

BIG IDEAS
MATH[®]
Modeling Real Life

Grade 5

Common Core Edition

Volume 2

Ron Larson
Laurie Boswell



Erie, Pennsylvania
BigIdeasLearning.com



Big Ideas Learning, LLC
1762 Norcross Road
Erie, PA 16510-3838
USA

For product information and customer support, contact Big Ideas Learning at 1-877-552-7766 or visit us at BigIdeasLearning.com.

Cover Image

Valdis Torms, enmyo/Shutterstock.com

Copyright © 2019 by Big Ideas Learning, LLC. All rights reserved.

No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including, but not limited to, photocopying and recording, or by any information storage or retrieval system, without prior written permission of Big Ideas Learning, LLC, unless such copying is expressly permitted by copyright law. Address inquiries to Permissions, Big Ideas Learning, LLC, 1762 Norcross Road, Erie, PA 16510.

Big Ideas Learning and Big Ideas Math are registered trademarks of Larson Texts, Inc.

Common Core State Standards: © Copyright 2010. National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved.

Printed in the U.S.A.

ISBN 13: 978-1-64208-541-9

4 5 6 7 8 9 10—22 21 20

About the Authors



Ron Larson

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.

A handwritten signature of Ron Larson in black ink, written in a cursive style.



Laurie Boswell

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.

A handwritten signature of Laurie Boswell in black ink, written in a cursive style.

Dr. Ron Larson and Dr. Laurie Boswell began writing together in 1992. Since that time, they have authored over four dozen textbooks. This successful collaboration allows for one voice from Kindergarten through Algebra 2.

Contributors, Reviewers, and Research

Big Ideas Learning would like to express our gratitude to the mathematics education and instruction experts who served as our advisory panel, contributing specialists, and reviewers during the writing of *Big Ideas Math: Modeling Real Life*. Their input was an invaluable asset during the development of this program.

Contributing Specialists and Reviewers

- **Sophie Murphy**, Ph.D. Candidate, Melbourne School of Education, Melbourne, Australia
Learning Targets and Success Criteria Specialist and Visible Learning Reviewer
- **Linda Hall**, Mathematics Educational Consultant, Edmond, OK
Advisory Panel
- **Michael McDowell**, Ed.D., Superintendent, Ross, CA
Project-Based Learning Specialist
- **Kelly Byrne**, Math Supervisor and Coordinator of Data Analysis, Downingtown, PA
Advisory Panel
- **Jean Carwin**, Math Specialist/TOSA, Snohomish, WA
Advisory Panel
- **Nancy Siddens**, Independent Language Teaching Consultant, Las Cruces, NM
English Language Learner Specialist
- **Kristen Karbon**, Curriculum and Assessment Coordinator, Troy, MI
Advisory Panel
- **Kery Obradovich**, K–8 Math/Science Coordinator, Northbrook, IL
Advisory Panel
- **Jennifer Rollins**, Math Curriculum Content Specialist, Golden, CO
Advisory Panel
- **Becky Walker**, Ph.D., School Improvement Services Director, Green Bay, WI
Advisory Panel and Content Reviewer
- **Deborah Donovan**, Mathematics Consultant, Lexington, SC
Content Reviewer
- **Tom Muchlinski**, Ph.D., Mathematics Consultant, Plymouth, MN
Content Reviewer and Teaching Edition Contributor
- **Mary Goetz**, Elementary School Teacher, Troy, MI
Content Reviewer
- **Nanci N. Smith**, Ph.D., International Curriculum and Instruction Consultant, Peoria, AZ
Teaching Edition Contributor
- **Robyn Seifert-Decker**, Mathematics Consultant, Grand Haven, MI
Teaching Edition Contributor
- **Bonnie Spence**, Mathematics Education Specialist, Missoula, MT
Teaching Edition Contributor
- **Suzu Gagnon**, Adjunct Instructor, University of New Hampshire, Portsmouth, NH
Teaching Edition Contributor
- **Art Johnson**, Ed.D., Professor of Mathematics Education, Warwick, RI
Teaching Edition Contributor
- **Anthony Smith**, Ph.D., Associate Professor, Associate Dean, University of Washington Bothell, Seattle, WA
Reading and Writing Reviewer
- **Brianna Raygor**, Music Teacher, Fridley, MN
Music Reviewer
- **Nicole Dimich Vagle**, Educator, Author, and Consultant, Hopkins, MN
Assessment Reviewer
- **Janet Graham**, District Math Specialist, Manassas, VA
Response to Intervention and Differentiated Instruction Reviewer
- **Sharon Huber**, Director of Elementary Mathematics, Chesapeake, VA
Universal Design for Learning Reviewer

Student Reviewers

- T.J. Morin
- Alayna Morin
- Ethan Bauer
- Emery Bauer
- Emma Gaeta
- Ryan Gaeta
- Benjamin SanFrotello
- Bailey SanFrotello
- Samantha Grygier
- Robert Grygier IV
- Jacob Grygier
- Jessica Urso
- Ike Patton
- Jake Lobaugh
- Adam Fried
- Caroline Naser
- Charlotte Naser

Research

Ron Larson and Laurie Boswell used the latest in educational research, along with the body of knowledge collected from expert mathematics instructors, to develop the *Modeling Real Life* series. The pedagogical approach used in this program follows the best practices outlined in the most prominent and widely accepted educational research, including:

- *Visible Learning*
John Hattie © 2009
- *Visible Learning for Teachers*
John Hattie © 2012
- *Visible Learning for Mathematics*
John Hattie © 2017
- *Principles to Actions: Ensuring Mathematical Success for All*
NCTM © 2014
- *Adding It Up: Helping Children Learn Mathematics*
National Research Council © 2001
- *Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages and Innovative Teaching*
Jo Boaler © 2015
- *What Works in Schools: Translating Research into Action*
Robert Marzano © 2003
- *Classroom Instruction That Works: Research-Based Strategies for Increasing Student Achievement*
Marzano, Pickering, and Pollock © 2001
- *Principles and Standards for School Mathematics*
NCTM © 2000
- *Rigorous PBL by Design: Three Shifts for Developing Confident and Competent Learners*
Michael McDowell © 2017
- Common Core State Standards for Mathematics
National Governors Association Center for Best Practices and Council of Chief State School Officers © 2010
- *Universal Design for Learning Guidelines*
CAST © 2011
- Rigor/Relevance Framework®
International Center for Leadership in Education
- *Understanding by Design*
Grant Wiggins and Jay McTighe © 2005
- Achieve, ACT, and The College Board
- *Elementary and Middle School Mathematics: Teaching Developmentally*
John A. Van de Walle and Karen S. Karp © 2015
- *Evaluating the Quality of Learning: The SOLO Taxonomy*
John B. Biggs & Kevin F. Collis © 1982
- *Unlocking Formative Assessment: Practical Strategies for Enhancing Students' Learning in the Primary and Intermediate Classroom*
Shirley Clarke, Helen Timperley, and John Hattie © 2004
- *Formative Assessment in the Secondary Classroom*
Shirley Clarke © 2005
- *Improving Student Achievement: A Practical Guide to Assessment for Learning*
Toni Glasson © 2009

Standards for Mathematical Practice



1 Make sense of problems and persevere in solving them.

- Multiple representations are presented to help students move from concrete to representative and into abstract thinking.
- In *Modeling Real Life* examples and exercises, students **MAKE SENSE OF PROBLEMS** using problem-solving strategies, such as drawing a picture, circling knowns, and underlining unknowns. They also use a formal problem-solving plan: understand the problem, make a plan, and solve and check.

2 Reason abstractly and quantitatively.

- Visual problem-solving models help students create a coherent representation of the problem.
- *Explore and Grows* allow students to investigate concepts to understand the **REASONING** behind the rules.
- Exercises encourage students to apply **NUMBER SENSE** and explain and justify their **REASONING**.

3 Construct viable arguments and critique the reasoning of others.

- *Explore and Grows* help students make conjectures, use **LOGIC**, and **CONSTRUCT ARGUMENTS** to support their conjectures.
- Exercises, such as *You Be The Teacher* and *Which One Doesn't Belong?*, provide students the opportunity to **CRITIQUE REASONING**.

4 Model with mathematics.

- Real-life situations are translated into pictures, diagrams, tables, equations, and graphs to help students analyze relations and to draw conclusions.
- Real-life problems are provided to help students apply the mathematics they are learning to everyday life.
- **MODELING REAL LIFE** examples and exercises help students see that math is used across content areas, other disciplines, and in their own experiences.

5 Use appropriate tools strategically.

- Students can use a variety of hands-on manipulatives to solve problems throughout the program.
- A variety of tools, such as number lines and graph paper, manipulatives, and digital tools, are available as students **CHOOSE TOOLS** and consider how to approach a problem.

6 Attend to precision.

- **PRECISION** exercises encourage students to formulate consistent and appropriate reasoning.
- Cooperative learning opportunities support precise communication.

7 Look for and make use of structure.

- *Learning Targets* and *Success Criteria* at the start of each chapter and lesson help students understand what they are going to learn.
- *Explore and Grows* provide students the opportunity to see **PATTERNS** and **STRUCTURE** in mathematics.
- Real-life problems help students use the **STRUCTURE** of mathematics to break down and solve more difficult problems.

8 Look for and express regularity in repeated reasoning.

- Opportunities are provided to help students make generalizations through **REPEATED REASONING**.
- Students are continually encouraged to check for reasonableness in their solutions.

Achieve the Core

Meeting Proficiency

As standards shift to prepare students for college and careers, the importance of focus, coherence, and rigor continues to grow.

FOCUS *Big Ideas Math: Modeling Real Life* emphasizes a narrower and deeper curriculum, ensuring students spend their time on the major topics of each grade.

COHERENCE The program was developed around coherent progressions from Kindergarten through eighth grade, guaranteeing students develop and progress their foundational skills through the grades while maintaining a strong focus on the major topics.

RIGOR *Big Ideas Math: Modeling Real Life* uses a balance of procedural fluency, conceptual understanding, and real-life applications. Students develop conceptual understanding in every *Explore and Grow*, continue that development through the lesson while gaining procedural fluency during the *Think and Grow*, and then tie it all together with *Think and Grow: Modeling Real Life*. Every set of practice problems reflects this balance, giving students the rigorous practice they need to be college- and career-ready.

Major Topics in Grade 5

Number and Operations in Base Ten

- Understand the place value system.
- Perform operations with multi-digit whole numbers and with decimals to hundredths.

Number and Operations—Fractions

- Use equivalent fractions as a strategy to add and subtract fractions.
- Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

Measurement and Data

- Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.

Use the color-coded Table of Contents to determine where the major topics, supporting topics, and additional topics occur throughout the curriculum.

- Major Topic
- Supporting Topic
- Additional Topic



1

Place Value Concepts

	Vocabulary	2
■ 1.1	Place Value Patterns	3
■ 1.2	Place Value with Whole Numbers	9
■ 1.3	Patterns and Powers of 10	15
■ 1.4	Decimals to Thousandths	21
■ 1.5	Place Value with Decimals	27
■ 1.6	Compare Decimals	33
■ 1.7	Round Decimals	39
	Performance Task: Penguins	45
	Game: Place Value Plug In	46
	Chapter Practice	47

2

Numerical Expressions

	Vocabulary	52
■ 2.1	Number Properties	53
■ 2.2	Order of Operations	59
■ 2.3	Write Numerical Expressions	65
■ 2.4	Evaluate Expressions with Grouping Symbols	71
	Performance Task: Atoms	77
	Game: Expression Boss	78
	Chapter Practice	79

- Major Topic
- Supporting Topic
- Additional Topic

3

Add and Subtract Decimals

Vocabulary	82
■ 3.1 Estimate Sums and Differences	83
■ 3.2 Use Models to Add or Subtract Decimals	89
■ 3.3 Add Decimals	95
■ 3.4 Subtract Decimals	101
■ 3.5 Add and Subtract Decimals	107
■ 3.6 Use Mental Math to Add or Subtract Decimals	113
■ 3.7 Problem Solving: Money	119
Performance Task: Rainfall	125
Game: Decimal Dots	126
Chapter Practice	127
Cumulative Practice	131
STEAM Performance Task: Student Store	135

4

Multiply Whole Numbers

Vocabulary	138
■ 4.1 Multiplication Patterns	139
■ 4.2 Estimate Products	145
■ 4.3 Multiply by One-Digit Numbers	151
■ 4.4 Multiply by Two-Digit Numbers	157
■ 4.5 Multiply by Multi-Digit Whole Numbers	163
Performance Task: Grand Coulee Dam	169
Game: Multiplication Adventure	170
Chapter Practice	171

Let's learn how to multiply whole numbers.



5

Multiply Decimals

	Vocabulary	174
■	5.1 Multiplication Patterns with Decimals	175
■	5.2 Estimate Products of Decimals and Whole Numbers	181
■	5.3 Use Models to Multiply Decimals and Whole Numbers	187
■	5.4 Multiply Decimals and Whole Numbers	193
■	5.5 Use Models to Multiply Decimals	199
■	5.6 Use Partial Products to Multiply Decimals	205
■	5.7 Use Strategies to Multiply Decimals	211
■	5.8 Multiply Decimals	217
■	5.9 Problem Solving: Multiply with Money	223
	Performance Task: Corn Plants	229
	Game: Race Around the World: Multiplication	230
	Chapter Practice	231

6

Divide Whole Numbers

	Vocabulary	236
■	6.1 Relate Multiplication and Division	237
■	6.2 Division Patterns	243
■	6.3 Estimate Quotients	249
■	6.4 Divide by One-Digit Numbers	255
■	6.5 Use Partial Quotients to Divide by Two-Digit Numbers	261
■	6.6 Use Partial Quotients with a Remainder	267
■	6.7 Divide Three-Digit Numbers by Two-Digit Numbers	273
■	6.8 Divide Four-Digit Numbers by Two-Digit Numbers	279
■	6.9 Problem Solving: Division	285
	Performance Task: Road Trip	291
	Game: Division Dots	292
	Chapter Practice	293

- Major Topic
- Supporting Topic
- Additional Topic

7

Divide Decimals

Vocabulary	298
■ 7.1 Division Patterns with Decimals	299
■ 7.2 Estimate Decimal Quotients	305
■ 7.3 Use Models to Divide Decimals by Whole Numbers	311
■ 7.4 Divide Decimals by One-Digit Numbers	317
■ 7.5 Divide Decimals by Two-Digit Numbers	323
■ 7.6 Use Models to Divide Decimals	329
■ 7.7 Divide Decimals	335
■ 7.8 Insert Zeros in the Dividend	341
■ 7.9 Problem Solving: Decimal Operations	347
Performance Task: Volunteering	353
Game: Race Around the World: Division	354
Chapter Practice	355
Cumulative Practice	359
STEAM Performance Task: Science Fair	363

Race Around the World: Division

Directions:

1. Players take turns.
2. On your turn, flip a Race Around the World: Division Card and find the quotient.
3. Move your piece to the next number on the board that is highlighted in the quotient.
4. The first player to make it back to North America wins!



8

Add and Subtract Fractions

	Vocabulary	366
■ 8.1	Simplest Form	367
■ 8.2	Estimate Sums and Differences of Fractions	373
■ 8.3	Find Common Denominators	379
■ 8.4	Add Fractions with Unlike Denominators	385
■ 8.5	Subtract Fractions with Unlike Denominators	391
■ 8.6	Add Mixed Numbers	397
■ 8.7	Subtract Mixed Numbers	403
■ 8.8	Problem Solving: Fractions	409
	Performance Task: Washington D.C.	415
	Game: Mixed Number Subtract and Add	416
	Chapter Practice	417

9

Multiply Fractions

	Vocabulary	422
■ 9.1	Multiply Whole Numbers by Fractions	423
■ 9.2	Use Models to Multiply Fractions by Whole Numbers	429
■ 9.3	Multiply Fractions and Whole Numbers	435
■ 9.4	Use Models to Multiply Fractions	441
■ 9.5	Multiply Fractions	447
■ 9.6	Find Areas of Rectangles	453
■ 9.7	Multiply Mixed Numbers	459
■ 9.8	Compare Factors and Products	465
	Performance Task: Rock Formations	471
	Game: Fraction Connection: Multiplication	472
	Chapter Practice	473

- Major Topic
- Supporting Topic
- Additional Topic

10

Divide Fractions

	Vocabulary	478
■ 10.1	Interpret Fractions as Division	479
■ 10.2	Mixed Numbers as Quotients	485
■ 10.3	Divide Whole Numbers by Unit Fractions	491
■ 10.4	Divide Unit Fractions by Whole Numbers	497
■ 10.5	Problem Solving: Fraction Division	503
	Performance Task: Robotics	509
	Game: Fraction Connection: Division	510
	Chapter Practice	511

11

Convert and Display Units of Measure

	Vocabulary	514
■ 11.1	Length in Metric Units	515
■ 11.2	Mass and Capacity in Metric Units	521
■ 11.3	Length in Customary Units	527
■ 11.4	Weight in Customary Units	533
■ 11.5	Capacity in Customary Units	539
■ 11.6	Make and Interpret Line Plots	545
■ 11.7	Problem Solving: Measurement	551
	Performance Task: Airlines	557
	Game: Surround and Capture	558
	Chapter Practice	559
	Cumulative Practice	563
	STEAM Performance Task: Sound Waves	567

Let's learn how to divide fractions!



12

Patterns in the Coordinate Plane

	Vocabulary	570
■ 12.1	Plot Points in a Coordinate Plane	571
■ 12.2	Relate Points in a Coordinate Plane	577
■ 12.3	Draw Polygons in a Coordinate Plane	583
■ 12.4	Graph Data	589
■ 12.5	Make and Interpret Line Graphs	595
■ 12.6	Numerical Patterns	601
■ 12.7	Graph and Analyze Relationships	607
	Performance Task: Animations	613
	Game: Treasure Hunt	614
	Chapter Practice	615

13

Understand Volume

	Vocabulary	620
■ 13.1	Understand the Concept of Volume	621
■ 13.2	Find Volumes of Right Rectangular Prisms	627
■ 13.3	Apply the Volume Formula	633
■ 13.4	Find Unknown Dimensions	639
■ 13.5	Find Volumes of Composite Figures	645
	Performance Task: Elevators	651
	Game: Volume Solve and Connect	652
	Chapter Practice	653

- Major Topic
- Supporting Topic
- Additional Topic

14

Classify Two-Dimensional Shapes

	Vocabulary	658
■ 14.1	Classify Triangles	659
■ 14.2	Classify Quadrilaterals	665
■ 14.3	Relate Quadrilaterals	671
	Performance Task: Solar Panels	677
	Game: Quadrilateral Lineup	678
	Chapter Practice	679
	Cumulative Practice	681
	STEAM Performance Task: Constellations	685
	Glossary	A1
	Index	A9
	Reference Sheet	A25

Quadrilateral Lineup

Directions:

1. Players take turns spinning the spinner.
2. On your turn, cover a quadrilateral that matches your spin.
3. If you land on *Lose a Turn*, then do not cover a quadrilateral.
4. The first player to get four in a row twice, horizontally, vertically, or diagonally, wins!



