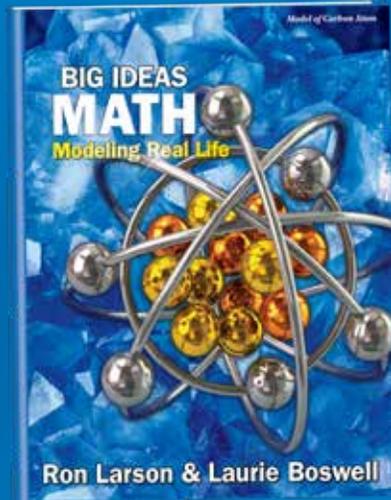
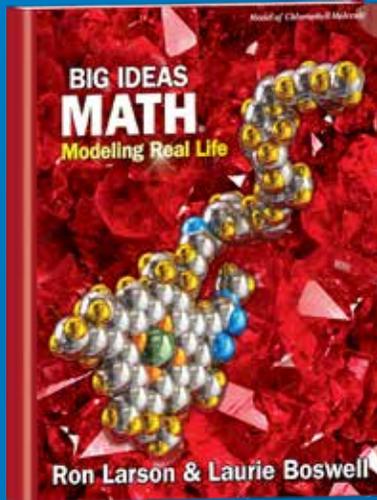
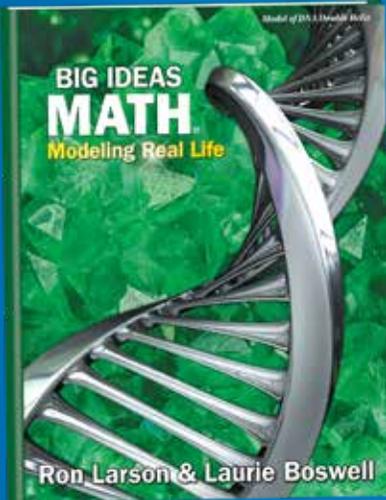


# BIG IDEAS MATH<sup>®</sup>

Grades 6–8

Ron Larson & Laurie Boswell



## Modeling Real Life

# Authors and Research

Big Ideas Learning® is pleased to introduce a new, research-based K–8 series, **Big Ideas Math®: Modeling Real Life**. Written by renowned authors Dr. Ron Larson and Dr. Laurie Boswell, this series uses an exploratory approach to engage students' inquiring minds through rich explorations and in-class problem solving. With one voice from Grade K through Grade 8, and into high school, students make connections through cohesive progressions and consistent, dependable instruction.

The pedagogical approach used in this program follows the best practices outlined in the most prominent and widely accepted educational research including John Hattie's *Visible Learning*, NCTM's *Principles to Actions*, Jo Boaler's *Mathematical Mindsets*, Wiggins and McTighe's *Understanding by Design*, and others.

*We created Big Ideas Math because we recognized the need for a truly balanced approach to learning, using discovery learning and scaffolded instruction.*

—Ron Larson, Ph.D.



**Ron Larson, Ph.D.**, is well known as the lead author of a comprehensive program for mathematics that spans school mathematics and college courses. He holds the distinction of Professor Emeritus from Penn State Erie, The Behrend College, where he taught

for nearly 40 years. He received his Ph.D. in mathematics from the University of Colorado. Dr. Larson's numerous professional activities keep him actively involved in the mathematics education community and allow him to fully understand the needs of students, teachers, supervisors, and administrators.



**Laurie Boswell, Ed.D.**, is the former Head of School at Riverside School in Lyndonville, Vermont. In addition to textbook authoring, she provides mathematics consulting and embedded coaching sessions. Dr. Boswell received her Ed.D. from the University of Vermont in 2010.

She is a recipient of the Presidential Award for Excellence in Mathematics Teaching and is a Tandy Technology Scholar. Laurie has taught math to students at all levels, elementary through college. In addition, Laurie has served on the NCTM Board of Directors and as a Regional Director for NCSM. Along with Ron, Laurie has co-authored numerous math programs and has become a popular national speaker.

*Students go deeper in their learning when they are motivated to dig in. My passion is to provide effective ways for teachers to begin each lesson.*

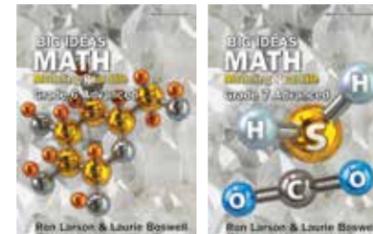
—Laurie Boswell, Ed.D.

## Big Ideas Math: Modeling Real Life fits the needs of today's middle school math classrooms!

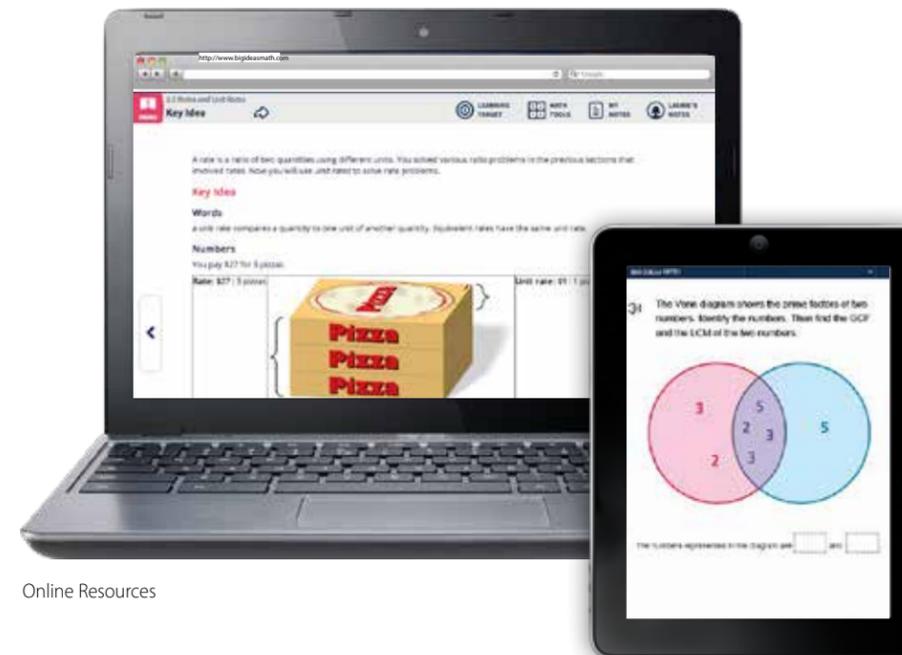
- Uses learning targets and success criteria for student self-assessment
- Supports deep conceptual understanding to facilitate meaningful application for success in higher-level math courses
- Helps teachers recognize the impact they have on students
- Allows students to grow as independent learners and experience the delight of mathematics



Grades 6–8



Advanced Middle School Courses



Online Resources

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# Instructional Design

The **Big Ideas Math: Modeling Real Life** program uses a Universal Design for Learning to create an engaging and innovative program that uses hands-on activities and scaffolded instruction. The instructional design guides students through concepts from surface-level to deep-level learning and allows them to transfer these skills to new concepts in a complete and comprehensive way. This allows for balanced lessons with built-in differentiation, as well as RTI support, that appeals to students and teachers alike. Learning targets and success criteria help to focus student learning and make learning visible to teachers and students.

With a strong emphasis on problem solving in the classroom, students can transfer their mathematical knowledge to new concepts and apply their understanding to real-life situations. Through in-class practice and activities, students become more comfortable with the problem-solving process to become strategic mathematical thinkers.

**Explorations** help students reach a deeper level of conceptual understanding. **Learning Targets** and **Success Criteria** encourage students to self-assess and evaluate their learning.

Lessons offer **scaffolding** to ensure all levels of learners attain procedural fluency.

## 2.1 Multiplying Fractions

**Learning Target:** Find products involving fractions and mixed numbers.  
**Success Criteria:**

- I can draw a model to explain fraction multiplication.
- I can multiply fractions.
- I can find products involving mixed numbers.
- I can interpret products involving fractions and mixed numbers to solve real-life problems.

**EXPLORATION 1 Using Models to Solve a Problem**

Work with a partner. A bottle of water is  $\frac{1}{2}$  full. You drink  $\frac{2}{3}$  of the water. Use one of the models to find the portion of the bottle of water that you drink. Explain your steps.

- number line
- area model
- tape diagram

**EXPLORATION 2 Solving a Problem Involving Fractions**

Work with a partner. A park has a playground that is  $\frac{3}{4}$  of its width and  $\frac{4}{5}$  of its length.

- Use a model to find the portion of the park that is covered by the playground. Explain your steps.
- How can you find the solution of part (a) without using a model?

**Math Practice**  
**Find General Methods**  
 How can you use your answer to find a method for multiplying fractions?

Section 2.1 Multiplying Fractions 45

### EXAMPLE 5 Multiplying Mixed Numbers

Find  $1\frac{4}{5} \times 3\frac{2}{3}$ . **Estimate:**  $2 \times 4 = 8$

$1\frac{4}{5} \times 3\frac{2}{3} = \frac{9}{5} \times \frac{11}{3}$  Write  $1\frac{4}{5}$  and  $3\frac{2}{3}$  as improper fractions.  
 $= \frac{9 \times 11}{5 \times 3}$  Multiply the numerators and the denominators.  
 $= \frac{99}{15}$  or  $6\frac{3}{5}$  Simplify.  
 The product is  $6\frac{3}{5}$ . **Reasonable?**  $6\frac{3}{5} \approx 8$  ✓

**Try It** Multiply. Write the answer in simplest form.

11.  $1\frac{7}{8} \cdot 2\frac{2}{5}$     12.  $5\frac{5}{7} \times 2\frac{1}{10}$     13.  $2\frac{1}{3} \cdot 7\frac{2}{3}$

**Self-Assessment for Concepts & Skills**

Solve each exercise. Then rate your understanding of the success criteria in your journal.

**MULTIPLYING FRACTIONS AND MIXED NUMBERS** Multiply. Write the answer in simplest form.

14.  $\frac{1}{8} \times \frac{1}{6}$     15.  $\frac{3}{8} \cdot \frac{2}{3}$     16.  $2\frac{1}{6} \cdot 4\frac{2}{5}$

17. **MP REASONING** What is the missing denominator?  
 $\frac{3}{7} \times \frac{1}{\square} = \frac{3}{28}$

18. **USING TOOLS** Write a multiplication problem involving fractions that is represented by the model. Explain your reasoning.

19. **USING TOOLS** Use the number line to find  $\frac{3}{4} \times \frac{1}{2}$ . Explain your reasoning.

48 Chapter 2 Fractions and Decimals

### EXAMPLE 6 Modeling Real Life

A city is resurfacing a basketball court. Find the area of the court.

You are given the dimensions of a basketball court. You are asked to find the area of the court.

Use the formula for the area of a rectangle. Find the product of the length and the width of the court.

$A = \ell w$  Write the formula.  
 $= 21\frac{1}{3} \cdot 13\frac{1}{2}$  Substitute for  $\ell$  and  $w$ .  
 $= \frac{64}{3} \cdot \frac{27}{2}$  Write  $21\frac{1}{3}$  and  $13\frac{1}{2}$  as improper fractions.  
 $= \frac{64 \cdot 27}{3 \cdot 2}$  Multiply the numerators and the denominators.  
 $= \frac{1728}{6}$  or 288 Simplify.  
 So, the area of the court is 288 square meters.

**Check Reasonableness**  
 Find an underestimate and an overestimate.  
 Underestimate:  $13 \cdot 21 = 273$   
 Overestimate:  $14 \cdot 22 = 308$   
 The answer is reasonable because  $273 < 288 < 308$ . ✓

**Self-Assessment for Problem Solving**

Solve each exercise. Then rate your understanding of the success criteria in your journal.

20. You spend  $\frac{5}{12}$  of a day at an amusement park. You spend  $\frac{2}{5}$  of that time riding waterslides. How many hours do you spend riding waterslides? Draw a model to show why your answer makes sense.

21. A venue is preparing for a concert on the floor shown. The width of the red carpet is  $\frac{1}{6}$  of the width of the floor. What is the area of the red carpet?

22. You travel  $9\frac{3}{8}$  miles from your house to a shopping mall. You travel  $\frac{2}{3}$  of that distance on an interstate. The only road construction you encounter is on the first  $\frac{2}{5}$  of the interstate. On how many miles of your trip do you encounter construction?

Section 2.1 Multiplying Fractions 49

**Self-Assessment opportunities** allow student ownership and accountability for their learning.

# Teaching Support

The **Big Ideas Math: Modeling Real Life** Teaching Edition is a comprehensive resource that guides teachers throughout instruction.

**Chapter 3 Learning Targets and Success Criteria**

Section	Learning Target	Success Criteria
3.1 Ratios	Understand the concepts of ratios and equivalent ratios.	<ul style="list-style-type: none"> <li>Write and interpret ratios using appropriate notation and language.</li> <li>Recognize multiplicative relationships in ratios.</li> <li>Describe how to determine whether ratios are equivalent.</li> <li>Name ratios equivalent to a given ratio.</li> </ul>
3.2 Using Tape Diagrams	Use tape diagrams to model and solve ratio problems.	<ul style="list-style-type: none"> <li>Interpret tape diagrams that represent ratio relationships.</li> <li>Draw tape diagrams to model ratio relationships.</li> <li>Find the value of one part of a tape diagram.</li> <li>Use tape diagrams to solve ratio problems.</li> </ul>
3.3 Using Ratio Tables	Use ratio tables to represent equivalent ratios and solve ratio problems.	<ul style="list-style-type: none"> <li>Use various operations to create tables of equivalent ratios.</li> <li>Use ratio tables to solve ratio problems.</li> <li>Use ratio tables to compare ratios.</li> </ul>
3.4 Graphing Ratio Relationships	Represent ratio relationships in a coordinate plane.	<ul style="list-style-type: none"> <li>Create and plot ordered pairs from a ratio relationship.</li> <li>Create graphs to solve ratio problems.</li> <li>Create graphs to compare ratios.</li> </ul>
3.5 Rates and Unit Rates	Understand the concept of a unit rate and solve ratio problems.	<ul style="list-style-type: none"> <li>Find unit rates.</li> <li>Use unit rates to solve ratio problems.</li> <li>Use unit rates to compare ratios.</li> </ul>
3.6 Converting Measures	Use ratio reasoning to convert units of measure.	<ul style="list-style-type: none"> <li>Write conversion facts as unit rates.</li> <li>Convert units of measure using ratio tables.</li> <li>Convert units of measure using conversion factors.</li> <li>Convert rates using conversion factors.</li> </ul>

**Laurie's Notes**

**Learning Target**  
Understand the concepts of ratios and equivalent ratios.

**Success Criteria**

- Write and interpret ratios using appropriate notation and language.
- Recognize multiplicative relationships in ratios.
- Describe how to determine whether ratios are equivalent.
- Name ratios equivalent to a given ratio.

**Warm Up**  
Cumulative, vocabulary, and prerequisite skills practice opportunities are available in the *Resources by Chapter* or at [BigIdeasMath.com](http://BigIdeasMath.com).

**ELL Support**  
Clarify the meaning of the word *relationship*. Explain that the mother of Sam's mother is Sam's grandmother. The word *relationship* describes the connections between people. Tell students that they will be creating tables to show ratio relationships. In a mathematical context, a table is a type of chart, not a type of furniture.

**Exploration 1**  
a-c. See Additional Answers.

**Exploration 2**  
a. yes  
b. Add 3 parts of iced tea for every 1 part of lemonade added.

A table in each chapter and the first page of each lesson highlight the **Learning Targets** and **Success Criteria** that guide student learning.

They encourage self-assessment and give students and teachers benchmarks for each lesson.

**Learning Target**  
Understand the concepts of ratios and equivalent ratios.

**Success Criteria**

- Write and interpret ratios using appropriate notation and language.
- Recognize multiplicative relationships in ratios.
- Describe how to determine whether ratios are equivalent.
- Name ratios equivalent to a given ratio.

**Laurie's Notes**

**Chapter 3 Overview**  
Students need time to think and discuss with their peers in a supportive learning environment. Be sure to model the expectation that all students engage in their learning, that errors lead to learning, and explanations help students to assess their understanding of the concepts.

A major focus of this course is the study of ratios and rates. In studying these topics, it is natural to make connections to whole-number multiplication and division. In this chapter, students have the opportunity to review and become more confident with these operations.

This chapter begins with introductory skills associated with writing and representing ratios. Fractional notation is purposely avoided. Instead, the number  $\frac{a}{b}$  is referred to as the value of the ratio  $a : b$ . Once the concept of a ratio has been introduced, equivalent ratios can be used to solve a wide variety of problems.

Students used tape diagrams in prior grades to show the relationship between numbers. For example, 13 can be decomposed into the two numbers 5 and 8. When the visual model is drawn to scale, it is called a tape diagram and can be used to find equivalent ratios. Another visual model that can be used is a double number line.

Students will also use the structure of a ratio table to find equivalent ratios, which in turn are used to solve real-life applications. In the third lesson, various operations are used to create ratio tables. Students will come to understand that in most cases a ratio table is the result of extending pairs of rows (or columns) of a multiplication table.

Once students have a good understanding of ratios, and can solve a variety of ratio problems using a tape diagram or a ratio table, rates are introduced. Students begin by graphing ratios in the first quadrant and recognizing that there is a constant rate at which the line is increasing. The connection to slope will be made in subsequent grades.

Rates, unit rates, and converting measures comparing applications of rates, such as miles per hour and students. Converting rates, or simply converting, unit, integrates prior computational skills and rat

**Suggested Pacing**

Chapter Opener	1 Day
Section 1	3 Days
Section 2	3 Days
Section 3	3 Days
Section 4	3 Days
Section 5	3 Days
Section 6	3 Days
Connecting Concepts	1 Day
Chapter Review	1 Day
Chapter Test	1 Day
Total Chapter 3	22 Days
Year-to-Date	50 Days

**Chapter Learning Target**  
Understand ratios.

**Chapter Success Criteria**

- Write and interpret ratios.
- Name ratios equivalent to a given ratio.
- Solve a problem using ratios.
- Convert units of measure using ratio reasoning.

**Learning Target**  
Understand the concepts of ratios and equivalent ratios.

**Success Criteria**

- Write and interpret ratios using appropriate notation and language.
- Recognize multiplicative relationships in ratios.
- Name ratios equivalent to a given ratio.

**Warm Up**  
Cumulative, vocabulary, and prerequisite skills practice opportunities are available in the *Resources by Chapter* or at [BigIdeasMath.com](http://BigIdeasMath.com).

**ELL Support**  
Clarify the meaning of the word *relationship*. Explain that the mother of Sam's mother is Sam's grandmother. The word *relationship* describes the connections between people. Tell students that they will be creating tables to show ratio relationships. In a mathematical context, a table is a type of chart, not a type of furniture.

**Exploration 1**  
a-c. See Additional Answers.

**Exploration 2**  
a. yes  
b. Add 3 parts of iced tea for every 1 part of lemonade added.

**Laurie's Chapter Overview** at the beginning of each chapter sets the stage for the content. The overview lays out the conceptual progression for that chapter and how it is developed and instructed in each lesson.

The information offers an efficient way to plan for the chapter and solidify math background.

Laurie's Notes provide effective tips for using models and making connections to previously learned concepts, as well as real-world applications.

**Laurie's Notes** appear at the chapter and lesson level for embedded professional development, implementation support, questioning strategies, and differentiation tips page-by-page every step of the way.



The **Progressions** highlight the program coherence from grade to grade. Teachers can see what was covered in the previous grade and how it builds to the content they are teaching. They can also see further connections and applications in the next grade.

In the Progressions Through the Chapter, the standards are called out for every section along with guidance on where students should be tracking on their conceptual development.

**Progressions Through the Grades**

Grade 5	Grade 6	Grade 7
<ul style="list-style-type: none"> <li>Multiply and divide decimals.</li> <li>Convert standard measurement units within a measurement system.</li> </ul>	<ul style="list-style-type: none"> <li>Understand ratios and describe ratio relationships.</li> <li>Understand unit rates and rates.</li> <li>Use ratio and rate reasoning to solve real-world and mathematical problems.</li> <li>Compare ratios using tables.</li> <li>Solve unit rate problems.</li> <li>Use ratio reasoning to convert measurement units.</li> </ul>	<ul style="list-style-type: none"> <li>Find unit rates associated with ratios of fractions, areas, and other quantities in like or different units.</li> <li>Decide whether two quantities are proportional using ratio tables and graphs.</li> <li>Represent proportional relationships with equations.</li> </ul>

**Progressions Through the Chapter**

Standard	3.1	3.2	3.3	3.4	3.5	3.6
Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.	•	•	•	•	•	•
Understand the concept of a unit rate $\frac{a}{b}$ associated with a ratio $a : b$ with $b \neq 0$ , and use ratio language in the context of a ratio relationship.						•
Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.	•	•	•	•	•	•
Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.			•	•	•	•
Solve unit rate problems including those involving unit pricing and constant speed.						•
Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.						•

**Key**  
 • = preparing    • = complete  
 ◦ = learning    ◻ = extending

The table identifies each standard as "Preparing," "Learning," "Complete," and "Extending" for each lesson.

**Laurie's Notes**

**Preparing to Teach**

- Students are familiar with comparing measurable attributes using language such as *longer than*, *less than*, *heavier than*, and so on.
- A **ratio** is a comparison of two quantities, and there is language and notation associated with ratios.
- Represent the **value of the ratio**  $a : b$  as the number  $\frac{a}{b}$ . Meaning, the quantity  $a$  is  $\frac{a}{b}$  times  $b$  (also the quantity  $b$  is  $\frac{b}{a}$  times  $a$ ). For example, the ratio 1:3 means 1 is  $\frac{1}{3}$  times 3 (or 3 is  $\frac{3}{1}$  times 1). This sounds like awkward language and unnecessarily complicated, however, when interpreting ratios and using ratios to solve problems, this is the type of reasoning students often have to use.

**Motivate**

- Ask for two volunteers. Hand 3 blocks to Student A and 1 to Student B.
- Ask the other students to describe the relationship between the numbers of blocks. Student A has 2 more blocks (additive relationship) or 3 times as many blocks (multiplicative relationship).
- Hand each student 1 more block. "Describe the relationship now." The additive relationship is still the same but the multiplicative relationship changed.
- Continue to add 1 block and ask about the relationships. You want students to realize that the relationship is never 3 to 1 again.
- You will revisit this scenario in the Closure.

**Exploration 1**

- State the learning target and success criteria for this section, and then relate these to the Motivate activity.
- Although the language and notation of ratios will likely be revealed in the Motivate, remind students that they should always read introductory text and directions. The definition of a ratio is provided before Exploration 1.
- Model with Mathematics:** Remind students that they can use a table to organize the possible numbers of girls and boys in the science class.
- Part (b) is not asking students to compare actual numbers, just relative quantities. Can students make a valid statement?
- Construct Visible Arguments and Critique the Reasoning of Others:** When discussing part (b), focus on student reasoning. Solicit several comments. Ask other students if they agree with explanations offered. "Student B, do you agree with what Student A said? Why?"

**Exploration 2**

- Expect students to read the problem and work with a partner or group. You are listening to conversations, not teaching the problem.
- Common Misconception:** Students may believe that if you add or subtract the same quantity to each number in a ratio, it is still the same relationship.
- Students may not have the language of **equivalent ratios**, yet it seems logical to double or triple the recipe. Record student answers so that you may reference these answers when discussing equivalent ratios.

Laurie's Notes offer guidance for building proficiency of the mathematical processes and proficiencies.

# Differentiation

## Embedded Differentiation

The Teaching Edition, along with the program's print and digital resources, offers support for all levels of learners.

The comprehensive guidance for scaffolding instruction in the Teaching Edition was thoughtfully written with both students and teachers in mind.

Throughout every Lesson, Laurie's Notes provide point-of-use differentiation for emerging, proficient, and advanced learners. The modification suggestions relate directly to the specific content of the exercises.

**Laurie's Notes**

**Scaffolding Instruction**

- Students explore how to use a ratio to describe the relationship between two quantities. They were also introduced to the concept of **equivalent ratios**.
- Emerging:** Additional practice for writing and interpreting ratios is given in Examples 1 and 2. Students should recognize that ratio relationships can be part-to-part, part-to-whole, or whole-to-part. Help students make sense of the definition for value of a ratio.
- Proficient:** If students are confident in writing and interpreting ratios that are part-to-part, part-to-whole, and whole-to-part, they can self-assess with Try It Exercises 1-3 and continue independently with Example 3.
- In Example 4, guided instruction may be needed for all students.

**Key Idea**

- In discussing the Key Idea, solicit examples of part-to-part, part-to-whole, and whole-to-part comparisons.
- Explain that phrases for each, for every, and per indicate that you are comparing two quantities. This is ratio language.
- When discussing the second and third examples, be sure to note that the ratio  $a:b$  is not the same as the ratio  $b:a$ . In comparing two unequal quantities, there are two ways of writing the ratio.
- Note that although fractional representation is not introduced at this time, students may use the connection.

**Extra Example 1**

You have the marbles shown.



- Write the ratio of green marbles to red marbles. 4 to 4, or 4:4
- Write the ratio of blue marbles to green marbles. 4 to 4, or 4:4
- Write the ratio of red marbles to the total number of marbles. 4 to 12, or 1:3

**Try It**

- 3 to 6, or 3:6
- 7 to 16, or 7:16

T-108

## Print and Digital Resources to meet the needs of all Learners

The new middle school series offers options and resources to curate a unique instructional experience. There are a variety of opportunities for reteaching, extra practice, enrichment, and extension in the Teaching Edition, online, and in printed resources.

**Common Errors**

**Concepts, Skills, & Problem Solving**

**Mini-Assessment**

In a pet shop, there are 12 dogs, 9 cats, and 17 fish. Write the ratio.

- cats to dogs: 9 to 12, or 3:4
- fish:
- 4:7
- 12:4
- fish to cats:

**Section Resources**

Surface Level	Deep Level
<b>Resources by Chapter</b> <ul style="list-style-type: none"> <li>Extra Practice</li> <li>Reteach</li> <li>Puzzle Time</li> </ul> <b>Student Journal</b> <ul style="list-style-type: none"> <li>Self-Assessment</li> <li>Practice</li> </ul> <b>Differentiating the Lesson</b> Tutorial Videos Skills Review Handbook Skills Trainer	<b>Resources by Chapter</b> <ul style="list-style-type: none"> <li>Enrichment and Extension</li> <li>Graphic Organizers</li> <li>Dynamic Assessment System</li> <li>Section Practice</li> </ul>

T-114



The Math Tools provide an array of virtual manipulatives for modeling lessons or for students to work out solutions while practicing in their Dynamic Student Edition.

**Teaching Strategy** boxes highlight teaching methods, such as using manipulatives, to help reach all learners.

**Teaching Strategy**

Manipulatives help students develop a visual understanding of various mathematical concepts. You can use different colors of linking cubes, counters, or square tiles to represent quantities. A visual representation is helpful for students when making comparisons or drawing conclusions about quantities. In most cases, the order in which the objects are referenced matters.

For example, if the ratio of apples to blueberries is 1:3, you can use 1 red and 3 blue tiles to represent the ratio.



From the same model, students will see the ratio of blueberries to apples is 3:1.

**Extra Example 2**

- The ratio of rock songs to pop songs in your music collection is 1:7. Find and interpret the value of the ratio. The number of rock songs is  $\frac{1}{8}$  times the number of pop songs.
- In your friend's music collection, the number of rock songs is 3 times the number of pop songs. Write the ratio of rock songs to pop songs. 3:1

**Try It**

- 5: The number of adult elephants is 5 times the number of baby elephants.

T-109

## ELL Support

The ELL support boxes are located throughout the Teaching Edition. These are quick, point-of-use notes to help teachers differentiate instruction for ELL students.

Some of the ELL notes even have differentiated levels of support to provide the most effective suggestions for these students.

### ELL Support

Explain that a sanctuary is a place where animals are helped and protected. They can live freely there, without harm from hunters. Have ELLs work in pairs to visually model the ratio by drawing squares to represent adult elephants and circles to represent baby elephants.

**Beginner:** Draw 5 squares and 1 circle. They will then state the value of the ratio as 5.

**Intermediate:** State the value of the ratio and verbally explain that the number of adult elephants is 5 times the number of baby elephants.

**Advanced:** State the value of the ratio and provide a written explanation that the number of adult elephants is 5 times the number of baby elephants.

The Section Resources in the Teaching Edition highlight resources for supporting all students in their transfer from surface- to deep-level understanding.

## School to Home Connections

The Resources by Chapter include Family Letters in English, Spanish, and other languages to support practice and homework exercises.

Name \_\_\_\_\_

**Chapter 3 Ratios and Rates**

Dear Family,

Sports and games provide an opportunity to relax and have fun with our families and friends. The spirit of competition gives us an opportunity to explore mathematics at the same time.

When we are competing, we are often thinking about how we are doing. Are we hitting the ball as well as we did last year? Are we running faster now than at the beginning of the season? Are we currently winning, or is our opponent winning? Even if we are only watching a game, many of us tend to obsess over our favorite players and team's performance.

Spend some time with your student talking about your family's favorite sport or game. What kinds of "stats" are kept about the players and events? How does that help you understand the game? For example, one of your student might talk about the following:

- How are batting averages figured out in baseball and softball? What does that tell you about the next time your favorite player is at bat?
- What does the ratio of red pieces to black pieces tell you about how a game of checkers is going? What strategy?
- How fast can you race a 300-meter sprint? Do you think you could run the same speed in the 300-meter or the 400-meter?

Next time your team is playing their big rival, ask your student how he or she could predict who will win. Do you think it matters more what each team's average score is, or what the win-loss ratio is for the team? What kind of information could help you decide which team is better?

Enjoy the game!

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 Big Ideas Math: Modeling Real Life Grade 6  
 Resources by Chapter

You have the marbles shown.



- Write the ratio of green marbles to red marbles.
- Write the ratio of blue marbles to green marbles.
- Write the ratio of red marbles to the total number of marbles.

7 red marbles, 4 green marbles, and 1 blue marble.

View this video with Spanish audio.

Extra Examples also include Lesson Tutorial Videos with English and Spanish audio to support students inside and outside the classroom.

# Assessment

The middle school program offers a variety of opportunities for both formative and summative assessment. Options include:

- Self-Assessments
- Prerequisite Skills Practice
- Pre-Course and Post-Course Test
- Quizzes
- Chapter Tests
- Alternative Assessments
- STEAM Performance Tasks
- Quarterly Benchmark Tests
- Online Assessments (see Technology page)

Student ownership and accountability for learning is a vital component of fluency with both the content and practice standards.

**Self-Assessment** opportunities appear throughout instruction for Concepts & Skills and Problem Solving.

Every Chapter offers a **Chapter Self-Assessment** for students to evaluate their understanding of the learning targets and their performance perception related to the success criteria. Laurie's Notes provide guidance for supporting all learners' success on the Self-Assessment.

**EXAMPLE 3 Determining Whether Ratios Are Equivalent**  
Determine whether the ratios are equivalent.  
a. 4:3 and 20:15  
b. 5:7 and 10:21  
**Try It** Determine whether the ratios are equivalent.  
4. 1:1 and 6:6    5. 1:2 and 3:4    6. 8:3 and 6:16

**Self-Assessment for Concepts & Skills**  
Solve each exercise. Then rate your understanding of the success criteria in your journal.

**WRITING AND INTERPRETING RATIOS** Write the ratio. Then find and interpret the value of the ratio.  
7. sharks to dolphins    8. dolphins to animals

**IDENTIFYING EQUIVALENT RATIOS** Determine whether the ratios are equivalent. Explain your reasoning.  
9. 2:3 and 24:36    10. 5:7 and 20:28

**12. DIFFERENT WORDS, SAME QUESTION** Which "best" answer?  
What kind of relationship is 2 peaches to 5 peaches?  
What kind of relationship is 2 peaches to 10 peaches?  
What kind of relationship is 2 peaches to 5 peaches?  
What kind of relationship is 2 peaches to 10 peaches?

**Laurie's Notes**  
**EXAMPLE 3**  
Determine whether the ratios are equivalent.  
a. 4:3 and 20:15  
b. 5:7 and 10:21  
**Try It**  
Determine whether the ratios are equivalent.  
4. 1:1 and 6:6    5. 1:2 and 3:4    6. 8:3 and 6:16

**Self-Assessment for Concepts & Skills**  
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The **Chapter Tests** and **Quizzes** are opportunities for students to demonstrate understanding. The problems include questions that extend concepts.

**Chapter 1 Quiz**  
1. List the factor pairs of 48.  
2. Write the prime factorization of 120.  
3. Find the GCF of 36 and 48.  
4. Find the LCM of 6 and 12.  
5. You have two strands of 100 beads each. One strand is red and the other is blue. How many beads are there in total?  
6. You are filling bags with 18 chocolate chip cookies each. You have 108 cookies. How many bags can you fill?  
7. What is the greatest perfect square that is a factor of 144?  
8. You are filling plates for your friend's birthday party. You have 12 ketchup, 18 mayo, and 24 ketchup. You want identical groups of gifts in each plate with an equal number of each. What is the greatest number of plates you can fill?  
9. Stephanie A changes color every 47 seconds and Stephanie B changes color every 60 seconds. Both sightlights changed color 60 seconds ago. After how many seconds will the sightlights change color at the same time again?  
10. A tank in the shape of a cube with edge lengths of 1 foot. Find the number of cubic feet of water needed to fill the tank. Then find the number of cubic yards of water needed to fill the tank.

**Chapter 1 Test A**  
11. A square vegetable garden has side lengths of 8 feet. You plant flowers in the center portion of the garden, a square that has side lengths of 4 feet. You divide the remaining space into 4 equal sections and plant tomatoes, onions, cucumbers, and peppers. What is the area of the onion section?  
12. What is the greatest perfect square that is a factor of 144?  
13. You are filling plates for your friend's birthday party. You have 12 ketchup, 18 mayo, and 24 ketchup. You want identical groups of gifts in each plate with an equal number of each. What is the greatest number of plates you can fill?  
14. Stephanie A changes color every 47 seconds and Stephanie B changes color every 60 seconds. Both sightlights changed color 60 seconds ago. After how many seconds will the sightlights change color at the same time again?  
15. A tank in the shape of a cube with edge lengths of 1 foot. Find the number of cubic feet of water needed to fill the tank. Then find the number of cubic yards of water needed to fill the tank.

Grade 6 Quiz

Grade 6 Chapter Test

The **STEAM Performance Task** activity provides students the opportunity to demonstrate their understanding of the chapter learning targets. It aligns with the Performance Task Preview from the beginning of the chapter and the Performance Task reference on the Connecting Concepts page.

**Chapter 3 Performance Task**  
**Oops! Unit Conversion Mistakes**  
Why is accuracy in unit conversions important? In what types of situations can mistakes in unit conversions cause problems?  
1. A patient is scheduled to receive 750 milliliters of blood over the course of 4.5 hours. There are 15 drops in 1 milliliter. The nurse is supposed to find the correct rate, in drops per minute, of the transfusion so that the patient's circulatory system is not over- or under-loaded. The nurse makes the following calculation.  
$$\frac{750 \text{ mL} \times 15 \text{ drops}}{4.5 \text{ h} \times 60 \text{ min}} = \frac{11250 \text{ drops}}{270 \text{ min}} = 41.67 \text{ drops/min}$$
  
The nurse made one very dangerous mistake. What is it? Find the correct rate.  
2. In July 1963, an Air Canada flight took off from Montreal. After one hour, the plane ran out of fuel and had to make an emergency landing. Before the flight, the aircraft personnel determined that the plane needed 22,300 total kilograms of fuel for the flight and that there was currently 7642 liters of fuel in the tank. They determined that the plane would need 4917 more liters of fuel by performing the following calculations.  
$$\text{Weight of fuel in the tank: } 7642 \text{ L} \times 1.77 \frac{\text{kg}}{\text{L}} = 13,597 \text{ kg}$$
  
$$\text{Weight of fuel to be added: } 22,300 \text{ kg} - 13,597 \text{ kg} = 8703 \text{ kg}$$
  
$$\text{Volume of fuel to be added: } \frac{8703 \text{ kg}}{1.77 \frac{\text{kg}}{\text{L}}} = 4917 \text{ L}$$
  
What did they do wrong? Find the correct amount (in liters) of fuel to be added. (1 kg = 2.2 lb)

Grade 6 STEAM Performance Task

High-stakes assessments require a deeper level of conceptual understanding. **Explorations** provide students with multiple opportunities to develop their conceptual understanding.

**3.1 Ratios**  
**Learning Target:** Understand the concepts of ratios and equivalent ratios.  
**Success Criteria:**  
• I can write and interpret ratios using appropriate notation and language.  
• I can recognize multiplicative relationships in ratios.  
• I can describe how to determine whether ratios are equivalent.  
• I can name ratios equivalent to a given ratio.  
**EXPLORATION 1 Writing Ratios**  
**Work with a partner.** A science class has two times as many girls as it has boys.  
a. Discuss possible numbers of boys and girls in the science class.  
b. What comparisons can you make between your class and the science class? Can you determine which class has more girls? more boys? Explain your reasoning.  
c. Write three ratios that you observe in your classroom. Describe what each ratio represents.  
**EXPLORATION 2 Using Ratios in a Recipe**  
**Work with a partner.** The ratio of iced tea to lemonade in a recipe is 3:1. You begin by combining 3 cups of iced tea with 1 cup of lemonade.  
$$\frac{3 \text{ cups iced tea}}{1 \text{ cup lemonade}}$$
  
a. You add 1 cup of iced tea and 1 cup of lemonade to the mixture. Does this change the taste of the mixture?  
b. Describe how you can make larger amounts without changing the taste.

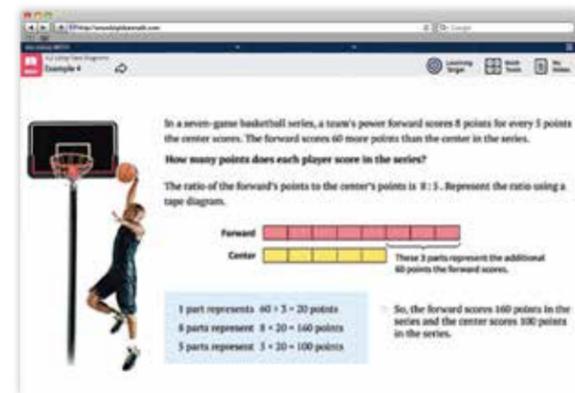
**3 Connecting Concepts**  
**Using the Problem-Solving Plan**  
1. You mix water, glue, and borax in the ratio of 3:1:2 to make slime. How many gallons of each ingredient should you use to make 0.75 gallon of slime?  
**Understand the problem.** You know the ratio of the ingredients in the slime and that you are making 0.75 gallon of slime. You also need to find the number of gallons of each ingredient needed to make 0.75 gallon of slime.  
**Make a plan.** Represent the ratio 3:1:2 using a tape diagram. Because there are 6 parts that represent 0.75 gallons, divide 0.75 by 6 to find the value of one part to find the number of gallons of each ingredient you should use.  
**Solve and check.** Use the plan to solve the problem. Then check your solution.  
2. You buy yogurt cups and frozen fruit bars for a party. Yogurt cups are sold in packages of six. The ratio of the number of yogurt cups in a package to the number of frozen fruit bars in a package is 3:2. What are the least numbers of packages you should buy in order to have the same numbers of yogurt cups and frozen fruit bars?  
3. The greatest common factor of two whole numbers is 9. The ratio of the greater number to the lesser number is 6:5. What are the two numbers? Justify your answer.  
**Performance Task** **Oops! Unit Conversion Mistakes**  
At the beginning of this chapter, you watched a STEAM Video called "Human Circulatory System." You are now ready to complete the performance task related to this video, available at [BigIdeasMath.com](http://BigIdeasMath.com). Be sure to use the problem-solving plan as you work through the performance task.

# Technology

**Big Ideas Math: Modeling Real Life** comes with an innovative and dependable technology package that supports and enhances instruction for teachers and students.

## Dynamic Student Edition

The Dynamic Student Edition is a complete, interactive version of the Student Edition. Students have access to interactive explorations, digital examples, virtual manipulatives, Lesson Tutorial Videos, and digital exercises from the textbook.

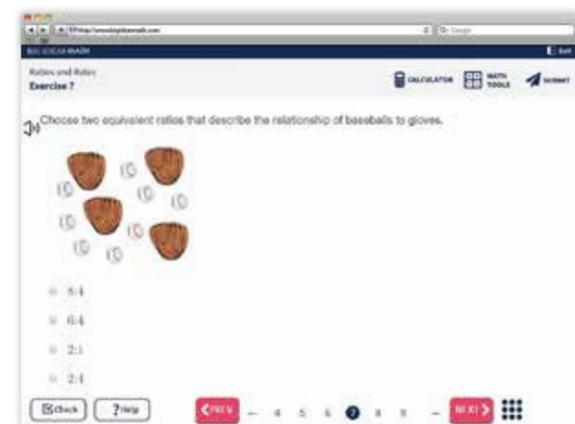


## Dynamic Assessment System

With the Dynamic Assessment System, teachers can create customizable homework and assessments with *Big Ideas Math* question banks or items they create!

Question types include a variety of technology-enhanced items, such as drag and drop, graphing, point plotting, multiple select, multiple choice, and more.

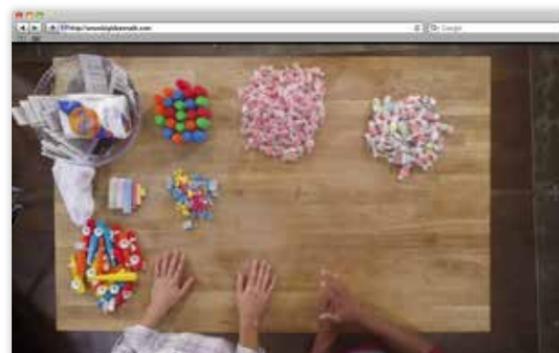
Students complete the assignments online and can receive immediate feedback on their progress. The reports in this system provide the feedback teachers need to drive instruction.



## STEAM Videos

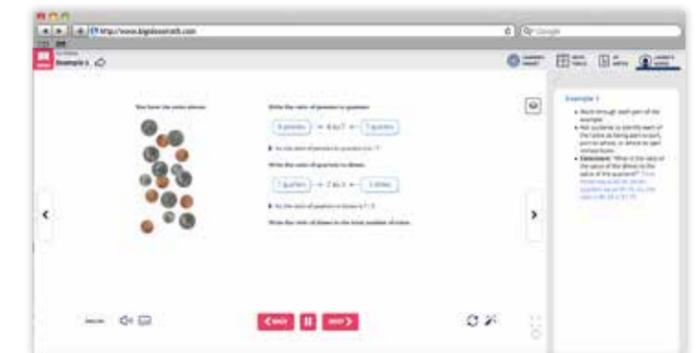
STEAM Videos allow students to see mathematics in real life.

They also come with corresponding Performance Tasks to make further connections to the mathematical content. Students learn about DNA, the carbon atom, natural disasters, and more!



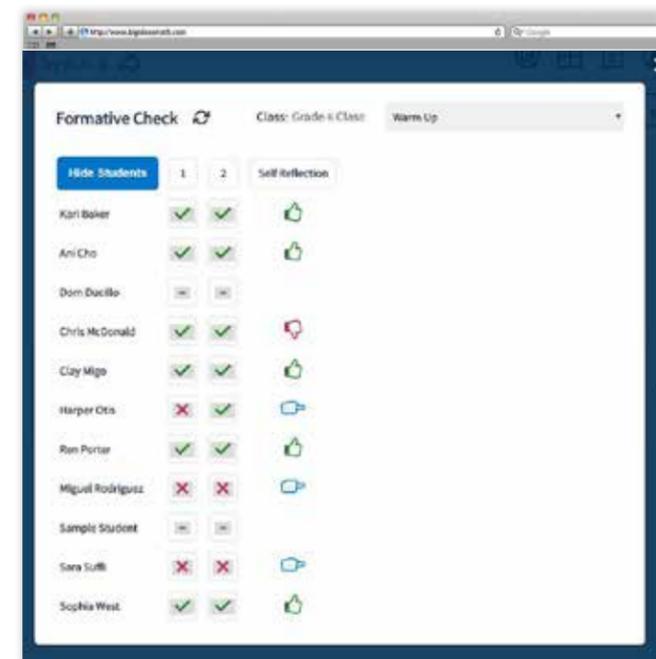
## Dynamic Classroom

The Dynamic Classroom mimics the students' Dynamic Student Edition, with additional resources and support for teachers. Interactive explorations and examples from the textbook create a 21st-century classroom atmosphere that engages students. Point-of-use Laurie's Notes guide instruction with motivation suggestions, teaching tips, questions to ask the students, closure strategies, and more!



## Formative Check

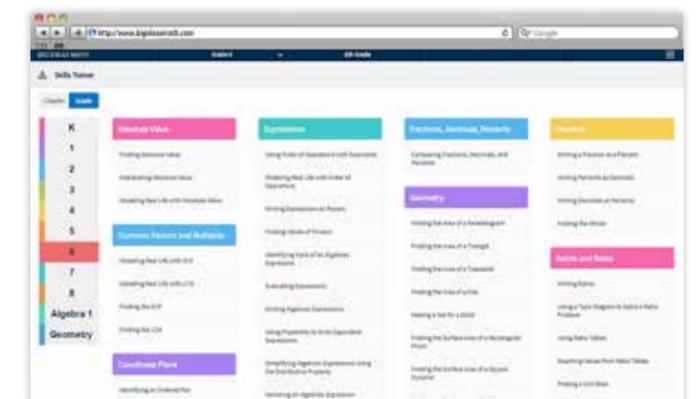
The Formative Check provides teachers with immediate feedback on student progress, making it easy to differentiate and provide support where it is needed the most.



## Skills Trainer

The Skills Trainer is an online interactive tool for skill practice that comes with detailed reports for teachers to gain insight into each student's proficiency. Students have access to every skill found within the *Modeling Real Life* series, as well as skills from Algebra 1 and Geometry.

The Skills Trainer can be used to engage students in remediation or as the daily warm-up for the lessons!



## Components

### PRINT RESOURCES

#### Student Edition

#### Teaching Edition

#### Student Journal

#### Resources by Chapter

- Family Letter
- Warm-Ups
- Extra Practice
- Reteach
- Enrichment and Extension
- Puzzle Time

#### Assessment Book

- Prerequisite Skills Practice
- Pre-Course Test
- Quizzes
- Chapter Tests
- Alternative Assessments
- STEAM Performance Tasks
- Course Benchmark Tests
- Post-Course Test

#### Skills Review Handbook

#### Rich Math Tasks

### TECHNOLOGY RESOURCES

#### Dynamic Student Edition

Includes access to Student Edition and Student Journal online, as well as:

- Virtual Manipulatives
- Interactive Explorations
- Digital Examples
- Lesson Tutorial Videos

#### Dynamic Classroom

Includes access to the Teaching Edition, as well as:

- Laurie's Notes
- Virtual Manipulatives
- Interactive Explorations
- Digital Examples
- Extra Examples
- Formative Check
- Mini-Assessments
- Flip-To

#### Dynamic Teaching Tools

- Answer Presentation Tool
- Skills Trainer
- Digital Flashcards
- STEAM Videos
- Game Library
- Multi-Language Glossary
- Additional Online Resources
  - Lesson Plans
  - Differentiating the Lesson
  - Graphic Organizers
  - Pacing Guides
  - Cross-Curricular Projects
  - Worked-Out Solutions Key
  - Math Tool Paper

#### Dynamic Assessment System

- Customized Practice and Assessments
- Detailed Reports

#### Video Support for Teachers

- Pedagogical Approach Videos
- Concepts and Tools Videos

# Big Ideas Math: Modeling Real Life offers a program that:

## INSPIRES

*Elevate student learning with a balanced approach*

## ENGAGES

*Captivate student learning with innovative technology*

## EMPOWERS

*Make learning visible through student accountability*

## GROWS

*Positively impact student performance in mathematics*

Learn more at [NGL.Cengage.com/BigIdeas](https://www.ngl.cengage.com/BigIdeas)

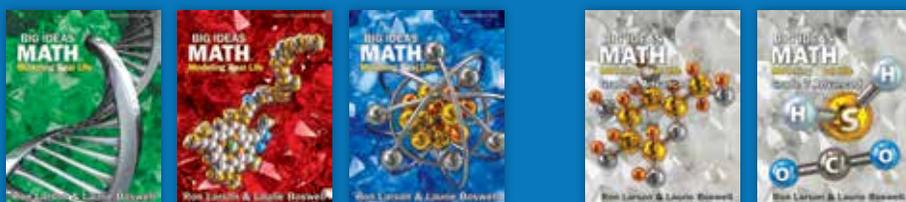
# K-12 Programs

*Big Ideas Math* programs offer a seamless articulation from elementary through high school. With a consistent author voice from level to level, students make connections through cohesive progressions and rich instruction.

*Big Ideas Math* uses a balanced approach to engage students' inquiring minds and empower them to become mathematical thinkers in their daily lives.



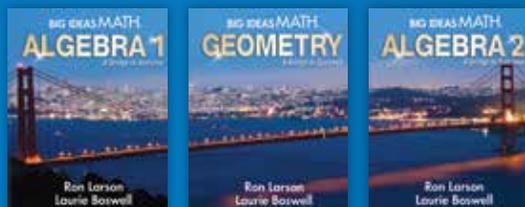
## Big Ideas Math: Modeling Real Life for Grades K-5



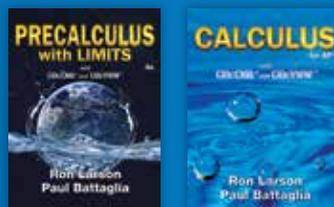
## Big Ideas Math: Modeling Real Life for Grades 6-8

Advanced middle school courses available!

Integrated Mathematics courses also available!



## Grades 9-12



## Precalculus/AP<sup>®</sup> Calculus

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## Learn more!

[NGL.Cengage.com/BigIdeas](https://www.ngl.cengage.com/BigIdeas)

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