

Equations for Real-World Problems

Week at a Glance

This week, students continue **Number Worlds**, Level I, Algebra. Students will understand and apply problem-solving strategies, such as make a drawing, use logical reasoning, and work backward, to solve real-world problems arithmetically. They will compare arithmetic and algebraic solutions for two-step equations. In addition, students will write and solve two-step equations to solve real-world problems.

Skills Focus

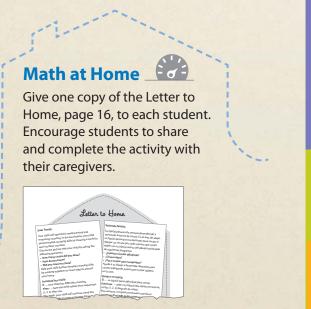
- Solve real-world problems arithmetically problem-solving strategies.
- Solve real-world problems algebraically using an equation.
- Compare arithmetic and algebraic solutions for real-world problems.
- Solve two-step, real-world problems arithmetically or algebraically, and explain the reason for choosing a particular problem-solving method.

How Students Learn

Help students extend and apply their understanding of number sense and arithmetic to develop strategies for solving problems algebraically. Have students first solve a problem arithmetically and then solve the problem algebraically. By comparing the arithmetic and algebraic solutions, students will deepen their conceptual understanding of solving real-world problems using equations.

English Learners 💷

For language support, use the **English Learner Support Guide**, pages 64–65, to preview lesson concepts and teach academic vocabulary. **Number Worlds** Vocabulary Cards are listed as additional materials in many lessons and can be used to preteach and reinforce academic vocabulary.



Weekly Planner

Lesson	Learning Objectives	
pages 234–235	Students can use problem-solving strategies to solve real-world problems arithmetically.	
2 pages 236–237	Students can write two-step equations arising from real-world problems and solve them algebraically.	
3 pages 238–239	Students can compare arithmetic and algebraic solutions to real-world problems.	
pages 240–241	Students can write and solve real-world two-step problems arithmetically or algebraically and explain why they choose the solution method.	
5 pages 242–243	Review and Assess Students review skills learned this week and complete the weekly assessment.	
Project pages 244-245	Students can write and solve two-step equations to determine the per-ticket cost for a concert.	

Key Standard for the Week

Domain: Expressions and Equations

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



7.EE.4.a Solve word problems leading to equations of the form px + q = r and p(x + q) = r where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

Materials		Technology
 Program Materials Student Workbook, pp. 42–43 Practice, p. 64 Activity Card 3M, Thinking It Out Solving Real-World Problems: Problem #1 Solving Real-World Problems: Problem #2 Solving Real-World Problems: Template Program Materials Student Workbook, pp. 44–45 Practice, p. 65 Activity Card 3N, Solving the Algebraic Way Solving Real-World Problems: Problem #1 Solving Real-World Problems: Problem #1 	Additional Materials Vocabulary Card 76, <i>variable</i>	Teacher Dashboard Teacher Dashboard
 Program Materials Student Workbook, pp. 46–47 Practice, p. 66 Activity Card 3O, It's Your Choice Solving Real-World Problems: Problem #1 Solving Real-World Problems: Problem #2 Solving Real-World Problems: Venn diagram Program Materials 	Additional Materials Vocabulary Card 76, <i>variable</i> Additional Materials	Teacher Dashboard Teacher Dashboard
 Student Workbook, pp. 48–49 Practice, p. 67 Activity Card 3P, Arithmatically or Algebraically: Which Will It Be? Number 1–6 Cubes Two-Color Counters Two-Step Real-World Problems Solving Real-World Problems: Template 	 calculators Vocabulary Card 76, <i>variable</i> 	
 Program Materials Student Workbook, pp. 50–51 Weekly Test, Assessment, pp. 43–44 		Review previous activities.
Program Materials • <i>Student Workbook,</i> p. 52 • Number 1–6 Cubes	Number Cards 20–49Spinner 1–10	Review previous activities.

WEEK 4 Equations for Real-World Problems

Find the Math

In this week, introduce students to writing and solving equations to real-world problems.

Use the following to begin a guided discussion:

Suppose you buy 3 pencils for 45 cents and a ruler for a total cost of 2 dollars. How can you determine the cost of the ruler? Possible answer: Determine the total cost of the pencils and subtract that amount from \$2; write and solve an equation to determine the cost.

Have students complete Student Workbook, page 41.

Lesson 1

Objective

Students can use problem-solving strategies to solve real-world problems arithmetically.

Standard 🥵

7.EE.4.a Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

Vocabulary

inverse operation

Creating Context

Discuss with English Learners what it means to work backward to solve a problem. Tell students that this strategy involves starting from the end of the problem and working towards the beginning. Provide everyday examples that illustrate working backward, such as figuring out what time to get up in the morning based on the time school starts and the tasks that need to be done before leaving for school.

Materials

Program Materials

- 📃 Solving Real-World Problems: Problem #1
- 🗐 Solving Real-World Problems: Problem #2
- 🗏 Solving Real-World Problems: Template

Prepare Ahead

Prepare Solving Real-World Problems: Problems #1, #2, and Template for display to the class.

1 WARM UP

Prepare

- Review with students the operations in the equations 2x + 1 = 9and 3(x - 4) = 6 and the corresponding inverse operations for each.
- Review with students key words and phrases that indicate which operation to use.



Student Workbook, p. 41

ENGAGE

Develop: Thinking It Out

"Today, we are going to solve real-world problems arithmetically by using problemsolving strategies, such as logical reasoning and working backward." Follow the instructions on the Activity Card **Thinking It Out.** As students complete the activity, be sure to use the Questions to Ask.

3M Think	cing It Out
Objective Students can use problem-solving strategies to solve real-world problems arithmetically.	 Have a volunteer read the problem aloud. Ask students what they know and what they are being asked to find.
Material Program Material Stabuty Revender Dedens: Problem 1 Stabuty Revender Dedens: Problem 2 Stabuty Revender Dedens: Trajenter Auszugender Detens: Trajenter Material Detensionen (Stabut) Stabuty Revender Detensionen (Stabut) Material (Stabut) Stabut (Stabut) Stabut) Stabut (Stabut) Stabut (Stabut) Stabut (Stabut) Stabut) Stabut (Stabut) Stabut) Stabut (Stabut) Stabut) Stabut (Stabut) Stabut) Stabut (Stabut) Stabut) Stabut (Stabut) Stabut) Stabut (Stabut) Stabut) Stabut (Stabut) Stabut) Stabut (Stabut) Stabut) Stabut (Stabut) Stabut) Stabut) Stabut (Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut) Stabut)	• There are many different types of problem- solving strengths, existencing reproducts and a strength of the strength of the strength strengths in strength on the strength of the strength backward to determine the solution. In White "make a determine the solution. The strength of the solution is a determine the solution. The solution of the solution of the solution of the solution of the solution of the solution. The will be blow white the solution. The solution is the solution of the solution of the solution of the solution. The solution is a solution of the solution. The solution of the solution of the solution. The solution of the solution of the solution.

Activity Card 3M

Alternative Groupings

Small Group: Complete this activity in small groups. Students can complete steps independently and compare their answers before completing subsequent steps.

Whole Class: Complete Problem #1 as a class. Have student volunteers complete the steps needed to solve Problem #2.

Progress Monitoring

If students are having difficulty	Then review key words and
determining the steps needed to	phrases that are often used to
solve word problems,	indicate operations.

Practice

Have students complete *Student Workbook,* pages 42–43. Guide students through the Key Idea example and the Try This exercises.

Interactive Differentiation



Consult the *Teacher Dashboard* for grouping suggestions. You can also use performance on the Engage activity to guide students.

Independent Practice

For additional practice solving multistep word problems, give students copies of Solving Real-World Problems: Template, and have them write a two-step equation with a whole number solution and create a real-world problem for the equation. Then have students exchange papers and solve the real-world problem arithmetically.

Supported Practice

For additional support, guide students through the process of solving real-world problems using arithmetic.

- Write the following problem on Solving Real World Problems: Template and display the template to students: Zoey has 20 tennis balls in a bag. She has 5 balls that are loose, and the rest are in cans. Each can contains 3 balls. How many cans of tennis balls does Zoey have?
- ► What information do we have about Zoey's tennis balls? What information do we have to determine? Let's work backward to determine the number of cans of tennis balls Zoey has.
- Use the template to guide students through the process of solving the problem.
- ▶ So, how many cans of tennis balls did Zoey have? 5

3 REFLECT

Think Critically

Review students' answers to the Reflect prompt at the bottom of **Student Workbook**, page 43, and then review the Engage activity.

► How can you check your answers? Possible answer: I can insert my answer into the original problem and perform the indicated operations to make sure it's correct.

Informal Assessment

Use the online or print Student Record, *Assessment*, page 128, to record informal observations.

Thinking It Out

- Did the student
- □ provide a clear explanation?
- □ choose appropriate strategies?
- □ communicate reasons and strategies? □ argue logically?

Additional Practice

For additional practice, have students complete *Practice*, page 64.



Practice, p. 64

Week 4 • Equations for Real-World Problems
Lesson 1
Key Idea Solving a real-world problem arithmetically means using only numbers and
operations. You can solve problems arithmetically using the following
three-step plan. Step 1 Decide on a problem-solving strategy, such as make a drawing, work
backward, or use logical reasoning.
Step 2 Decide which inverse operations you need to perform.
Step 3 Perform the indicated operations to solve the problem, check your solution, and write a concluding sentence.
Try This
For each real-world problem, decide on a problem-solving strategy. Check students'
Then describe the operations you would use to solve the problem. strategies. L Peyton bought 3 movies that each cost the same amount and a game.
The game cost \$12, and she spent a total of \$57. How much money did each movie cost?
strategy:
operations: subtraction and division
operations
2. Five friends went to a restaurant, and each friend bought the lunch special.
Each friend had a \$2-off coupon, and the total cost of the meal was \$40. How much did each lunch special cost before the coupon was applied?
strategy:
operations:division and addition
3. During the summer, Pedro works 21 hours a week at a part-time job. He works
6 hours on the weekends, and the same number of hours each weekday. How
many hours does Pedro work each weekday?
strategy: operations: subtraction and division
operations
42 Level I Unit 3 Algebra
Practice Check students' work. Solve each real-world problem arithmetically. Show your work. Describle work is given
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Student Workbook, pp. 42–43

WEER 4 Equations for Real-World Problems

Lesson 2

Objective

Students can write two-step equations arising from real-world problems and solve them algebraically.

Standard 💴

7.EE.4a Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

Vocabulary

- coefficient
 equation
 variable
- constant
- inverse operation

Creating Context

English Learners who speak Spanish may recognize that many of the English words used in algebra are cognates or share root words with Spanish terms. For example, English terms such as *expression, addition,* and *application* have the same root words as the Spanish terms *expressión, adición,* and *applicación*.

Materials

Program Materials

• Solving Real-World Problems:

Additional Materials Vocabulary Card 76, variable

- Problem #1

 Solving Real-World Problems:
 Problem #2
- Solving Real-World Problems: Template

Prepare Ahead

Locate the previously created display copy of Solving Real-World Problems and Equations: Problems #1, #2, and Template for use in today's activity.

WARM UP

Prepare

- Review with students key words and phrases that indicate which operation to use.
- Review with students how to solve 2x + 1 = 9 by using inverse operations to first isolate the term with the variable and then isolate the variable.
- Review with students how to solve 3(x 4) = 6 by using inverse operations to first isolate the quantity and then isolate the variable.

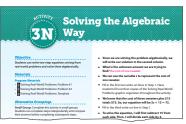
Just the Facts

Have students identify the first operation they would perform to solve each two-step equation. Students can write answers on individual whiteboards or separate sheets of paper. Use equations such as the following:

- ▶ 2x + 3 = 11 subtract 3
- 3(x + 4) = 27 divide by 3

Develop: Solving the Algebraic Way

"Yesterday, we solved real-world problems arithmetically. Today, we are going to solve the same real-world problems algebraically." Follow the instructions on the Activity Card **Solving the Algebraic Way.** As students complete the activity, be sure to use the Questions to Ask.



Activity Card 3N

Alternative Groupings

Small Group: Complete this activity in small groups. Students can complete steps independently and compare their answers before completing subsequent steps.

Whole Class: Complete the activity as a class. Have student volunteers complete the steps needed to solve Real-World Problem #2.

Progress Monitoring

If... students have trouble writing two-step equations for real-world problems,

Then... help students identify the unknown in each problem and define a variable for each unknown.

Practice

Have students complete *Student Workbook,* pages 44–45. Guide students through the Key Idea example and the Try This exercises.

Interactive Differentiation



Consult the *Teacher Dashboard* for grouping suggestions. You can also use performance on the Engage activity to guide students.

Independent Practice

For additional practice solving multistep word problems, give students copies of Solving Real-World Problems: Template. Have them write twostep equations and a real-world context for each equation. Then have students work together to solve the equations algebraically.

Supported Practice

For additional support, guide students through the process of solving real-world problems using algebra.

- Display the Solving Real-World Problems: Template used in the previous class. Have students locate their copies.
- Remember Zoey and her tennis balls? Today we will determine how many cans of balls she has using algebra. We can use the variable c to represent the number of cans.
- Fill in the first write-on line in Step 1.
- ► What algebraic expression can we write to determine the number of tennis balls in each can? 3c + 5 = 20
- Fill in the second write-on line in Step 1.
- What is the first step to solving the equation? the second step? subtract 5 from each side of the equation; divide each side by 3
- Fill in the write-on lines in Step 2.
- ▶ Use the information from Steps 1 and 2 to solve the equation.
- Solve for *c* in Step 3.

- ▶ So, how many cans of tennis balls does Zoey have? 5
- Write a concluding sentence on the Step 3 write-on line.
- ▶ We can check our answer by substituting 5 for c in the original equation. Since 3(5) + 5 = 20, our solution of 5 cans is correct.

REFLECT

Think Critically

Review students' answers to the Reflect prompt at the bottom of Student Workbook, page 45, and then review the Engage activity.

▶ What is a real-world context that can be represented by the equation 3x + 2 = 20? by the equation 3(x + 2) = 24? Possible answers: Three pizzas, plus a delivery charge of \$2, costs \$20; three friends each bought a pizza costing the same amount and a beverage costing \$2, for a total bill of \$24.

Real-World Application

Leo bought 4 packages of printer paper and a printer cartridge for a total of \$47.95. The printer cartridge cost \$24.95.

- ▶ What equation can you write to determine the cost of each package of **printer paper?** 4p + 24.95 = 47.95, where *p* represents the cost of one package of printer paper
- ▶ What is the cost per package of printer paper? Explain your steps. \$5.75; I subtracted 24.95 from each side of the equation to get 4p = 23. I divided each side by 4 to get p = 5.75.



Informal Assessment

Use the online or print Student Record, Assessment, page 128, to record informal observations.

Did the student

- \Box apply learning to a new situation?
- \Box contribute concepts?
- \Box contribute answers? □ connect mathematics to the real world?

Additional Practice

For additional practice, have students complete *Practice,* page 65.



Practice, p. 65

Week	• Equations for Real-World Problems
~~~~~~	son 2
LE2:	
Key Solving	idea a real-world problem algebraically means using a variable to represent
the unk	e following three-step plan.
Step 1	
	Decide which inverse operations you need to perform. Perform the indicated operations to solve the equation, check
	your solution, and write a concluding sentence.
T	
	CLIS       Possible variables         eal-world problem, define a variable to represent the unknown.       Possible variables         e an equation you would use to solve the problem.       and equation are
The ga did ea	hought 3 movies that each cost the same amount and a game. me cost \$12, and she spent a total of \$57. How much money ch movie cost?
variab equat	le: Let represent the cost of each movie on: $3m + 12 = 57$
Each f	ends went to a restaurant, and each friend bought the lunch special. iend had a \$2-off coupon, and the total cost of the meal was \$40. How did each lunch special cost before the coupon was applied?
variab equat	le: Let <u>c</u> represent the cost of <u>each lunch special before the coupon</u> . on: $5(c-2) = 40$
6 hou	) the summer, Pedro works 21 hours a week at a part-time job. He works s on the weekends, and the same number of hours each weekday. How hours does Pedro work each weekday?
variab	e: Let <u>h</u> represent the number of hours worked on each weekday
equat	$\frac{5h+6=21}{2}$
<b>44</b> Level I	Unit3 Algebra
Dese	
<b>Prac</b> Use an o	quation to solve each real-world problem algebraically. Show your work.
Use an e Check 4. Dave	
Use an e Check 4. Dave He s five	quation to solve each real-world problem algebraically. Show your work. <b>students' work. Possible equations are given.</b> • scored the same number of points on each of his first four quizzes. scored 85 points on his fifth quiz and a total of 465 points on the first quizzes. What did Dave score on each of the first four quizzes?
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Use and Check 4. Daviv 4. Davit 5. Davit 4. Davit 5. Davi	<pre>quation to solve each real-world problem algebraically. Show your work. students' work. Possible equations are given. scored B5 points on his fifth quiz and a total of 465 points on the first puizzes. What did Dave score on each of his first four quizzes. + 85 = 465, where p represents Dave's number of points on each of the tour quizzes. + 85 = 465, where p represents Dave's number of points on each of the tour quizzes. + 85 = 465, where p represents Dave's number of points on each of the tour quizzes - 95 points on his fith quiz and to the poster? - 96 points on each of his first four quizzes. + 85 = 465, where p represents the length of the poster - 97 points on each of the poster? - 98 points on the days. She read 63 pages the first day and the same unknown number of pages each day until she finished the . How many pages did she read per day after the first day? - 107 pages per perpresents the number of pages Lydia read each - after the first day - 107 pages per perpresents the number of pages Lydia read each - 107 stirst how was at tended by 275 people. The other three shows? - 00 people attended each of the last three shows? - 275 = 1,325, where p represents the number of people at each of the - 275 = 1,325, where p represents the number of people at each of the - 275 = 1,325, where p represents the number of people at each of the - 275 = 1,325, where p represents the cost of each jacket - 275 = 185, where j represents the cost of each jacket - 275 = 185, where j represents the cost of each jacket - 275 = 185, where j represents the cost of each jacket - 275 = 185, where j represents the cost of each jacket - 275 = 185, where j represents the cost of each jacket - 275 = 185, where j represents the cost of each jacket - 275 = 185, where j represents the cost of each jacket - 275 = 185, where j represents the cost of each jacket sor? - 275 =</pre>

Student Workbook, pp. 44–45

### WEER 4 Equations for Real-World Problems

# Lesson 3

#### Objective

Students can compare arithmetic and algebraic solutions to real-world problems.

#### Standard 🥵

**7.EE.4.a** Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

#### Vocabulary

fficient •	equation
------------	----------

• constant

coe

inverse operation

#### **Creating Context**

Help English Learners by explaining that the prefix *un*- means "not." Discuss the meanings of words with the prefix *un-*, such as *unlaced*, *unmasked*, *unplugged*, and *unorganized*. In mathematics, an unknown represents a quantity that is not known. An unknown is represented by a variable.

#### Materials

**Program Materials** 

• Solving Real-World Problems:

Additional Materials Vocabulary Card 76, variable

• variable

- Solving Real-World Problems: Venn diagram

#### **Prepare Ahead**

- Prepare Solving Real-World Problems: Venn diagram for display to the class, or draw the Venn diagram on the board.
- Locate previously filled out Solving Real-World Problems: Problem #1 and Problem #2 for use in today's activity.

# **WARM UP**

#### **Prepare**

- Ask students to describe the steps needed to solve for x in the equation 3x 2 = 4. add 2, divide by 3
- Ask students to describe the steps needed to solve for *n* in the equation 3(n + 3) = 18. divide by 3, subtract 3

#### **Just the Facts**

Have students hold up the number of fingers that represent the solution of the equation. Use equations such as the following:

- ▶ 2x 6 = 10 8 fingers
- ▶ 3x + 4 = 16 4 fingers
- ▶ 2(x-3) = 14 10 fingers

# **ENGAGE**

#### **Develop:** It's Your Choice

"Today, we are going to compare solving real-world problems two ways: arithmetically and algebraically." Follow the instructions on the Activity Card **It's Your Choice.** As students complete the activity, be sure to use the Questions to Ask.

30 It's Yo	our Choice
Objective Sudents can compare arithmetic and algebraic subtions to real-world problems.	Begin the Activity • Write the following problem on the board: Mrs. Hudden bought 45 key pops. She bought 6 boars of
Materials Program Materials 	ice pops that each had the same number of ice pops. Each box had 5 cherry ice pops and an unknown, but equal, number of grape ice pops. How many grape ice pops did Mrs. Hudson buy?
Solving Real-World Problems: Problem #2	Divide the class into two equal groups.
Additional Materials Vocabulary Card 76, veriable	<ul> <li>One group will solve the problem on the board using arithmetic. The other group will solve the problem using algebra.</li> <li>Monitor student progress.</li> </ul>
Alternative Grouping	<ul> <li>Ask each group how they approached solving the problem, invite a volunteer from each group to write</li> </ul>

Activity Card 30

#### **Alternative Grouping**

**Whole Class:** Solve each problem as a whole class, using both methods for each problem.

#### **Progress Monitoring**

**If...** students have trouble writing two-step equations,

Then... review key words and phrases that indicate which operations should be used. Then guide students through the process of defining a variable and writing an equation.

### **Practice**

Have students complete *Student Workbook,* pages 46–47. Guide students through the Key Idea example and the Try This exercises.

#### **Interactive Differentiation**



Consult the *Teacher Dashboard* for grouping suggestions. You can also use performance on the Engage activity to guide students.

#### Independent Practice

Have students work in Round Robin groups of 3. Each student writes a real-world problem that involves two steps. Next, students exchange problems and solve problems arithmetically. Then, students exchange problems one more time and solve problems algebraically. Papers are returned to their original students. Students compare solutions and discuss the advantages and disadvantages of each method.

#### **Supported Practice**

For additional support with writing and solving equations, write the following problem on the board:

Kendall spent \$18 at the bookstore. She bought 2 magazines that cost the same amount and a book that cost \$10. What was the cost of each magazine?

- ► What do you need to find out? how much each magazine cost
- What equation can you write to determine the cost of each magazine? 2m + 10 = 18, where m represents the cost of one magazine
- Write 2m + 10 = 18 on the board.
- ► What is the first step to solving the equation? the second step? subtract 10 from each side of the equation; divide each side by 2
- Perform the steps on the equation.
- ▶ What is the value of *m*? 4
- ▶ What is the cost of each magazine? \$4

REFLECT

### **Think Critically**

Review students' answers to the Reflect prompt at the bottom of Student Workbook, page 47, and then review the Engage activity.

Why is writing an equation helpful when solving real-world problems? Possible answer: The operations used in the problem are included in the equation. After the equation is written, the inverse operations can be easily identified.

#### **Real-World Application**

- Write the following real-world context on the board: The perimeter of a rectangular garden is 90 feet. The width of the garden is 15 feet.
- ► Suppose you want to determine the length of the garden. Will you solve the problem using arithmetic or by writing and solving an equation? Explain your choice. Possible answer: I will write an equation. Once I write the equation, I will use inverse operations to solve the equation.
- ▶ What is the length of the garden? 30 feet



#### Informal Assessment

Use the online or print Student Record, Assessment, page 128, to record informal observations.

#### **It's Your Choice**

Did the student	
pay attention to the contributions of others?	improve on a strategy?

□ contribute information and ideas?

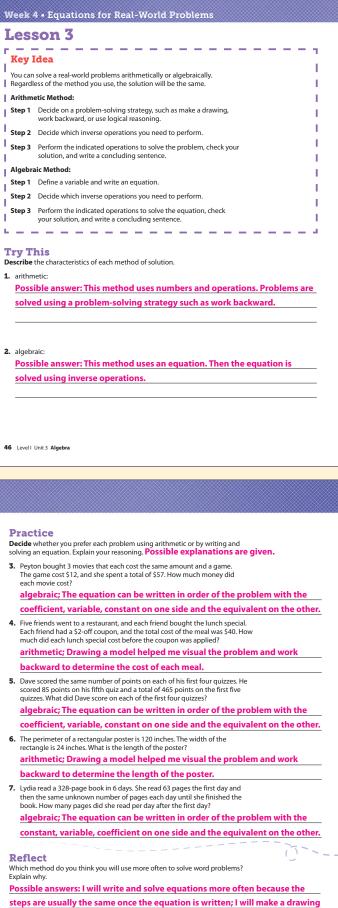
□ reflect on and check accuracy of work?

#### **Additional Practice**

For additional practice, have students complete *Practice*, page 66.



Practice, p. 66



н.

1

to help me visualize the problem, and then work backward.

Week 4 Equations for Real-World Problems • Lesson 3 47

Student Workbook, pp. 46-47

### WEEKA **Equations for Real-World** Problems

# Lesson 4

#### Objective

Students can write and solve real-world two-step problems arithmetically or algebraically and explain why they chose the solution method.

#### CCSS Standard

**7.EE.4.a** Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

#### Vocabularv

- coefficient • equation variable
- constant

inverse operations

#### **Creating Context**

Explain to English Learners that the suffix -ly, when used to indicate an adverb, means "done in a ____ ____way." Adverbs are words that describe actions. Ask students to name other adverbs that end in -ly, such as slowly and quickly. Write arithmetically and algebraically on the board, circling the suffix and underlining arithmetic and algebra. Then have students explain what each term means in their own words.

#### **Materials**

#### **Program Materials**

- Number 1–6 Cubes, 1 per pair
- calculators, 1 per student • Vocabulary Card 76, variable

**Additional Materials** 

- Two-Color Counters, 1 per pair • Two-Step Real-World Problems, 1 per student
- E Solving Real-World Problems: Template

#### **Prepare Ahead**

- Prepare Two-Step Real-World Problems for display to the class.
- Make multiple copies of Real-World Problems: Template for use in Supported Practice.

# WARM UP

#### Prepare

- Review the steps needed to solve two-step equations using arithmetic.
- Review the steps needed to solve two-step equations using algebra.

#### **Just the Facts**

Have students hold up the number of fingers that represent the solution of the equation. Use equations such as the following:

- ▶ 4x + 2 = 18 4 fingers
- ▶ 3x 9 = 12 7 fingers
- ►  $x \div 2 + 1 = 5$  8 fingers

# **ENGAGE**

### **Develop:** Arithmetically or Algebraically: Which Will It Be?

"Today, we are going to solve real-world problems arithmetically and algebraically." Follow the instructions on the Activity Card Arithmetically or Algebraically: Which Will It Be? As students complete the activity, be sure to use the Questions to Ask.

Alternative Groupings



Activity Card 3P

Individual: Have students solve the problems using a method of their choice.

Whole Class: Write the equations for the problems as a class, then divide the class into two teams. Have a member of each team solve one problem at the board, with a member from one team using arithmetic and a member from the other team using algebra. Then, continue having students from the teams solve problem at the board using both methods until all of the problems are finished.

#### **Progress Monitoring**

If... students have trouble writing and/or solving two-step equations for real-world problems,

**Then...** have students practice writing and/or solving one-step equations for real-world problems.

### Practice

Have students complete Student Workbook, pages 48–49. Guide students through the Key Idea example and the Try This exercises.

#### Interactive Differentiation



Consult the Teacher Dashboard for grouping suggestions. You can also use performance on the Engage activity to guide students.

#### **Independent Practice**

For additional practice solving problems arithmetically and algebraically, provide pairs of students with additional real-world problems that can be represented by two-step equations. Have students take turns solving the problems using the two methods, comparing solutions obtained using each method.

#### **Supported Practice**

For additional support with writing and solving equations, provide problems such as the following: The perimeter of a rectangular photo is 36 inches. The length of the photo is 10 inches. What is the width of the photo?

- ▶ What information are you given? The perimeter is 36 inches. The length is 10 inches.
- What are you asked to find? the width
- Guide students as they use Solving Real-World Problems: Template to solve the problem using both algebra and arithmetic.
- ▶ What is the value for w? 8
- ▶ What is the width? 8 inches

**3** REFLECT

### **Think Critically**

Review students' answers to the Reflect prompt at the bottom of **Student Workbook**, page 49, and then review the Engage activity.

► How do you check your solution when solving arithmetically? algebraically? Possible answer: When solving arithmetically, I apply the operations stated in the problem to my answer. When solving algebraically, I substitute my answer for the variable in the original equation to see if I get a true statement.

#### **Real-World Application**

A book has 384 pages. Each chapter has the same number of pages, including 4 pages of diagrams. If there are 16 chapters in the book, how many pages of text does each chapter have?

- What equation can you write to determine the number of pages of text in each chapter? 16(x + 4) = 384, where x represents the number of pages of text in each chapter
- ► What is the value of x? 20
- ► How many pages of text does each chapter have? 20 pages

# 

#### **Informal Assessment**

Use the online or print Student Record, *Assessment*, page 128, to record informal observations.

#### Arithmetically or Algebraically: Which Will It Be?

Did the student

- $\hfill\square$  make important observations?
- provide insightful answers?
- □ extend or generalize learning? □ pose insightful questions?

#### **Additional Practice**

For additional practice, have students complete *Practice*, page 67.



Practice, p. 67

Student Workbook, pp. 48–49

### WEER 4 Equations for Real-World Problems

# Lesson 5 Review

#### Objective

Students review skills learned this week and complete the weekly assessment and project.

#### Standard 🚥

**7.EE.4.a** Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

#### Vocabulary

Review vocabulary introduced during the week.

#### **Creating Context**

Students have worked with inverse operations, but they may not know that *inverse* means "*opposite*." Addition and subtraction are inverse operations, as are multiplication and division. Have students name opposites in non-mathematical contexts, such as putting on and taking off a pair of shoes or turning on and turning off a light.

# 1 WARM UP

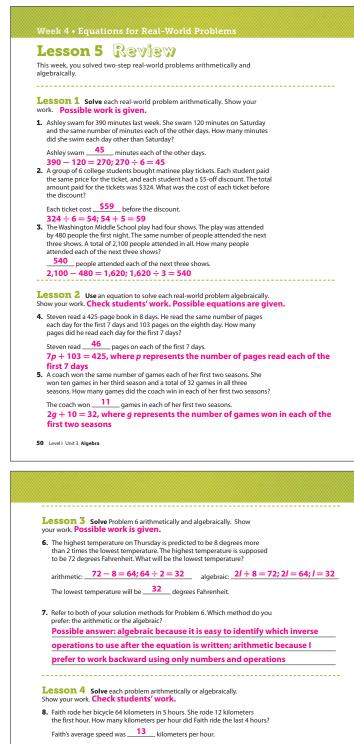
#### **Prepare**

- ► What is the first step in solving the equation 3x 2 = 13? the second step? add 2 to each side of the equation; divide each side by 3
- ► What is the first step in solving the equation 3(x 2) = 21? the second step? divide each side by 3; add 2 to each side of the equation
- What are the two methods we have used to solve real-world problems? arithmetic, algebraic
- Which method do you prefer? Explain. Possible answers: I prefer to solve arithmetically because I like the work backward problemsolving strategy; I prefer to solve algebraically because writing an equation helps me choose the correct inverse operations.
- Review words and phrases that are used to indicate addition, subtraction, multiplication, and division.



#### **Practice**

Have students complete Student Workbook, pages 50-51.



 The perimeter of a rectangular bedroom is 64 feet. The width of the room is 12 feet. What is the length of the room? The length of the room is <u>20</u> feet.

#### Reflect

What does it mean to solve a real-world problem arithmetically? algebraically? Possible answer: Solving a problem arithmetically uses only numbers and operations and involves problem-solving strategies, such as working backward or making a drawing. Solving a problem algebraically uses an equation that has a variable representing the unknown.

Week 4 Equations for Real-World Problems • Lesson 5 51

Student Workbook, pp. 50-51



### **Think Critically**

Review students' answers to the Reflect prompts at the bottom of **Student Workbook**, pages 50–51.

Discuss the answers with the group to reinforce Week 4 concepts.

# 

#### Formal Assessment 🧹

Students may take the weekly assessment online.

As an alternative, students may complete the weekly test on **Assessment**, pages 43–44. Record progress using the Student Assessment Record, **Assessment**, page 128.

# Going Forward

Use the **Teacher Dashboard** to view results of the online assessments, to input the results of print student assessments, and to review progress before making decisions about next steps. Use the weekly test results and observations to determine the next steps for each student.

Retention		
Student displays good grasp of this week's concepts and skills.	Have pairs of students practice solving multi- step word problems using algebra. One student writes an equation in the form $p(x + q) = r$ and the other student writes an equation in the form px + q = r. Students exchange and solve equations, checking each other's work.	
Remediation		
Student is still struggling with the week's concepts and skills.	Have students determine the operations needed to write and solve real-world problems that can be represented with one-step equations. Help students recognize words and phrases that indicate the four operations. Allow students to use calculators so they can focus on developing a conceptual understanding of the equation- solving process. Then help students apply this knowledge to real-world problems involving two steps.	

**Suggestions for Re-Evaluation:** If a student has struggled without success for several weeks, use observations and test results to place the student at a level where he or she can find success and build confidence to move forward.

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f. for a part of a big the place		Equations for Real World Problems	·	
More and the dependent of a S20 bill? <u>51.99</u> 9.0 space in charge 3 and the dependent of the depe		<ol> <li>Donna wants to buy a telescope that costs \$265. She paid a deposit of \$40 and then paid the same amount for 5 weeks. How much did she pay</li> </ol>		
pege are in denotice year of the period		<ol> <li>Mr. Han spent \$6.54 for food and \$12.37 for gas at a convenience store. How much change did he get from a \$20 bill?</li> </ol>		
		<ol> <li>A book has 432 pages divided into 12 chapters. How many pages are in each chapter? <u>36 pages</u></li> </ol>		
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Verture 3 Were and the set of	146	solving the equation. Show your work. 5. A store has 74 pairs of running shoes. People bought 38 pairs of shoes on Friday night and 27 pairs on Saturday morning. How many pairs		
Name Date         Equations for Real World Problems         4. A crowd of 456 people went to a movie. Half of the people had a discount coupon. The rest paid full price. How many people paid full price. How many people paid full price.         9. A crowd of 456 people went to a movie. Half of the people had a discount coupon. The rest paid full price. How many people paid full price.         9. Mane	Ospright C McGan Hill Bucklion. Pembion is gareed to reproduce for dataroon	74 - 38 - 27 = p; p = 9		
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Equations for Real World Problems 6. A crowd of 456 people went to a movie. Half of the people had a discount coupon. The rest paid full price. How many people paid full price: $\frac{456 \times \frac{1}{2} = f, f = 228 \text{ people}}{2}$ 7. The distance around a rectangular garden is 90 feet. The width of the garden is 15 feet. How long is the yard? $(2 \times 15) + (2 \times I) = 90, I = 30$ 7. The bill for a group of friends at a restaurant was \$45. They left a 20% tip. How much did the pay, including the tip? $\frac{1 + \frac{5}{45} + (\frac{5}{45} \times 0.2); t = \frac{5}{54}$ Solve each problem either arithmetically or by writing an equation and solving it. Show your work. 9. A family drove for 2 hours at an average rate of 55 miles an hour. They then drove for 1 hours at 40 miles an hour. How far did they drive in all? $(2 \times 55) + (1\frac{1}{2} \times 40) = d; d = 170 \text{ miles}$				
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<ul> <li>10. Coronado County is 3 times larger than Mason County, plus 18 square miles. If Mason County is 94 square miles, how big is Coronado County?</li> <li>c = 3(94) + 18; c = 300 square miles</li> </ul>	9.	They then drove for $1\frac{1}{2}$ hours at 40 miles an hour. How far did they drive		0
	10.	miles. If Mason County is 94 square miles, how big is Coronado County?		opyright © McGraw-Hill Educ at
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Assessment, pp. 43-44

# **Project Preview**

This week, students learned to write and solve real-world problems involving two-step equations. The project for this unit requires students to extend the knowledge they gained in Find the Math and what they have learned this week. They will use two-step equations to determine the per ticket cost of a set of tickets purchased for a concert.

#### **Project-Based Learning**

Standards-driven Project-Based Learning is effective in building deep content understanding. Project-Based Learning increases long-term retention of concepts and has been shown to be more effective than traditional instruction. Completing a project to answer an essential question challenges students to apply and demonstrate mastery of concepts and skills by expressing understanding through discussion, research, and presentation.

# **Essential Question**

**WHERE** will I need to know how to solve equations other than in the classroom?

# **Project Evaluation Criteria**

Review project evaluation criteria with students prior to beginning the project.

**Exceeds Expectations** 

- □ Project result is explained and can be extended.
- Project result is explained in context and can be applied to other situations.
- Project result is explained using advanced mathematical vocabulary.
- □ Project result is explained and extended, and shows advanced knowledge of mathematical concepts and skills.

Meets Expectations

- □ Project result is explained.
- □ Project result is explained in context.
- □ Project result is explained using mathematical vocabulary.
- □ Project result is described, and mathematics are used correctly.
- □ Project result is explained, and shows satisfactory knowledge of mathematical concepts and skills.

#### **Does Not Meet Expectations**

- □ Project result is not explained.
- □ Project result is explained, but out of context.
- Project result is explained, but mathematical vocabulary is oversimplified.
- $\hfill\square$  Project result is described, but mathematics are not used correctly.
- □ Project result is not explained and/or extended, or shows less than satisfactory knowledge of mathematical concepts and skills.

# What Things Cost

#### Objective

Students can write and solve two-step equations to determine the per-ticket cost for a concert.

#### Standard CCSS

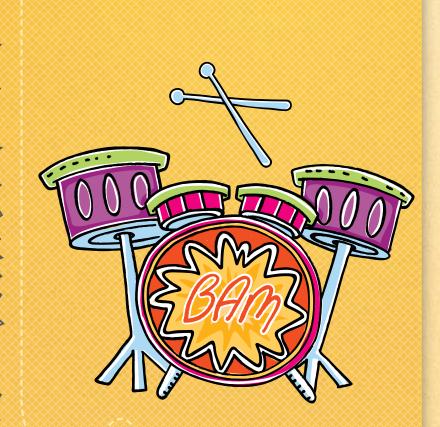
**7.EE.4.a** Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

#### **Materials**

- Number 1–6 Cube
- Number Cards 20-49
- Spinner 1–10

#### **Best Practices**

- Provide project directions that are clear and brief.
- Provide meaning and organization to the lessons and concepts.
- Set clear expectations, rules, and procedures.



# Introduce

Have you ever been to a concert? There are concerts in people's homes, and there are concerts in stadiums. All kinds of music are performed in concerts.

- What type of music concert would you want to attend?
- How much money would you be willing to spend to see your favorite performers?

## **Explore**

- Today you will continue your project by writing and solving a twostep equation to solve a real-world problem.
- Spin the Spinner three times to determine the total cost of attending the concert.
- Roll the Number 1–6 Cube to determine the number of tickets you will buy.
- Randomly choose a Number Card to determine the cost of the transportation.
- ► Complete Student Workbook, page 52.

# Wrap Up

- Allow students time to determine the total cost, the number of tickets, and the cost of transportation.
- Make sure that each student can write an equation to represent the situation that he or she created.
- What is the total cost for your group of friends?
- How many tickets will your group of friends buy?
- What is the cost of transportation?
- Discuss students' answers to the Reflect prompt at the bottom of Student Workbook, page 52.

**If time permits,** have each student prepare a slide for his or her digital slide presentation that describes the advantages and disadvantages of solving equations arithmetically and algebraically.

# Week 4 • Equations for Real-World Problems Project What Things Cost Spin a spinner, roll a number cube, and choose a number card to determine the costs of attending a concert. Check students' work.

- Spin the spinner 3 times. These three digits will be the digits of the total cost of attending the concert. What is the total cost?
- Roll a Number 1–6 Cube to determine the value of n, the number of friends going to the concert. How many tickets will you buy?
- Choose a Number Card from 20–49 to determine the value of t, the cost of transportation to and from the concert.
- Write an equation to represent how to determine the cost of each ticket.
- 5. What is the cost per ticket to the nearest whole dollar?

# Reflect

- 1. What two methods can you use to determine the cost per ticket? arithmetic, algebraic
- 2. Explain how you would determine the cost per ticket using both methods.
  Possible answer: arithmetically: Subtract the transportation cost from the
  total cost and divide the difference by the number of tickets; algebraically:
  Solve the equation by subtracting the constant from each side and
  dividing by the coefficient.
- 3. Which method did you use? Why did you choose this method? Check students' answers.

### Student Workbook, p. 52

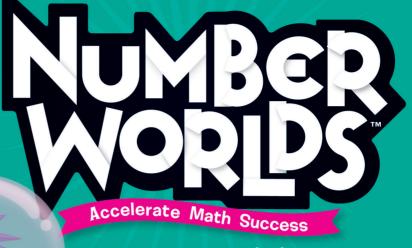
#### **Teacher Reflect**

52 Level I Unit 3 Algebra

- □ Did I explain how to organize the activity?
- Was I able to answer questions when students did not understand?
- Did I adequately explain and discuss the Reflect questions with students?

Week 4 Equations for Real-World Problems • Lesson 5 245





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