LESSON 5.3

Problem Solving • Use the Distributive Property

FOCUS COHERENCE RIGOR

LESSON AT A GLANCE

F C R Focus:

Common Core State Standards

3.NBT.A.3 Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9×80, 5×60) using strategies based on place value and properties of operations.

Also 3.OA.A.3, 3.OA.B.5, 3.OA.C.7

MATHEMATICAL PRACTICES

MP1 Make sense of problems and persevere in solving them. **MP3** Construct viable arguments and critique the reasoning of others. **MP4** Model with mathematics. **MP7** Look for and make use of structure.

F C R Coherence:

Standards Across the Grades

Before	Grade 3	After
2.OA.C.3	3.NBT.A.3	4.NBT.B.5

F C R Rigor:

Level 1: Understand Concepts.....*Share and Show* (✓ Checked Items)
Level 2: Procedural Skills and Fluency.....*On Your Own*
Level 3: Applications.....*Think Smarter and Go Deeper*

Learning Objective

Solve multiplication problems by using the strategy *draw a diagram*.

Language Objective

Students use the strategy *draw a diagram* to explain how to multiply with multiples of 10.

Materials

MathBoard

F C R For more about how *GO Math!* fosters **Coherence** within the Content Standards and Mathematical Progressions for this chapter, see page 259H.

About the Math

Professional Development

Using an Area Model to Multiply

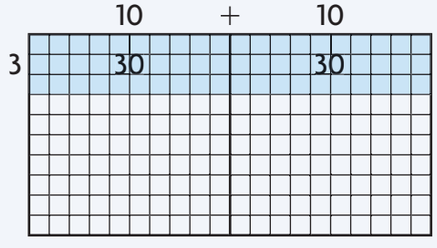
An area model helps students visualize multiplication and how the Distributive Property can be used to multiply with greater numbers.

In this lesson, students learn that they can use the Distributive Property and draw a corresponding area model as strategies to multiply with greater numbers (multiples of 10). For example, to find 3×20, the Distributive Property can be used to break apart the factor 20 into $10 + 10$. So, $3 \times 20 = 3 \times (10 + 10)$. Students then shade 3 rows of 10 squares adjacent to another group of 3 rows of 10 squares.

Students connect the model to the Distributive Property as they find the product of each smaller rectangle, and then add the partial products to find the total product.

Professional Development Videos

$3 \times 20 = 3 \times (10 + 10)$



$3 \times 10 = 30$ $3 \times 10 = 30$

$30 + 30 = 60$

$3 \times 20 = 60$

Daily Routines

Common Core

Problem of the Day 5.3

Use the factors 3 and 6 to write an equation that shows the Commutative Property of Multiplication. $6 \times 3 = 3 \times 6$

Vocabulary

GO DIGITAL
- Interactive Student Edition
- Multimedia eGlossary

Fluency Builder

Common Core Fluency Standard 3.NBT.A.2

Add 3-Digit Numbers Write the following problems on the board. Have students practice adding 3-digit numbers by solving the problems and checking their answers with a partner.

$196 + 235 = 431$	$308 + 692 = 1{,}000$
$217 + 384 = 601$	$639 + 257 = 896$
$435 + 321 = 756$	$972 + 26 = 998$

1 ENGAGE

with the Interactive Student Edition

Essential Question

How can you use the strategy *draw a diagram* to multiply with multiples of 10?

Making Connections

Invite students to tell you what they know about multiples of 10.

What is a multiple of 10? a number that has 10 as a factor **What pattern do you see in multiples of 10?** Possible answer: They end in 0. **What digit does 30 end in?** 0

Learning Activity

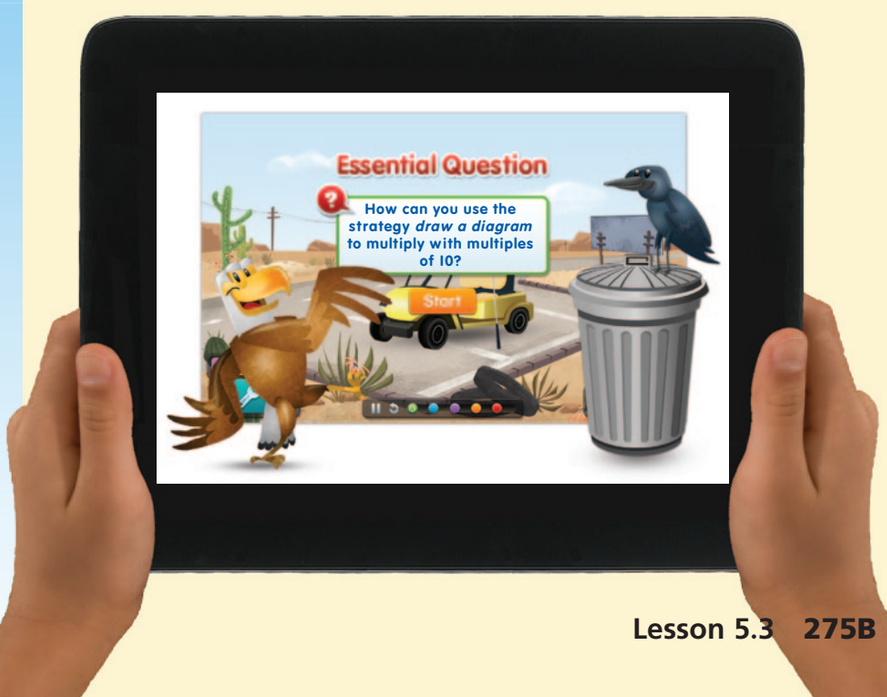
What is the problem the students are trying to solve? Connect the story to the problem.

- **How many boxes are there?** 3 boxes
- **How many golf balls are in each box?** 30 golf balls
- **What operations could you use to find the total number of golf balls?** multiplication, addition
- **What equations could you use to find the total number of golf balls?** 3×30, $30 + 30 + 30$

Literacy and Mathematics

Choose one or more of the following activities.

- Ask students to clarify the story and the problem by asking them to pick out the important information from the lesson opener.
- Have students think of reasons a golfer might hit so many golf balls. Why did he want to practice?



2 EXPLORE

Unlock the Problem

MATHEMATICAL PRACTICES

MP4 Model with mathematics. Make sure students understand that they need to find the number of third graders at the assembly. Discuss with students how the graphic organizer helps to organize their problem solving.

- **Why are you using the Distributive Property?** Possible answer: if I break apart the factor into smaller numbers, I can multiply by smaller numbers.

Discuss with students that drawing a model on grid paper is like making an array. It shows rows and columns but there is no space between the rows and columns. This model is called an area model.

- **How does the diagram show the Distributive Property?** Possible answer: it shows 3 rows of 10 added to another 3 rows of 10.

MP4 Model with mathematics.

- **If the third graders fill 3 rows, how many seats are left over?** 40 seats
- **Could you break apart the factors in a different way? Explain.** Yes; possible explanation: I could break apart the 3 into a 1 and a 2. Multiply $2 \times 20 = 40$ and $1 \times 20 = 20$. Add $40 + 20 = 60$.

ELL Strategy:
Elicit Prior Knowledge

Students can learn to multiply by 10s using the strategies they have used for other numbers.

- Select a problem from the lesson. Have students draw an array or rectangle to represent the problem.
- Show students how to solve the problem by breaking apart the larger rectangle into smaller ones. For example, $4 \times 30 = 4(10 + 10 + 10)$.
- Have students use their models to explain to a partner how they arrived at their answers.
- Remind them that the breaking apart strategy is also called the *Distributive Property*. Encourage them to use that term in their explanation.

Common Core **3.NBT.A.3** Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9×80, 5×60) using strategies based on place value and properties of operations.

Name _____

PROBLEM SOLVING Lesson 5.3

Problem Solving • Use the Distributive Property

Essential Question How can you use the strategy *draw a diagram* to multiply with multiples of 10?

Common Core **Number and Operations in Base Ten—3.NBT.A.3** *Also 3.OA.A.3, 3.OA.B.5, 3.OA.C.7*

MATHEMATICAL PRACTICES **MP1, MP3, MP4, MP7**

Unlock the Problem

The school assembly room has 5 rows of chairs with 20 chairs in each row. If the third-grade classes fill 3 rows of chairs, how many third graders are at the assembly?

Read the Problem

What do I need to find?

I need to find how many third graders are at the assembly.

What information do I need to use?

There are 20 chairs in each row.

The third graders fill 3 rows of chairs.

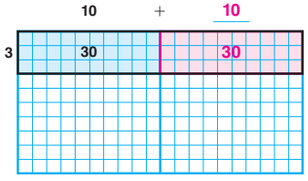
How will I use the information?

The Distributive Property tells me I can break apart the factor 20 to multiply.

$3 \times 20 = 3 \times (10 + 10)$

Solve the Problem

Draw a diagram. Finish the shading to show 3 rows of 20 chairs.



I can use the sum of the products of the smaller rectangles to find how many third graders are at the assembly.

$3 \times 10 = 30$ $3 \times 10 = 30$

$30 + 30 = 60$

$3 \times 20 = 60$

So, 60 third graders are at the assembly.

1. Explain how breaking apart the factor 20 makes finding the product easier. Possible explanation: I can use facts I know to find the product.

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Reteach 5.3

RtI

Name _____ Lesson 5.3 Reteach

Problem Solving • Use the Distributive Property

There are 6 rows of singers in a performance. There are 20 singers in each row. How many singers are in the performance?

Read the Problem	Solve the Problem
What do I need to find? I need to find how many singers are in the performance	**Record the steps you used to solve the problem.** 10 + 10; 6 rows; 60 60
What information do I need to use? There are 6 rows of singers. Each row has 20 singers.	First, I draw and label a diagram to show 6 rows of 20 singers. Next, I break apart 20 into 10 + 10 and find the products of the two smaller rectangles. $6 \times 10 = 60$ $6 \times 10 = 60$ Then, I find the sum of the two products. $60 + 60 = 120$ $6 \times 20 = 120$ So, there are 120 singers.
How will I use the information? I can draw a diagram and use the Distributive Property to break apart the factor 20 into 10 + 10 to use facts I know.	

1. Eight teams play in a Little League series. Each team has 20 players. How many players are in the series? 160 players

2. The assembly room has 6 rows with 30 chairs in each row. If third graders fill 3 rows, how many third graders are in the room? 90 third graders

Chapter Resources 5-9 Reteach

Enrich 5.3

Differentiated Instruction

Name _____ Lesson 5.3 Enrich

Apply the Distributive Property

Use the Distributive Property to help solve each problem.

Use this problem for 1–3.
An artist sells 4 paintings for $20 each, 4 sculptures for $60 each, and 4 photographs for $10 each at her art show.

1. How much money does the artist make on these sales in all? $360

2. The artist sells 2 more paintings and 4 more sculptures at the same prices. What is the total amount of money the artist has made so far? $640

3. How many more paintings, sculptures, and photographs would the artist need to sell to make another $500? Possible answer: 5 paintings, 5 sculptures, 10 photographs

Use this problem for 4–6.
Lee has 6 sheets of stickers with 30 stickers on each sheet. She has 8 sheets with 20 stickers each and 9 sheets with 10 stickers each.

4. How many stickers does Lee have in all? 430 stickers

5. Lee gives 4 sheets with 20 stickers and 3 sheets with 10 stickers to her sister. How many stickers does Lee have left? 320 stickers

6. Now Lee gives some stickers to her friend Myla. What sheets does Lee give to Myla if she has 200 stickers left? Possible answer: 2 sheets with 30 stickers and 3 sheets with 20 stickers

7. Write Math How did the Distributive Property help you solve the problems? Possible answer: I used the Distributive Property to break apart greater numbers into lesser numbers that are easier to work with.

Chapter Resources 5-10 Enrich

Try Another Problem

Megan is watching a marching band practice. The band marches by with 4 rows of people playing instruments. She counts 30 people in each row. How many people march in the band?

Read the Problem	Solve the Problem
What do I need to find? I need to find how many people march in the band.	**Record the steps you used to solve the problem.** 10 + 10 + 10 4 × 40 40 40 First, I shade 4 rows of 30, or 10 + 10 + 10. Next, I find the products of the three smaller rectangles. 4 × 10 = 40 4 × 10 = 40 4 × 10 = 40 Then, I find the sum of the three products. 40 + 40 + 40 = 120 4 × 30 = 120 So, 120 people march in the band.
What information do I need to use? The band has 4 rows of people. There are 30 people in each row.	
How will I use the information? I will draw a diagram and break apart the factor 30 into 10 + 10 + 10 to use facts I know.	

2. How can you check to see if your answer is reasonable?

Possible answer: there are 4 rows with 30 people in each row; 30 + 30 + 30 + 30 = 120.

So, my answer of 120 people is reasonable.

3. Explain how you can use the Distributive Property to help you find a product.

Possible explanation: I can break apart the greater factor to use facts I know. Then I can add the products to find the total product.

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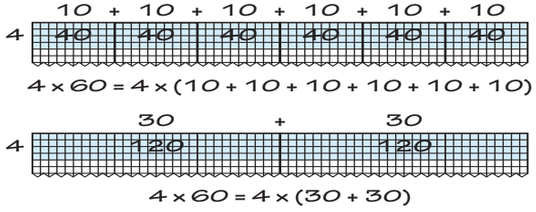
Advanced Learners

Visual / Kinesthetic
Individual / Partners

Materials Base-Ten Grid Paper (see *eTeacher Resources*)

- Have students find all the possible ways to break apart a factor into multiples of 10 for 4 × 60 = ■. Students should break apart 60 into addends that are multiples of 10. Let students know that they may use any number of addends.
- Have students show each example on grid paper with an equation that shows the Distributive Property.



- Have students write an explanation for how they found all the ways to break apart the factor.

Try Another Problem

For this problem, make sure students understand that they need to find the number of people marching in the band. Have students answer the questions in the graphic organizer and solve the problem. Invite students to share their diagrams by sketching them on the board. Ask them to communicate the steps they used.

- **What strategy and steps did you use to solve the problem?** Possible answer: I broke apart the factor 30 into 10 + 10 + 10. I shaded 4 rows of 10. I used the diagram to find the products of the smaller rectangles. Then I added the products.
- **Why do you add the products of the smaller rectangles to find the total product?** Possible answer: each smaller product is part of the total product. I add the parts together to find the whole product.
- **How could you break apart the factor 30 into three addends?** Possible answer: I could break apart 30 into 10 + 10 + 10.
- **What is another way you can break apart the factor 30?** Possible answer: 10 + 20

MP2 Reason quantitatively and abstractly.

- **How can knowing how to use the Distributive Property help you multiply when you are making a purchase?**

Portfolio

You may suggest that students place completed Try Another Problem graphic organizers in their portfolios.

COMMON ERRORS

Error Students may use addition instead of multiplication when using an area model to solve a problem.

Example To solve Try Another Problem students write:

4 + 10 = 14 4 + 10 = 14
4 + 10 = 14

14 + 14 + 14 = 42

4 × 30 = 42

Springboard to Learning Remind students that an area model shows equal groups. Help students recognize that these groups are shown by rows, which each have the same number of squares. Point out that the number of rows and the number of squares in each row represent factors.

3 EXPLAIN

Share and Show

The first problem connects to the learning model. Have students use the MathBoard to explain their thinking. Suggest that students begin solving the problem by first writing the problem they need to solve (6×40).

Exercise 2 requires students to reinterpret Exercise 1 given different information.

MP3 Construct viable arguments and critique the reasoning of others. Have students compare their models in Exercise 1 and discuss different ways to break apart the factors.

Use the checked exercises for Quick Check. Students should show their answers for the Quick Check on the MathBoard.

Quick Check

If a student misses the checked exercises

Then Differentiate Instruction with

- Reteach 5.3
- Personal Math Trainer 3.NBT.A.3
- RtI Tier 1 Activity (online)

On Your Own

If students complete the checked exercises correctly, they may continue with the On Your Own section.

THINK SMARTER

Math on the Spot Video Tutor

Use this video to help students model and solve this type of *Think Smarter* problem.

GO DIGITAL **Math on the Spot** videos are in the Interactive Student Edition and at *www.thinkcentral.com*.

Name _____

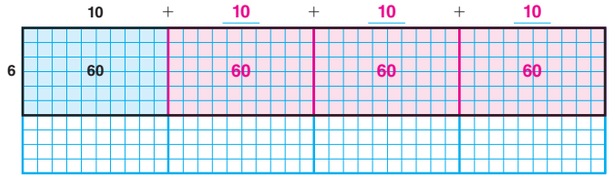
Share and Show

1. People filled all the seats in the front section of the theater. The front section has 6 rows with 40 seats in each row. How many people are in the front section of the theater?

Unlock the Problem

- Circle the numbers you will use.
- Use the Distributive Property and break apart a greater factor to use facts you know.
- Draw a diagram to help you solve the problem.

First, draw and label a diagram to break apart the problem into easier parts to solve.



Next, find the products of the smaller rectangles.

$6 \times 10 = 60$ $\quad 6 \times 10 = 60$

$6 \times 10 = 60$ $\quad 6 \times 10 = 60$

Then, find the sum of the products.

$60 + 60 + 60 + 60 = 240$

So, there are 240 people in the front section of the theater.

2. What if seats are added to the front section of the theater so that there are 6 rows with 50 seats in each row? How many seats are in the front section?

300 seats

On Your Own

3. THINK SMARTER Tova sewed 60 pieces of blue ribbon together to make a costume. Each piece of ribbon was 2 meters long. She also sewed 40 pieces of red ribbon together that were each 3 meters long. Did Tova use more blue ribbon or red ribbon? Explain.

She used the same amount. $60 \times 2 = 120$; $40 \times 3 = 120$

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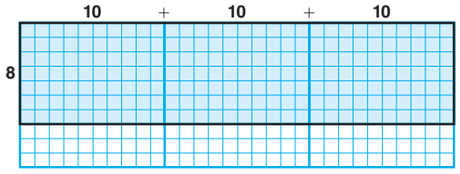
4. MATHEMATICAL PRACTICE 3 **Verify the Reasoning of Others**
Carina draws this diagram to show that $8 \times 30 = 210$. Explain her error.

Possible explanation:



Carina shaded 7 rows of 30 and added the products $7 \times 10 = 70$, $7 \times 10 = 70$, and $7 \times 10 = 70$; $70 + 70 + 70 = 210$. She should have shaded 8 rows of 30 and added the products $8 \times 10 = 80$, $8 \times 10 = 80$, and $8 \times 10 = 80$; $80 + 80 + 80 = 240$. So, $8 \times 30 = 240$.

5. WRITE Math Tamika wants to display 10 trophies on a table in a rectangular array. How many different ways can Tamika arrange the trophies? Explain your answer.

4 ways; possible explanation: she can make 10 rows of 1, 1 row of 10, 2 rows of 5, or 5 rows of 2.

6. GO DEEPER The drama club has 350 tickets to sell. They sell 124 tickets on Monday and 98 tickets on Tuesday. How many tickets does the drama club have left to sell?

128 tickets

7. THINK SMARTER Select the equations that show the Distributive Property. Mark all that apply.

- ● $3 \times 20 = (3 \times 10) + (3 \times 10)$
- Ⓑ $(7 + 3) + 8 = 7 + (3 + 8)$
- ● $(5 \times 10) + (5 \times 10) = 5 \times 20$
- ● $(9 \times 2) + (9 \times 4) = 9 \times 6$

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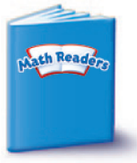
DIFFERENTIATED INSTRUCTION INDEPENDENT ACTIVITIES

Grab-and-Go!™
Differentiated Centers Kit

Activities
Multiplication Dash

Students complete orange Activity Card 17 by using models to apply multiplication facts through 12 by 12.

Literature
Party Plans by the Numbers!



Students read the book and use multiplication facts and strategies to plan a party.

Games
Multiplication Bingo

Students practice multiplication facts through 10.

4 ELABORATE

Common Core MATHEMATICAL PRACTICES

MP3 Construct viable arguments and critique the reasoning of others. In Exercise 4, students need to analyze the diagram to find the error.

GO DEEPER

Exercise 6 is a multistep problem that involves addition and subtraction. Suggest students write a number sentence to represent the problem.

THINK SMARTER

Students will need to identify applications of the Distributive Property. Each of the correct answers shows different representations of equations that use the Distributive Property. Students should be able to recognize the property's application in different formats.

5 EVALUATE Formative Assessment

Essential Question

Using the Language Objective

Reflect Have students draw and explain to answer the Essential Question.

How can you use the strategy *draw a diagram* to multiply with multiples of 10?

Possible answer: I can draw and shade a rectangle on grid paper to show the problem. Then I can break apart a factor to make smaller rectangles for facts I know.

Math Journal WRITE Math

Write a description of how a diagram can help you solve 2×40.

Practice and Homework

Use the Practice and Homework pages to provide students with more practice of the concepts and skills presented in this lesson. Students master their understanding as they complete practice items and then challenge their critical thinking skills with Problem Solving. Use the Write Math section to determine student's understanding of content for this lesson. Encourage students to use their Math Journals to record their answers.

Name _____

Practice and Homework
Lesson 5.3

Problem Solving • Use the Distributive Property

Common Core **COMMON CORE STANDARD—3.NBT.A.3**
Use place value understanding and properties of operations to perform multi-digit arithmetic.

Read each problem and solve.

1. Each time a student turns in a perfect spelling test, Ms. Ricks puts an achievement square on the bulletin board. There are 6 rows of squares on the bulletin board. Each row has 30 squares. How many perfect spelling tests have been turned in?

   Think: $6 \times 30 = 6 \times (10 + 10 + 10)$

   $= 60 + 60 + 60 = 180$

   180 spelling tests

2. Norma practices violin for 50 minutes every day. How many minutes does Norma practice violin in 7 days?

   350 minutes

3. A kitchen designer is creating a new backsplash for the wall behind a kitchen sink. The backsplash will have 5 rows of tiles. Each row will have 20 tiles. How many tiles are needed for the entire backsplash?

   100 tiles

4. A bowling alley keeps shoes in rows of cubbyholes. There are 9 rows of cubbyholes, with 20 cubbyholes in each row. If there is a pair of shoes in every cubbyhole, how many pairs of shoes are there?

   180 pairs of shoes

5. WRITE Math Write a description of how a diagram can help you solve 2×40.

   Check students' work.

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Common Core **PROFESSIONAL DEVELOPMENT**

Mathematical Practices in Your Classroom

CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.

Students can persevere in solving problems involving multiplying with multiples of 10 by breaking apart a factor and drawing a corresponding area model. Students make a plan for breaking apart a factor that makes multiplying easier. By drawing an area model, students also learn how to visualize situations involving equal groups.

The following activities can help promote students' use of breaking apart a factor and area models as entry points to solving problems involving equal groups with multiples of 10:

- **Draw an area model showing the number of months in the year that have 30 days to find the total number of days.**
- **Draw an area model showing how many stamps you have if you buy 6 sheets of stamps with 20 stamps on each sheet.**
- **Write a word problem about a garden with a number of rows with 40 plants in each row.**

Lesson Check (3.NBT.A.3)

1. Each snack pack holds 20 crackers. How many crackers in all are there in 4 snack packs?

80 crackers

2. A machine makes 70 springs each hour. How many springs will the machine make in 8 hours?

560 springs

Spiral Review (3.OA.A.1, 3.NBT.A.1, 3.MD.B.4)

3. Lila read 142 pages on Friday and 168 pages on Saturday. Estimate how many pages Lila read on Friday and Saturday combined.

Possible answer: about 300 pages

4. Jessica wrote 6 + 6 + 6 + 6 on the board. What is another way to show 6 + 6 + 6 + 6?

Possible answers: 4 × 6 or 6 × 4

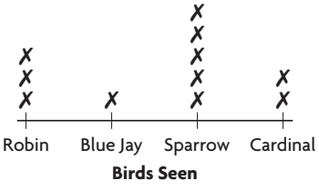
Use the line plot for 5–6.

5. Eliot made a line plot to record the number of birds he saw at his bird feeder. How many more sparrows than blue jays did he see?

4 more sparrows

6. How many robins and cardinals combined did Eliot see?

5 robins and cardinals



Birds Seen

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Continue concepts and skills practice with Lesson Check. Use Spiral Review to engage students in previously taught concepts and to promote content retention. Common Core standards are correlated to each section.