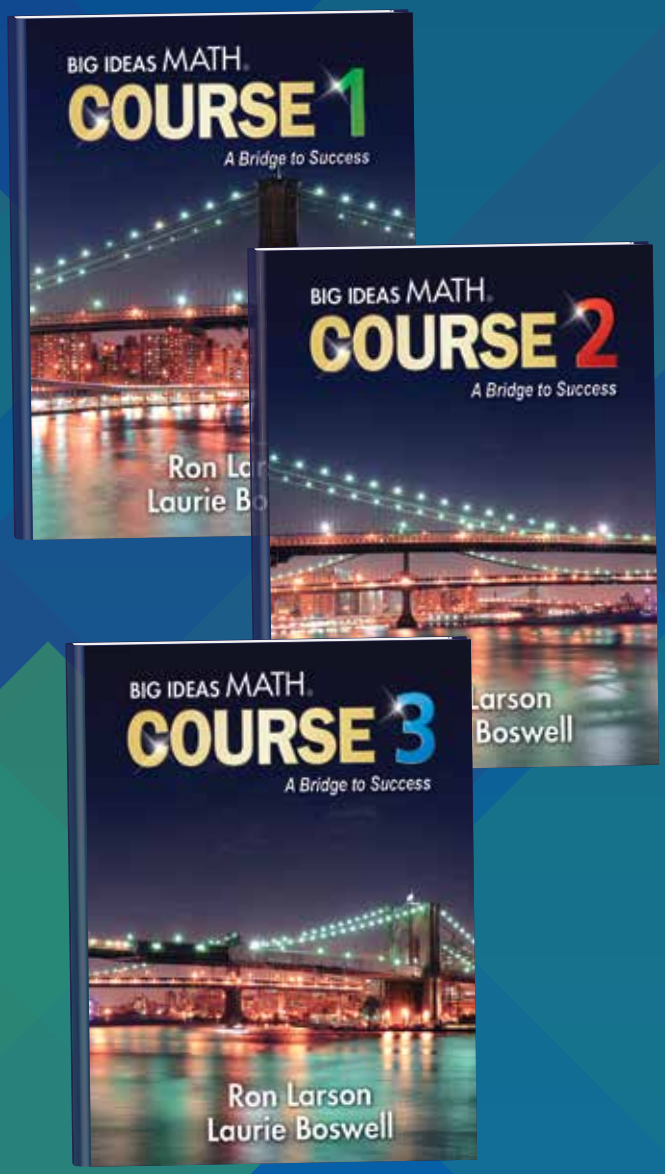
# BIG IDEAS MATH®

## Ron Larson
## Laurie Boswell




BIG IDEAS LEARNING®

**Middle School**

A BRIDGE TO SUCCESS

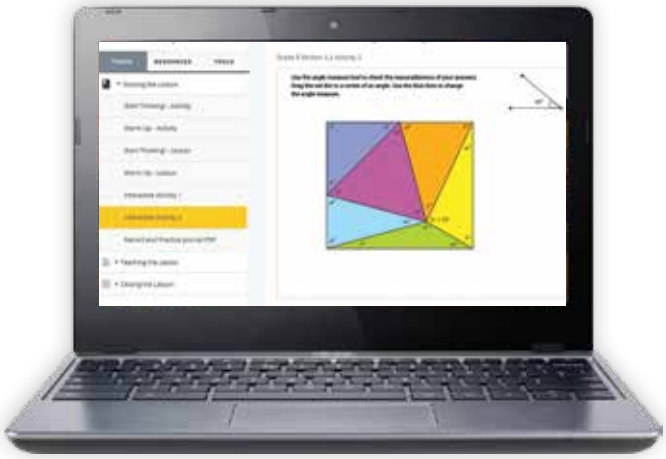
NATIONAL GEOGRAPHIC LEARNING | CENGAGE

# Empower Learning with *Big Ideas Math*

Big Ideas Learning® is pleased to offer a complete middle school program built for student success—***Big Ideas Math®: A Bridge to Success***. Written by Ron Larson and Laurie Boswell, the program was developed using consistent, dependable learning and instructional theory that is research-based.

**Create Confident Learners With:**

- Dynamic Technology for the 21st-Century Classroom
- Complete Support for Teachers in Lesson Planning and Lesson Presentation
- Dynamic Assessment System
- Research-Based Content and Delivery
- Rigorous, Focused, and Coherent Curriculum
- Balanced Approach to Instruction
- Continuous Preparation for High-Stakes Assessment
- Embedded RTI, Differentiated Instruction, and ELL Support



EQUUS QUAGGA

*Plains Zebra*

COVER: Zebras are social animals that spend time in herds. They graze together, primarily on grass, and even groom one another.

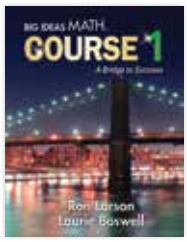
Plains zebras are the most common species. They live in small family groups consisting of a male (stallion), several females, and their young. These units may combine with others to form awe-inspiring herds thousands of head strong, but family members will remain close within the herd.

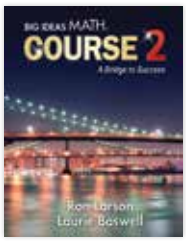
http://www.nationalgeographic.com/animals/mammals/p/plains-zebra/

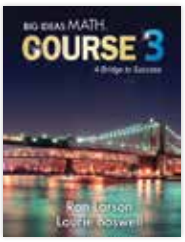
PHOTO CREDIT: jacksonboy58 / iStock by Getty Images

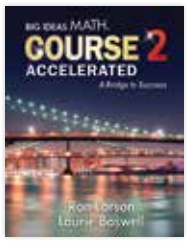
# Expert Authors

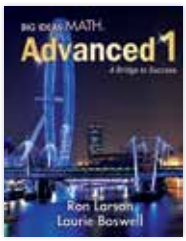
The ***Big Ideas Math*** authors are dedicated to fostering curiosity and confidence in learners.



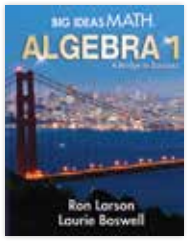








*We created Big Ideas Math because we recognized the need for a truly balanced approach to learning, using discovery learning and scaffolded instruction.*

—Ron Larson, Ph.D.

*Big Ideas Math encourages productive struggle. It's not about being hard. The entire program is accessible for all students.*

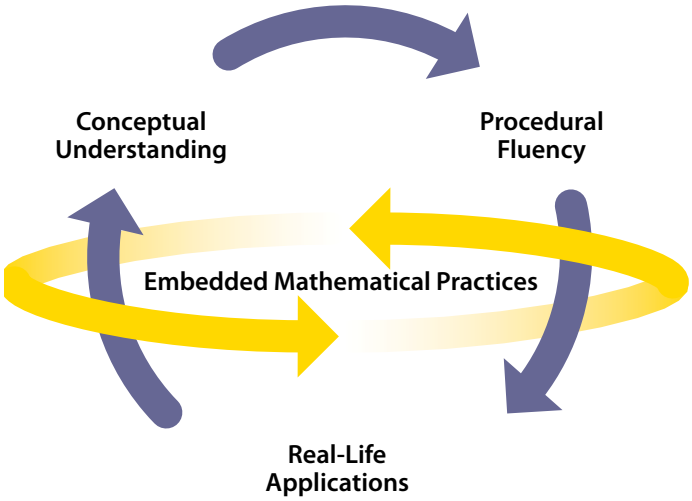
—Laurie Boswell, Ed.D.

Dr. Larson and Dr. Boswell began writing together in 1992. Since that time, they have authored over three dozen textbooks. In their collaboration, Ron is primarily responsible for the Student Edition while Laurie is primarily responsible for the Teaching Edition.

**Ron Larson, Ph.D.,** is well known as the lead author of a comprehensive program for mathematics that spans middle school, high school, 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.

# **Program Philosophy:** Rigor and Balance with Embedded Mathematical Practices

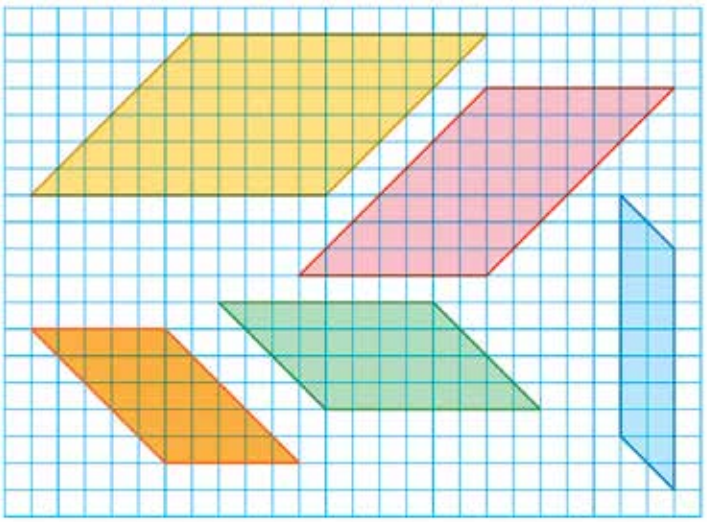



The ***Big Ideas Math*** program balances conceptual understanding with procedural fluency. Real-life applications create connections to content and help turn mathematical learning into an engaging and meaningful way to explore the real world.

Embedded ***Mathematical Practices*** in grade-level content promote a greater understanding of how mathematical concepts are connected to each other and to real-life scenarios.

**2 ACTIVITY: Finding Areas of Parallelograms**

**Work with a partner.**



**Math Practice**

**Use Assumptions**

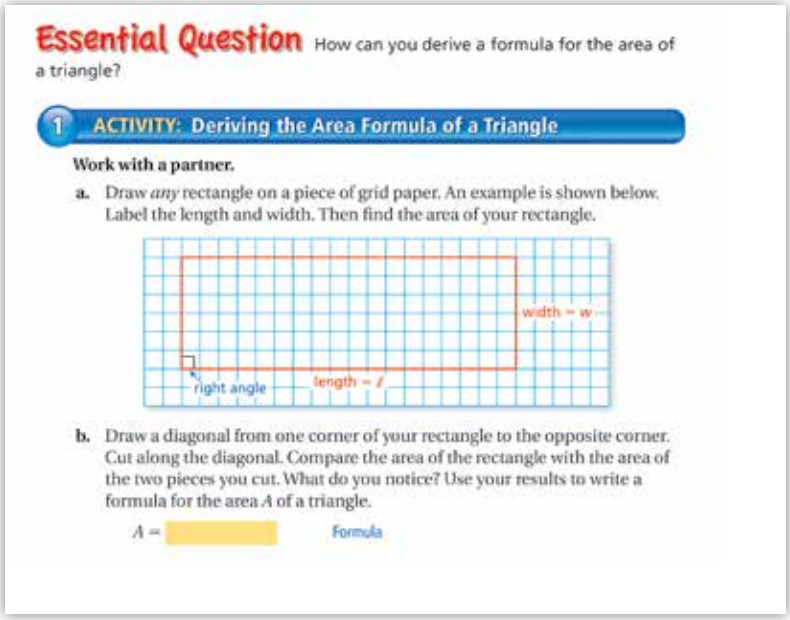
How are rectangles and parallelograms similar? How can you use this information to solve the problem?

**a.** Find the area of each parallelogram by cutting it into two pieces to form a rectangle.

**b.** Use the formula you wrote in Activity 1 to find the area of each parallelogram. Compare your answers to those in part (a).

**c.** Count unit squares for each parallelogram to check your results.

> *In writing the Activities and Explorations, I wanted to provide ALL students with the opportunity to start them with some success.*
>
> —Ron Larson, Ph.D.



**Essential Question** How can you derive a formula for the area of a triangle?

**1 ACTIVITY: Deriving the Area Formula of a Triangle**

**Work with a partner.**

**a.** Draw *any* rectangle on a piece of grid paper. An example is shown below. Label the length and width. Then find the area of your rectangle.

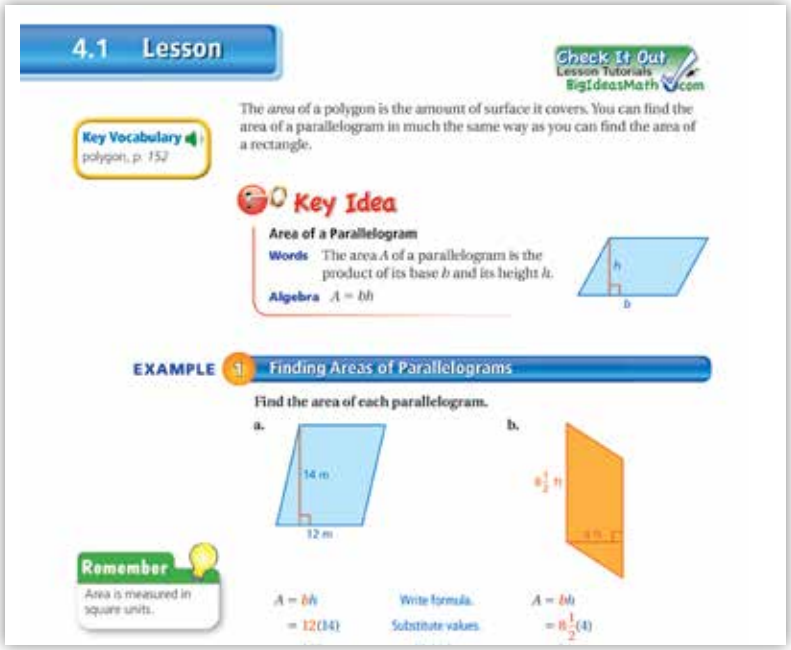


**b.** Draw a diagonal from one corner of your rectangle to the opposite corner. Cut along the diagonal. Compare the area of the rectangle with the area of the two pieces you cut. What do you notice? Use your results to write a formula for the area $A$ of a triangle.

$A =$ ____ Formula

**Conceptual Understanding**

Activities and guiding Essential Questions encourage ***conceptual understanding***.



**4.1 Lesson**

Check It Out
Lesson Tutorials
BigIdeasMath.com

**Key Vocabulary**
polygon, p. 152

The *area* of a polygon is the amount of surface it covers. You can find the area of a parallelogram in much the same way as you can find the area of a rectangle.

**Key Idea**

**Area of a Parallelogram**

**Words** The area $A$ of a parallelogram is the product of its base $b$ and its height $h$.

**Algebra** $A = bh$

**EXAMPLE 1 Finding Areas of Parallelograms**

**Find the area of each parallelogram.**

**a.** 14 m, 12 m

**b.** $8\frac{1}{2}$ ft, 4 ft

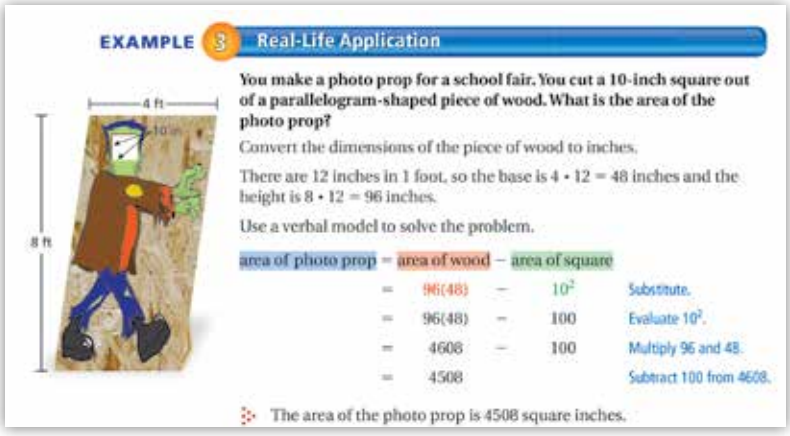
**Remember**
Area is measured in square units.

$A = bh$ Write formula.
$= 12(14)$ Substitute values.

$A = bh$
$= 8\frac{1}{2}(4)$

**Procedural Fluency**

Scaffolded lessons allow for ***procedural fluency*** and provide the opportunity to use clear, precise mathematical language.



**EXAMPLE 3 Real-Life Application**

**You make a photo prop for a school fair. You cut a 10-inch square out of a parallelogram-shaped piece of wood. What is the area of the photo prop?**

4 ft, 10 in, 8 ft

Convert the dimensions of the piece of wood to inches.

There are 12 inches in 1 foot, so the base is $4 \cdot 12 = 48$ inches and the height is $8 \cdot 12 = 96$ inches.

Use a verbal model to solve the problem.

area of photo prop = area of wood − area of square

$= 96(48) - 10^2$ Substitute.
$= 96(48) - 100$ Evaluate $10^2$.
$= 4608 - 100$ Multiply 96 and 48.
$= 4508$ Subtract 100 from 4608.

The area of the photo prop is 4508 square inches.

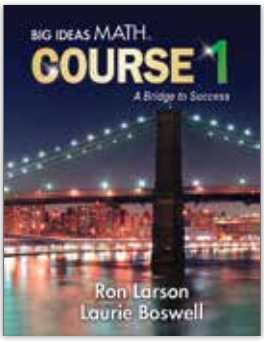
**Real-Life Applications**

***Real-life applications*** provide students with opportunities to create connections between classroom lessons and realistic scenarios.

# Multiple Pathways to Student Success

## The Regular Pathway

prepares students for Algebra 1 in the 9th Grade.



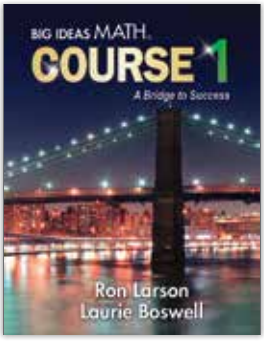

**Course 1**

1. Numerical Expressions and Factors
2. Fractions and Decimals
3. Algebraic Expressions and Properties
4. Areas of Polygons
5. Ratios and Rates
6. Integers and the Coordinate Plane
7. Equations and Inequalities
8. Surface Area and Volume
9. Statistical Measures
10. Data Displays

---

## The Compacted Pathway

prepares accelerated learners for Algebra 1 in their third year of middle school.



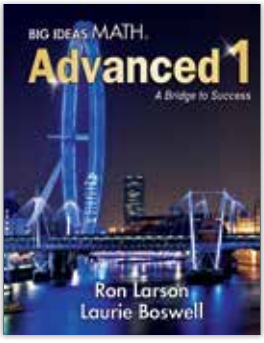

**Course 1**

1. Numerical Expressions and Factors
2. Fractions and Decimals
3. Algebraic Expressions and Properties
4. Areas of Polygons
5. Ratios and Rates
6. Integers and the Coordinate Plane
7. Equations and Inequalities
8. Surface Area and Volume
9. Statistical Measures
10. Data Displays

---

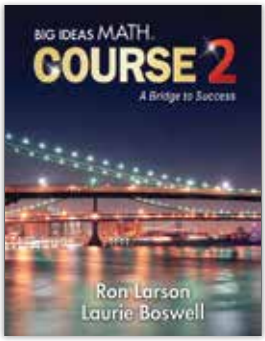
## The Advanced Pathway

allows students to complete the requirements for Grades 6, 7, and 8 in two years and prepares students for high school Algebra 1 in their third year of middle school.



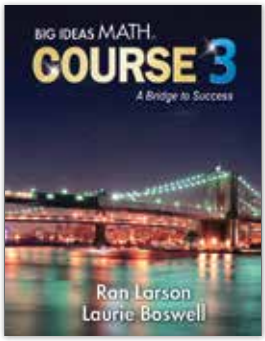

**Advanced 1**

1. Numerical Expressions and Factors
2. Fractions and Decimals
3. Algebraic Expressions and Properties
4. Areas of Polygons
5. Ratios and Rates
6. Integers and the Coordinate Plane
7. Equations and Inequalities
8. Surface Area and Volume
9. Statistical Measures
10. Data Displays
11. Integers
12. Rational Numbers
13. Expressions and Equations
14. Ratios and Proportions
15. Percents




## Course 2

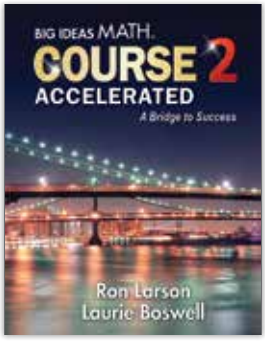
1 Integers
2 Rational Numbers
3 Expressions and Equations
4 Inequalities
5 Ratios and Proportions
6 Percents
7 Constructions and Scale Drawings
8 Circles and Area
9 Surface Area and Volume
10 Probability and Statistics




## Course 3

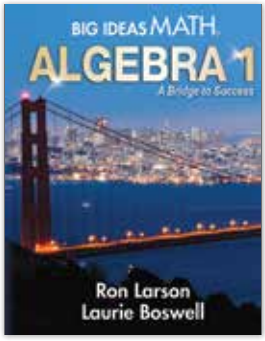
1 Equations
2 Transformations
3 Angles and Triangles
4 Graphing and Writing Linear Equations
5 Systems of Linear Equations
6 Functions
7 Real Numbers and the Pythagorean Theorem
8 Volume and Similar Solids
9 Data Analysis and Displays
10 Exponents and Scientific Notation

---




## Course 2 Accelerated

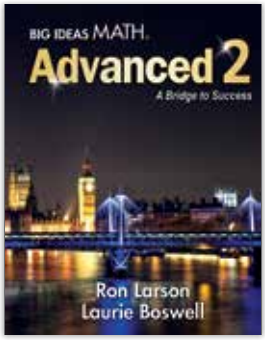
1 Integers
2 Rational Numbers
3 Expressions and Equations
4 Inequalities
5 Ratios and Proportions
6 Percents
7 Constructions and Scale Drawings
8 Circles and Area
9 Surface Area and Volume
10 Probability and Statistics
11 Transformations
12 Angles and Triangles
13 Graphing and Writing Linear Equations
14 Real Numbers and the Pythagorean Theorem
15 Volume and Similar Solids
16 Exponents and Scientific Notation




## Algebra 1

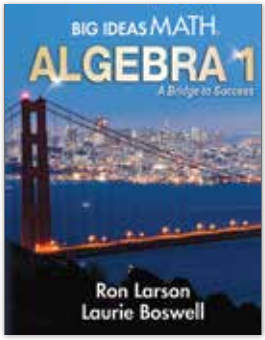
1 Solving Linear Equations
2 Solving Linear Inequalities
3 Graphing Linear Functions
4 Writing Linear Functions
5 Solving Systems of Linear Equations
6 Exponential Functions and Sequences
7 Polynomial Equations and Factoring
8 Graphing Quadratic Functions
9 Solving Quadratic Equations
10 Radical Functions and Equations
11 Data Analysis and Displays

---




## Advanced 2

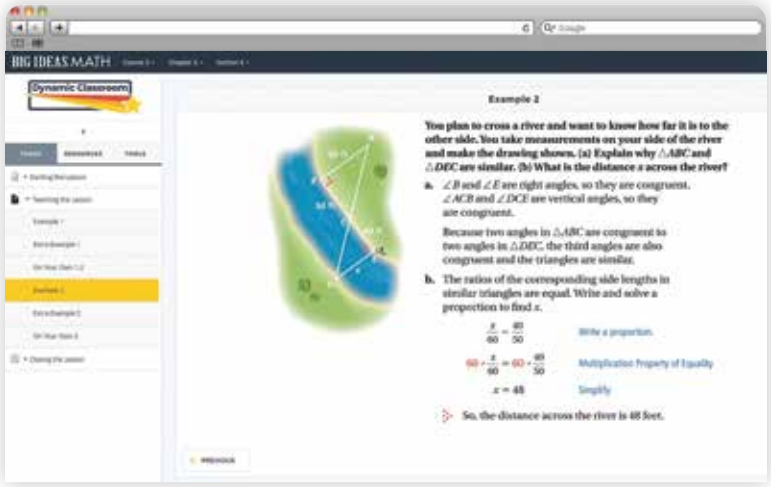
1 Equations
2 Transformations
3 Angles and Triangles
4 Graphing and Writing Linear Equations
5 Systems of Linear Equations
6 Functions
7 Real Numbers and the Pythagorean Theorem
8 Volume and Similar Solids
9 Data Analysis and Displays
10 Exponents and Scientific Notation
11 Inequalities
12 Construction and Scale Drawings
13 Circles and Area
14 Surface Area and Volume
15 Probability and Statistics




## Algebra 1

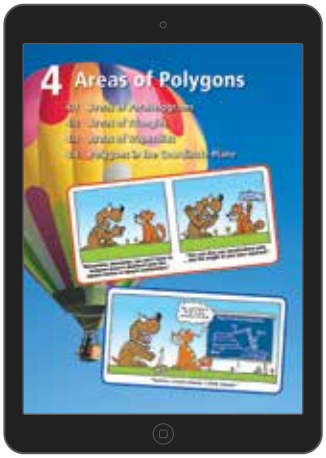
1 Solving Linear Equations
2 Solving Linear Inequalities
3 Graphing Linear Functions
4 Writing Linear Functions
5 Solving Systems of Linear Equations
6 Exponential Functions and Sequences
7 Polynomial Equations and Factoring
8 Graphing Quadratic Functions
9 Solving Quadratic Equations
10 Radical Functions and Equations
11 Data Analysis and Displays

# Ignite Learning with Dynamic Technology




## Dynamic Classroom

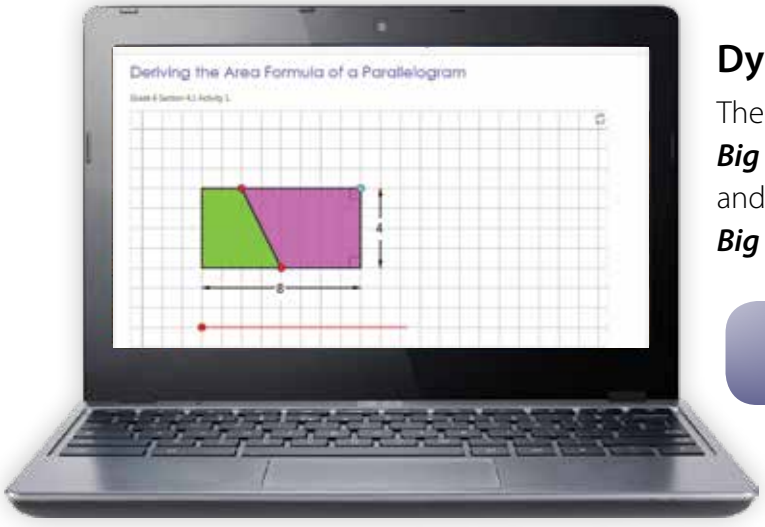
The ***Dynamic Classroom*** is a digital lesson presentation tool built to engage students. Teachers can progress through each lesson from opening to closing with one simple click. The ***Dynamic Classroom*** includes daily lesson resources like the ***Dynamic Investigations*** and ***Record and Practice Journal***, as well as a variety of interactive teaching tools.




## Student Dynamic eBook

The ***Student Dynamic eBook*** is a complete electronic version of the Student Edition that includes interactive digital resources. The eBook allows students to navigate through the textbook, highlight important information, and add notes or bookmarks. While this eBook is available off-line, with a data or internet connection, students can access embedded, digital enhancements.

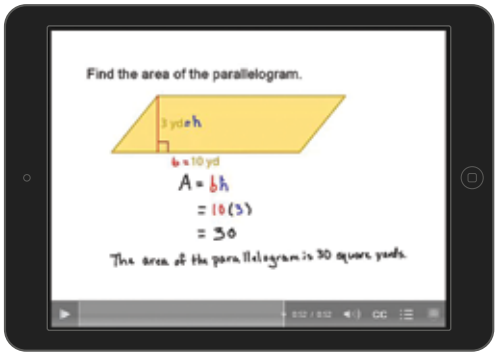
***Audio available in English and Spanish***




## Dynamic Investigations

The ***Dynamic Investigations*** in the ***Big Ideas Math*** program allow students and teachers to interactively complete the ***Big Ideas Math*** activities.

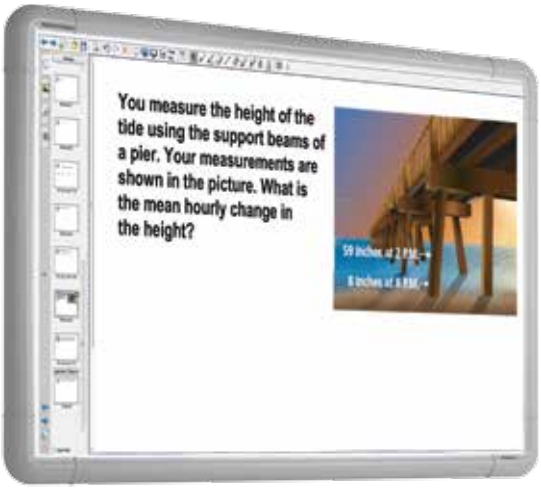
**CREATE CONNECTIONS THROUGH EXPLORATION!**




## Lesson Tutorial Videos

These two- to three-minute lesson tutorials provide colorful visuals and audio support for every example in the textbook. The tutorials are an invaluable resource for students who are absent, who need a second explanation, or who need help with homework.

**ENCOURAGE ALL STUDENTS WITH ENGAGING VISUALS!**




## Dynamic Teaching Tools

These tools feature the ***Interactive Whiteboard Lesson Library***. Teachers can present any ***Big Ideas Math*** lesson from an interactive whiteboard. Standard whiteboard lessons and customizable templates are included.

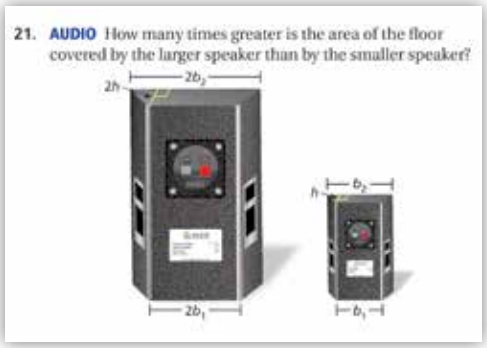
**VISUALLY RICH PRESENTATIONS!**

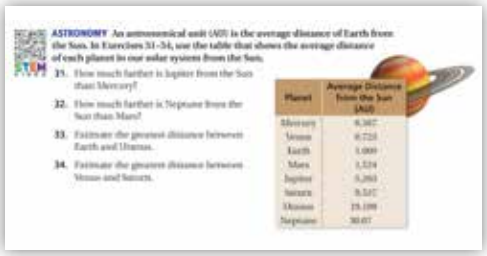
## Dynamic Assessment System

The ***Dynamic Assessment System*** allows teachers to track and evaluate their students' advancement through the curriculum. Developed exclusively for ***Big Ideas Math***, this technology provides teachers and students an intuitive and state-of-the-art tool to help students effectively learn mathematics. The Dynamic Assessment System also includes direct links to Lesson Tutorial Videos and related sections from the textbook. Built for ease of use, the tool is available on a wide range of devices.

# Preparation for the Journey Toward High-Stakes Testing

Each chapter of the ***Big Ideas Math*** program features question types frequently found on standardized tests. The balanced approach to instruction also helps students develop the habits of mind required to be successful on high-stakes tests.


21. **AUDIO** How many times greater is the area of the floor covered by the larger speaker than by the smaller speaker?


**ASTRONOMY** An astronomical unit (AU) is the average distance of Earth from the Sun. In Exercises 31–34, use the table that shows the average distance of each planet in our solar system from the Sun.

| Planet | Average Distance from the Sun (AU) |
|---|---|
| Mercury | 0.387 |
| Venus | 0.723 |
| Earth | 1.000 |
| Mars | 1.524 |
| Jupiter | 5.203 |
| Saturn | 9.537 |
| Uranus | 19.191 |
| Neptune | 30.07 |

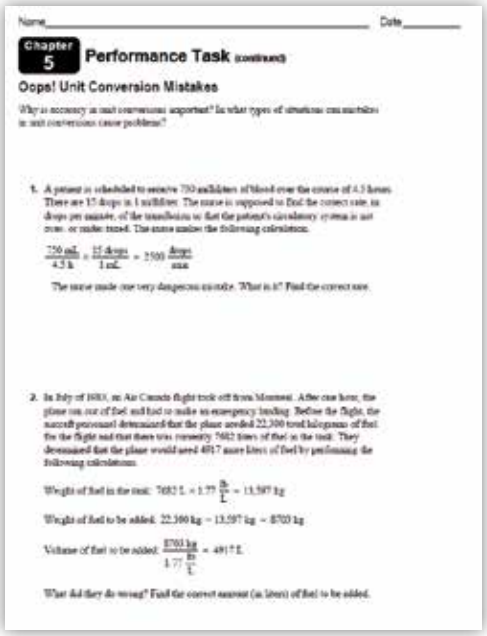
31. How much farther is Jupiter from the Sun than Mercury?
32. How much farther is Neptune from the Sun than Mars?
33. Estimate the greatest distance between Earth and Uranus.
34. Estimate the greatest distance between Venus and Saturn.


56. **PROBLEM SOLVING** You have 6 pints of glaze. It takes $\frac{2}{3}$ of a pint to glaze a bowl and $\frac{3}{10}$ of a pint to glaze a plate.

a. How many bowls could you glaze? How many plates could you glaze?

b. You want to glaze 5 bowls, and then use the rest for plates. How many plates can you glaze? How much glaze will be left over?

c. How many of each object could you glaze so that there is no glaze left over? Explain how you found your answer.


Name _____ Date _____

Chapter 5 **Performance Task** (continued)

**Oops! Unit Conversion Mistakes**

Why is accuracy in unit conversions important? In what types of situations can errors 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-taxed. The nurse makes the following calculations.

$$\frac{750 \text{ mL}}{4.5 \text{ h}} \cdot \frac{15 \text{ drops}}{1 \text{ mL}} = 2500 \frac{\text{drops}}{\text{min}}$$

The nurse made one very dangerous mistake. What is it? Find the correct rate.

2. In July of 1983, 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 7692 liters of fuel in the tank. They determined that the plane would need 4917 more liters of fuel by performing the following calculations.

Weight of fuel in the tank: $7692 \text{ L} \cdot 1.77 \frac{\text{kg}}{\text{L}} = 13{,}597 \text{ kg}$

Weight of fuel to be added: $22{,}300 \text{ kg} - 13{,}597 \text{ kg} = 8703 \text{ kg}$

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.

### Exercises

The Exercises in the ***Big Ideas Math*** program provide students with opportunities to use multiple approaches to solve problems.

### Dynamic Assessment System

This tool allows teachers to provide customizable homework directly related to the ***Big Ideas Math*** program. Assignments are automatically scored and students have access to immediate remediation on homework questions.

### Activities

The Activities that begin each section require students to use higher-level thinking to work through each problem and to explain their reasoning in the solution.

### Cumulative Assessments

Each chapter in the ***Big Ideas Math*** program includes a Cumulative Assessment. The questions in each assessment were carefully chosen to represent problem types and reasoning patterns frequently found on standardized tests.

### Quizzes and Tests

The Quizzes and Tests in the ***Big Ideas Math*** program assess the concepts students learned in each lesson.

### Online Test Practice

Self-grading tests are available in the Student Dynamic eBook, allowing students to receive immediate feedback on their progress.

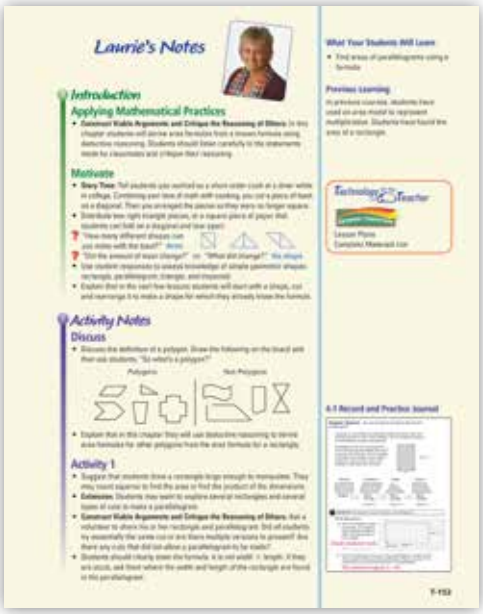
### Performance Tasks

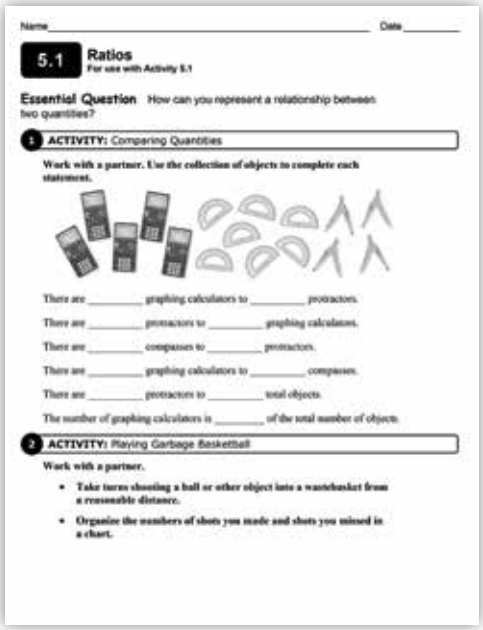
Each chapter of the ***Big Ideas Math*** program contains a Performance Task that correlates to the STEM video of the chapter and allows students to work with multiple objectives. Students can scan the QR Code® in each chapter to be taken directly to the STEM Video and Performance Task.

### Alternative Assessments

Alternative Assessments provide teachers with the opportunity to assess students on the same content in a variety of ways.

# Robust Print Support for All Learners





## Student Edition

The Student Edition was designed using the Universal Design for Learning Guidelines (CAST © 2011) and features carefully chosen images that increase student engagement and enhance the mathematical content.

## Teaching Edition

The Teaching Edition provides teachers with complete support for every ***Big Ideas Math*** lesson. Master educator Laurie Boswell incorporates instructional insights and recommendations in Laurie's Notes.

## Record and Practice Journal *Available in English and Spanish*

- Fair Game Review Worksheets
- Activity Recording Journal
- Practice Worksheets
- Glossary
- Activity Manipulatives

## Resources by Chapter

- Start Thinking!
- Warm Up
- Extra Practice (Practice A and B)
- Enrichment and Extension
- Puzzle Time
- Technology Connection
- Projects with Rubric
- Family and Community Involvement

*Available in English and Spanish*

## Assessment Book

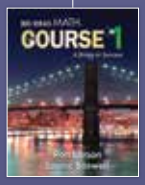
- Quizzes
- Chapter Tests
- Cumulative Assessments with Item Analysis
- Alternative Assessments with Scoring Rubrics
- Pre-Course Test with Item Analysis
- End-of-Course Tests
- Gridded Response Answer Sheet

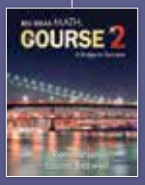
**CONVENIENTLY ACCESS ALL PRINT COMPONENTS ONLINE AT *BIGIDEASMATH.COM*!**

## Count on us for your Larson solutions from Grade 6 through AP®

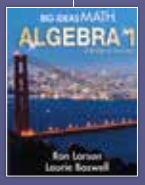
### THE REGULAR PATHWAY

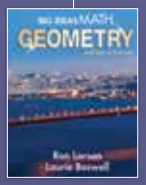
MIDDLE SCHOOL

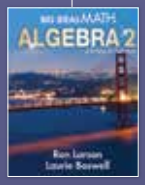




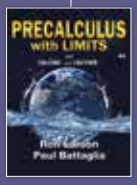

HIGH SCHOOL

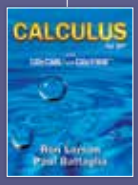






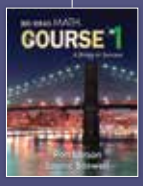

PRECALCULUS/AP® CALCULUS

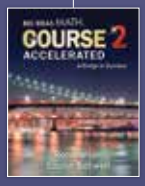


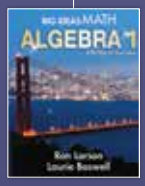



### THE COMPACTED PATHWAY

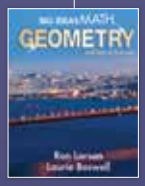
MIDDLE SCHOOL

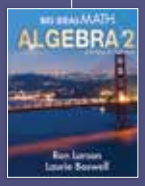




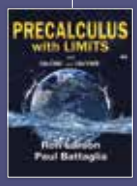


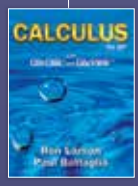

HIGH SCHOOL





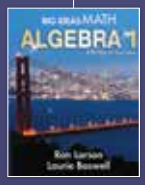

PRECALCULUS/AP® CALCULUS



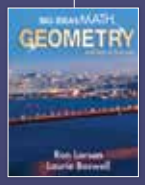


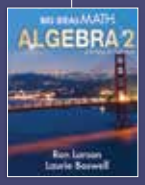

### THE ADVANCED PATHWAY

MIDDLE SCHOOL

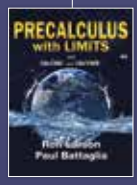


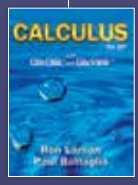

HIGH SCHOOL






PRECALCULUS/AP® CALCULUS






## Learn more!

### NGL.Cengage.com/BigIdeas

- @natgeolearning
- @ExploreInside
- @natgeolearning

### BigIdeasLearning.com

- @BigIdeasLearning
- @BigIdeasMath
- @BigIdeasMath


Visit **NGL.Cengage.com/repfinder** to locate your sales consultant for pricing or ordering information. Or, call 888-915-3276.



NATIONAL GEOGRAPHIC LEARNING | CENGAGE

BIG IDEAS LEARNING®



JUNE/17

ISBN-13: 978-13374-85692
ISBN-10: 13374-85691
90000
9 781337 485692