the opportunity to answer YES/NO as an alternative to using an array of response options (*e.g., **Is this next step correct? Should I add four positive tiles?***).

TEACH

ATTENTION GETTER / INTRODUCE THE LESSON

What are some of your favorite games? Take a few responses. **Some games, like checkers or chess, have pieces that can only move in certain directions on the board. There are rules to follow to play correctly—I call those *legal moves*. Algebra can be the same way. Let's work on some quick problems and think about the moves used to solve the equations.**

Have students work through some examples of one-step equations. Working with tiles for the unknowns, students should practice working to get the x tiles isolated by making *legal* moves.

Write 2x – 4 = -8 in a visible space. **Let's work on this problem: Two x minus four equals negative eight.** Work through the problem with the students (see **Tips for Teachers** for step-by-step instruction using tiles). The students should be recording their work (steps) for solving.

Have the students turn to pg. 66 in the Student Book. **Today, we will begin Chapter 3, Topic 12: *Solve equations with variables on one side of the equal sign*.**

Professor Júlio says, "Time to use what we've learned and solve some equations!"

TOPIC VOCABULARY

Choose the best strategy for your students:

Model-Lead-Test

Model: **The term [*legal moves*] means [*the correct order of steps for solving an equation*].**

Lead: **Say it with me. [*Legal moves*] means [*the correct order of steps for solving an equation*].**

Test: **What term means [*the correct order of steps for solving an equation*]?**

Student indicates correct term. Continue with any additional vocabulary words that need to be practiced.

Time-Delay

Write out the term so that it can be easily displayed. Follow the Time-Delay procedure. Repeat the procedure for any vocabulary that need to be practiced.

LESSON WALK THROUGH

Choose between the printed or the alternate version of the lesson. **Let's start reading about today's topic.**

Solving equations means finding a value for a variable that will make the equation true. Solving requires operations to be used in the correct order to isolate the variable. We're trying to move the variable to one side of the equal sign and the known integers to the other.

Each piece in a game of chess has a specific type of operation, or move. A "legal move" is a step that follows the rules. Algebra also has certain steps, or "legal moves", that must be done in order to properly balance and solve an equation.

First, we need to simplify an equation as much as we can. Any operation we perform on one side of the equal sign needs to also be performed on the other side. We then multiply or divide to remove any coefficient of the variable. With a single variable on one side of the equal sign and a value on the other, we've solved the equation! Walk through the example on pg. 66 in the Student Book so students can see how you solve for x.

Tips for Teachers

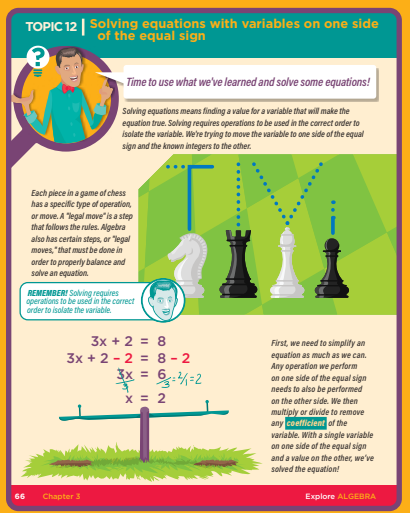
$2x - 4 = -8$

Students should add four tiles to each side of the equation to isolate the two x tiles. The *Additive Inverse Property* will eliminate the single unit tiles on the left side. The right side will be left with four negative tiles (four positive tiles will cancel four negative tiles). Next, the students will divide the tiles into two equal groups. The solution for x is two negative tiles.

VOCABULARY

Terms to Know

Legal moves
The correct order of steps for solving an equation



LESSON WALK THROUGH CONTINUED

Present the Fun Fact: **Here's a Fun Fact: When a pawn makes it all the way across the chessboard, it can be promoted to any position (except for the king). The pawn can become a knight, rook, bishop, or queen!**

Professor Júlio says, "In the real world, answers don't always come to whole numbers." Sometimes, there's a little bit left over or missing. For instance, how much does one piece of this candy bar weigh?

The equation is written as four pieces weighing an unknown amount (x) that equals six ounces. We would write 4x equal six. Multiply each side by the reciprocal of four to isolate the variable. Each piece is equal to 1.5 ounces!

Can you figure out how much each piece would cost? We know there are four pieces. We also know that each bar costs three dollars. Our equation is 4x = 3. Let's solve. Walk through the steps aloud. **Each piece would cost 75¢ (or three-fourths of a dollar).**

REINFORCEMENT • REMEMBER!

Read the Remember! text aloud and have students read along with you: **Solving requires operations to be used in the correct order to isolate the variable.** Ask comprehension questions. Reinforce and confirm correct responses. If needed, re-read portions of the text to emphasize the correct answer.

Students need to be recording all steps and work for solving. Practicing the skills and recording work will reinforce the process of solving. More complicated equations will be solved using similar steps so this strategy will assist students in developing mastery of the concept.

If possible, have students pair off and complete a partner solve activity to work through solving equations *(see **Tips for Teachers** for step-by-step instruction)*. Self-checking fluency practice can be found online (worksheets with puzzle features, mazes, etc.).

DISCUSSION

Solving equations means trying to find the value that will make the equation true. Solving an equation requires operations to be used in the correct order to isolate the variable. Let's go through the moves for solving an equation together. First, we add or subtract both sides of the linear equation by the same number (the constant). Second, we multiply or divide both sides of the linear equation by the same number (the coefficient). (We can also multiply by the reciprocal.) Have students follow along and repeat the steps.

LANGUAGE BUILDER

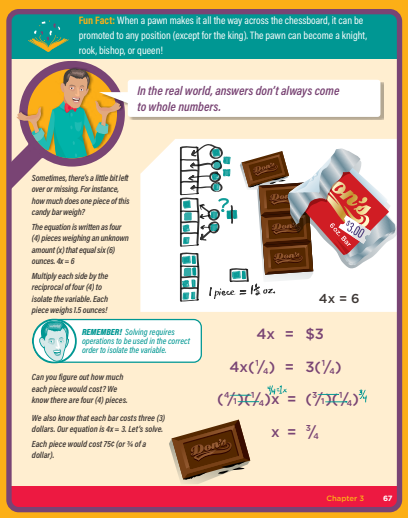
Students may explain the steps of the process to the instructor to show mastery. As the student explains their process, they may use words like *variable*, *substitute*, or *legal move.* Have students present examples of when following the correct order of steps is a must, outside of mathematics. Each student should give real-world examples of why following the correct order in many instances is essential (*e.g., a schedule, a story, timelines*). Present these to the group.

APPLY

MORE EQUATION SOLVING

1 **On the next page, we're going to keep practicing solving equations. Let's read the directions and complete our first activity.**

Once the page has been completed, have students present their answers to each other or to you in front of their peers. Reinforce and confirm correct answers. For any correction, discuss the answer aloud as a group. If students are struggling, provide more problems on the whiteboard and solve them as a group.



REMEMBER!

Solving requires operations to be used in the correct order to isolate the variable.

Tips for Teachers

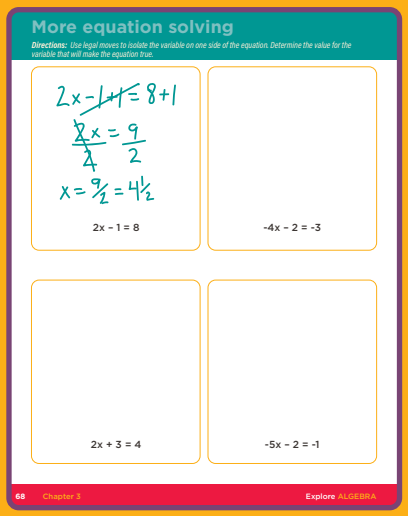
Partner Solve Activity

Student 1 does the first step and explains the step.

Student 2 checks the work of the first step and then solves the second step, explaining the next step.

Student 2 can solve the first step of the next problem. Have students change order and repeat with a new problem.

Students should always explain their work and methods.



TILE IT IN!

On the last page of this topic, we're going to solve equations using our algebra tiles. Let's read the directions and complete our second activity.

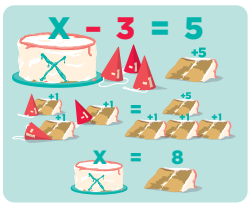
You may choose to review the example problem and give an explanation of each step of the procedure.

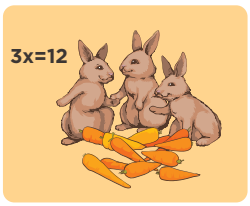
Once the page has been completed either as a group or individually, have students present their answers to each other or to you in front of the group as another language-building exercise.

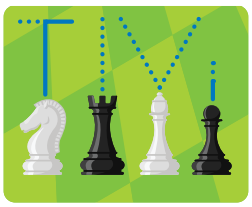
CLOSING

Review the topic by doing one or more of the following:

- Read the topic from the first page;
- Have students read or follow along with the Remember! text;
- Select the current topic from a group of topics;
- Select the topic illustration from a group of illustrations.







A For students accessing the Level A lessons, have them show what they know by choosing the topic illustration that best depicts the lesson's big idea.

EXTENDED PRACTICE

Have students create and share their own problems for other students to solve. Some examples may include:

Temperature *Predict degrees Celsius from Fahrenheit; predict temperature change over time*

Cost Problems *Predict the cost of a repair job; find the cost of an item on sale or if multiple items are purchased*

Banking/Finance *Predict the amount in the account after credits or debits are counted for several weeks*

LANGUAGE BUILDER

Have students lead the group through the steps for solving the problem they created. Students should use vocabulary, when possible, to explain the solution. Each student should be able to justify their answer to the group; students should give evidence as to why their solution is correct.

EXTEND

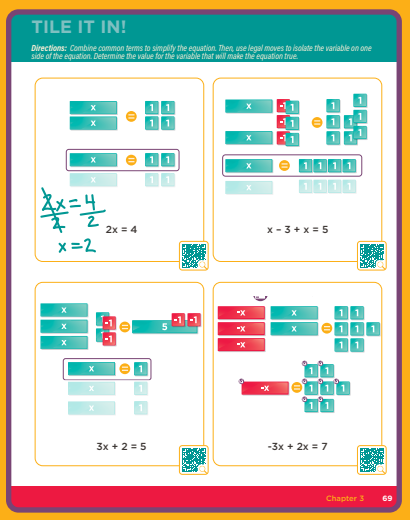
CHALLENGE EXTENSIONS

Extend to solving equations that have fractions or decimals.

Work on taking word problems and forming equations from the story. Use the solving methods to answer the question. Examples:

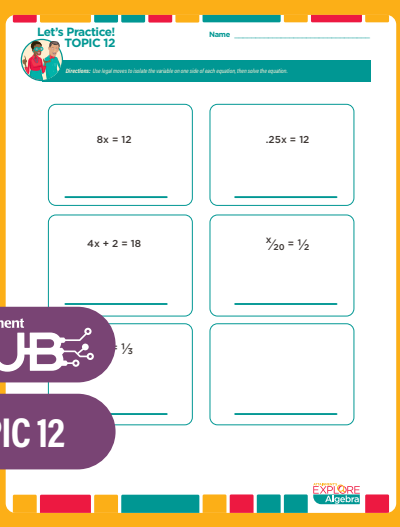
1. *McKenzie had $24 to spend on seven pencils. After buying them she had $10. How much did each pencil cost? Answer: 24-7x= 10; x=$2*
2. *Isla spent half of her weekly allowance playing mini-golf. To earn more money her parents let her wash the car for $4. What is her weekly allowance if she ended with $12? Answer: x/2 + 4 = 12; x=$16*

Additional practice sheets may be accessed and printed from the HUB.



Tips for Teachers

Give each student an opportunity to create and solve at least one problem. Students may use tiles or other hands-on manipulatives to represent integers and explain their answers.



Attainment HUB

TOPIC 12

EXPLORE INEQUALITIES

PRE-TEACH

I CAN STATEMENT(S)

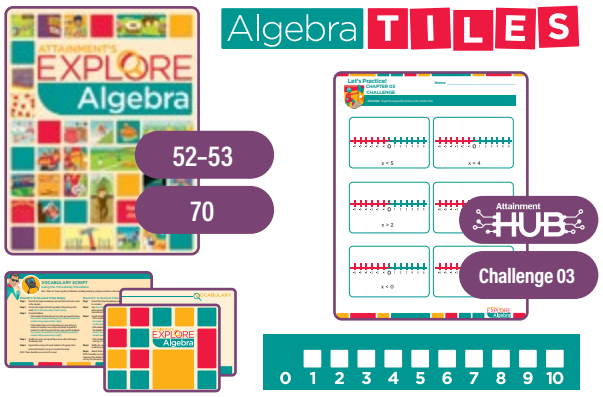
1 ▪ I can determine the solution set for an inequality.

2 ▪ I can represent solutions to inequalities by drawing the regions on number lines.

A I can select the topic illustration that depicts the big idea of the lesson.

MATERIALS LIST

- **Explore Algebra Student Book**
  pgs. 52–53; 70
- A number line
- **Explore Algebra .pdf files**
  from the HUB: Challenge 03
- Lesson vocabulary cards:
  inequality, greater than, less than
- Time-Delay Script Card



ALIGNMENT

Reason about and solve one-variable equations and inequalities.

CCSS.MATH.CONTENT.6.EE.B.5 *Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.*

CCSS.MATH.CONTENT.6.EE.B.6 *Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.*

CCSS.MATH.CONTENT.6.EE.B.8 *Write an inequality of the form x > c or x < c to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form x > c or x < c have infinitely many solutions; represent solutions of such inequalities on number line diagrams.*

Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

CCSS.MATH.CONTENT.7.EE.B.4 *Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.*

FOUNDATIONAL CONCEPTS

Students must understand the value of integers, both positive and negative. Reinforcement of the concept can be done using tiles or number lines to determine which values are greater or less than one another.

To aid students in understanding which direction to shade on a number line, students should work concretely by selecting various values and testing the inequality.

For instance, x > 4; students can plug in 7 > 4 deciding if it is true or false.

Then try other values for x and mark each success on the number line. Upon completion, shade or connect the values to demonstrate the solution area for the inequality.

UNIVERSAL DESIGN FOR LEARNING (UDL) FRAMEWORK

ENGAGEMENT

- Discuss real-life situations in which mathematical inequalities exist: *travel time, speed limit, minimum credit card payment, sleep time, etc.*
- Share a video(s) on inequalities with the students to start this lesson. Enter *graphing and solving inequalities* into your search engine for demonstrations of solving inequalities.
- Give students an opportunity to read the text on pg. 70 of the **Student Book**. Have students take turns with reading; have one student read Professor Fern's statement, another read the paragraph about number lines, and another

REPRESENTATION

- Use a number line to show various examples of inequalities. Write different numbers on the whiteboard and ask students to show the numbers that are greater than or less than the ones shown.
- Create a graphic organizer listing: the symbol, what it means, and word phrases associated with it. For example, > means *greater than*, and word phrases associated with it may include *more than* or *above*.
- Project real photos or pictures of inequalities onto a whiteboard to represent the concepts of *greater than* and *less than*. Enter *inequality math pictures* into your search engine for ideas.

EXPRESSION

- Provide a choice board for students with simple YES/NO options so students can point to, pull off, or eye gaze toward a selected choice (e.g., ***Is this less than? Is this greater than?***)
- Have students study the different kinds of *inequality*, including mathematical inequality as well as social inequalities. Each student should then give a declarative statement on what they learned about *inequality*. Discuss the topic, highlighting inequality in terms of gender, race, age, health care, etc.
- Encourage students to create a graphic that highlights what inequality means to them (this graphic could be a picture, image, drawing, etc.).

TEACH

ATTENTION GETTER / INTRODUCE THE LESSON

In a previous lesson, we worked to solve equations. Equations have an equal sign. What does an equal sign really mean? Discuss the concept of equal signs, defining discrete values to a variable. Review previous vocabulary terms like: *integer*, *positive/negative value*, *discrete value*, *variable*, etc. within discussion.

What if I asked you how many pieces of candy you'd like? You might say five or ten, or you might say a thousand! You might just say more than one. Sometimes in math we don't need an exact number. Instead, we're comparing values to decide which one is greater or smaller.

Inequalities are values that are NOT equal.

Have the students turn to pg. 70 in the Student Book. **Today, we will begin the Chapter 3 Challenge!: *Explore Inequalities*.**

Professor Fern says, "Sometimes there are a range of answers to an equation." What do you think that means? Have students make suggestions.

TOPIC VOCABULARY

Choose the best strategy for your students:

Model-Lead-Test

Model: **The term [*inequality*] means [*when values are not equal*].**

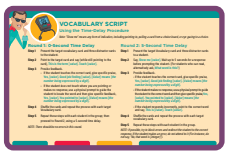
Lead: **Say it with me. [*Inequality*] means [*when values are not equal*].**

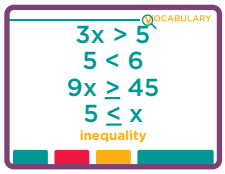
Test: **What term means [*when values are not equal*]?**

Student indicates correct vocabulary word. Continue with any additional vocabulary words.

Time-Delay

Write out the vocabulary so that it can be easily displayed. Follow the Time-Delay procedure. Repeat the procedure for all vocabulary words in the lesson.





LESSON WALK THROUGH

Choose between the printed or the alternate version of the lesson. Start by introducing the symbols used for greater and less than. **Here are the symbols for greater than and less than. We read the signs from left to right. The wide part of the arrow is first so this side is greater than the value that the arrow point is pointing to (smaller value):**

">" Is greater than, 6 > 4 means six is *greater than* four. "<" Is less than, -7< 0 means negative seven is *less than* zero. Make sure students understand that the two signs are different and what they mean before moving on.

Tips for Teachers

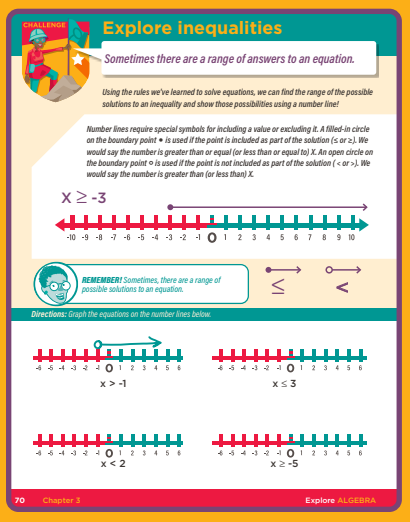
Give each student an opportunity to create and solve at least one problem. Students may use tiles or other hands-on manipulatives to represent integers.

VOCABULARY

Inequality
When values are not equal

Greater than
All of the numbers to the right of a value on the number line

Less than
All of the numbers to the left of a value on the number line



LESSON WALK THROUGH CONTINUED

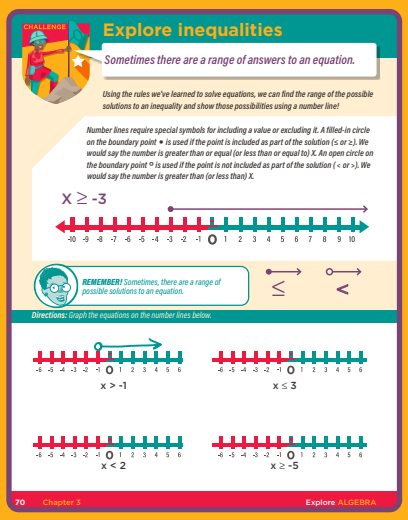
Now we're going to add a little more. If an equal sign is included *with* the inequality symbol, then the values being compared might be equal—*or*—they might be less than or greater than the compared value.

X ≤ 6 means the variable, x, is *less than or equal to* six. X *could be* six, which makes it equal; or, it could be a number *less than* six. X ≥ 4 means the variable, x, *is greater than or equal to* four. X *could be* four, which makes it equal; or, it could be a number *greater than* four.

Inequalities have more than one value as the solution. There can actually be an infinite number of solutions to an inequality. You may need to discuss infinite numbers as a concept. **Answers are often graphed on number lines to represent of the possible solutions.**

Using the rules we've learned to solve equations, we can find the range of the possible solutions to an inequality and show those possibilities using a number line!

Number lines require special symbols for including a value or excluding it. A filled-in circle on the boundary point is used if the point is included as part of the solution (≤ or ≥). We would say the number is *greater than or equal to* (or less than or equal to) x. An open circle on the boundary point is used if the point is not included as part of the solution (< or >). We would say the number is *greater than* (or less than) x. Review the example in the Student Book and give other examples so that students understand the graphing of inequalities.



REMEMBER!

Sometimes, there are a range of possible solutions to an equation.

REINFORCEMENT • REMEMBER!

Read the Remember! text aloud and have students read along with you: **Sometimes, there are a range of possible solutions to an equation.** Ask comprehension questions. Reinforce and confirm correct responses. If needed, re-read portions of the text to emphasize the correct answer.

Students could begin with a number line that is shaded and then write the inequality statement that explains the solution area. Students could challenge each other by making up either a graph or a statement and giving it to a partner to solve.

Self-checking fluency practice can be found online (worksheets with puzzle features, mazes, etc.).

DISCUSSION

Discuss scenarios that might require a range of answers where an inequality may be used. Have students share scenarios and then create an inequality as a class or in small groups or pairings. **What are some other times where we might use an inequality?** Respond and solve each suggestion. **How would we write that as an inequality?** Some examples might be:

- How many jellybeans might be in a bag if there are at least ten?
- How much money does a new car cost if the lowest-priced car is $11,000?
- How many days are left of summer break if summer break lasts 84 days in total?

Tips for Teachers

Allowing students to present their own real-world examples to the group not only reinforces conceptual understanding, but also allows opportunity to practice both interpretive and expressive modes of communication!

LANGUAGE BUILDER

Students may explain the steps of their problem-solving process to the instructor to show mastery. As the student explains their process, they may use words like *greater/less than, equal to,* or *inequality.* As a language-building exercise, students can create and present a Frayer model for the word *inequality*. When sharing the model with the group, they should provide the definition and characteristics of the word *inequality*, as well as examples and non-examples.

APPLY

CHALLENGE ACTIVITY!

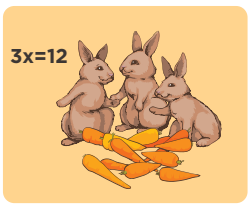
Now we're going to practice what we've learned about inequalities and number lines. Let's read the directions and complete our challenge activity.

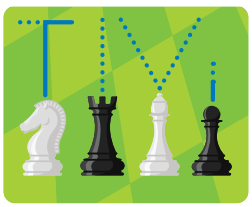
Once the page has been completed, have students present their answers to each other or to you in front of their peers. Reinforce and confirm correct answers. For any correction, discuss the answer aloud as a group. If students are struggling, provide more problems on the whiteboard and solve them as a group.

CLOSING

Review the topic by doing one or more of the following:

- Read the topic from the first page;
- Have students read or follow along with the Remember! text;
- Select the current topic from a group of topics;
- Select the topic illustration from a group of illustrations.





For students accessing the Level A lessons, have them show what they know by choosing the topic illustration that best depicts the lesson's big idea.

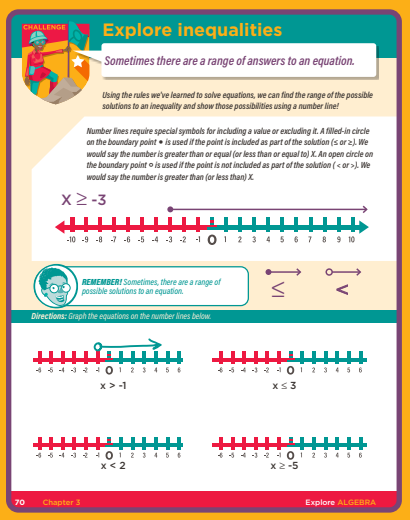
EXTENDED PRACTICE

Have students create and share inequalities for other students to solve.

LANGUAGE BUILDER

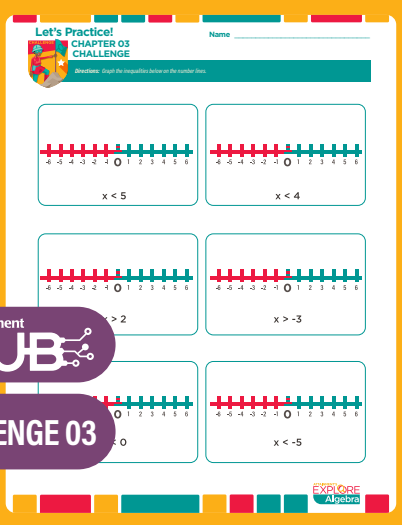
Have students lead the group through the steps for solving the problem they created. Students should use vocabulary, when possible, to explain the solution. Each student should be able to justify their answer to the group; students should give evidence as to why their solution is correct. As a challenge, have students come up with synonyms for the word *inequality*. Some examples may include *not equal*, *imbalance*, *contrast*, *different*, or *unlike*.

CROSS-CONTENT CHALLENGE: Give students an opportunity to present or share information on *inequality* in the real world around them. How do they feel *inequality* impacts them? Students can use a PowerPoint, a poster demonstration, or a prerecorded video to express their points of view.



Tips for Teachers

Algebra tiles can be used to demonstrate inequalities. Have students evaluate an inequality with a variable, substituting tiles to make the statement true.



EXTEND

CHALLENGE EXTENSIONS

Have students work on longer word problems and transform stories into appropriate inequalities.

Have students solve inequalities containing decimal or fractional values.

Additional practice sheets may be accessed and printed from the HUB.

Attainment HUB

CHALLENGE 03