BRIDGES GRADE 5 SUPPLEMENT

CCSS Supplement Sets

Activities & Worksheets

Bridges Correlations to Common Core State Standards, Grade 5

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Bridges in Mathematics Grade 5 Supplement
Common Core State Standards Sets

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Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Bridges in Mathematics Grade 5 Supplement

Common Core State Standards Sets

Introduction

The *Bridges Grade Five Supplement* is a collection of activities written to help teachers address the Common Core State Standards published in 2010. These materials are available for free as downloadable files on The Math Learning Center Web site at www.gotomlc.org/ccss. This supplement will continue to be refined and subsequent versions will also be available online at no charge.

The activities included here are designed to be used in place of, or in addition to, selected sessions in *Bridges Grade Five* starting in Unit Three. All of the activities are listed on pages 2–4 in the order in which they appear in the Supplement. They are listed in recommended teaching order on pages 5 & 6. On pages 7–16, you'll also find a set of sheets designed to replace the Planning Guides found at the beginning of Units 3, 5, 6, and 7 in the *Bridges Teacher's Guides*. These sheets show exactly how the Supplement activities fit into the flow of instruction. We suggest you insert these sheets into your *Bridges* guides so you can see at a glance when to teach the Supplement activities through the school year.

The majority of activities and worksheets in this supplement come in sets of three or more, providing several in-depth experiences around a particular grade level expectation or cluster of expectations. Many of the activities will take an hour of instructional time, though some are shorter, requiring 30–45 minutes.

Almost all of the activities are hands-on and require various math manipulatives and/or common classroom supplies. The blacklines needed to make any overheads, game materials, and/or student sheets are included after each activity. Some of the supplement sets in this collection include independent worksheets, designed to be completed by students in class or assigned as homework after related activities. See page 17 for a complete list of materials required to teach the activities in each Supplement set.

Note Fifth grade standards not listed on pages 2–4 are adequately addressed in *Bridges* and/or *Number Corner* sessions. For a full correlation of *Bridges* Grade Five to the Common Core State Standards, see pages i–xii.

Activities & Common Core State Standards

(Activities Listed in Order of Appearance in the Supplement)

SET A4 NUMBER & OPERATIONS: LONG DIVISION		
Page	**Name**	**Common Core State Standards**
A4.1	Activity 1: Introducing the Standard Algorithm	5.NBT 6. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.
A4.11	Activity 2: Extending the Standard Algorithm	

SET A6 NUMBER & OPERATIONS: FRACTION CONCEPTS		
Page	**Name**	**Common Core State Standards**
A6.1	Activity 1: Simplify & Compare	5.NF 1. 1. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.
A6.9	Activity 2: Same-Sized Pieces	
A6.19	Independent Worksheet 1: Using the Greatest Common Factor to Simplify Fractions	
A6.21	Independent Worksheet 2: Finding the Least Common Denominator	
A6.23	Independent Worksheet 3: LCM and GCF	

SET A9 NUMBER & OPERATIONS: MULTIPLYING FRACTIONS		
Page	**Name**	**Common Core State Standards**
A9.1	Activity 1: Geoboard Perimeters	5.NF 2. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators. 5.NF 4b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas. 5.NF 5b. Interpret multiplication as scaling (resizing) by explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number, explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence a/b = (n×a)/(n×b) to the effect of multiplying a/b by 1. 5.NF 6. Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.
A9.11	Activity 2: Fraction Multiplication Story Problems	
A9.19	Activity 3: Using the Area Model for Multiplying Fractions	
A9.25	Activity 4: Generalizations about Multiplying Fractions	
A9.33	Independent Worksheet 1: Picturing Fraction Multiplication	
A9.35	Independent Worksheet 2: More Fraction Multiplication	
A9.37	Independent Worksheet 3: Fraction Stories	

SET A10 NUMBER & OPERATIONS: INTEGERS		
Page	**Name**	**Common Core State Standards**
A10.1	Activity 1: Introducing Integers	5.G 1. Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate). 5.G 2. Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.
A10.13	Activity 2: Integer Tug O' War	
A10.23	Activity 3: Four-Quadrant Battleship	
A10.29	Independent Worksheet 1: Negative & Positive Temperatures	
A10.31	Independent Worksheet 2: Temperature & Elevation Riddles	
A10.33	Independent Worksheet 3: Shapes on a 4-Quadrant Grid	

Activities & Common Core State Standards (cont.)

SET A11 NUMBER & OPERATIONS: MULTIPLYING DECIMALS		
Page	**Name**	**Common Core State Standards**
A11.1	Activity 1: Multiplying by Powers of 10	5.NBT 1. Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left. 5.NBT 2. Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. 5.NBT 4. Use place value understanding to round decimals to any place. 5.NBT 6. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. 5.NBT 7. Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. 5.NF 2. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators. 5.NF 4a. Interpret the product $(a/b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$. 5.NF 4b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas. 5.NF 5a. Interpret multiplication as scaling (resizing) by comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication. 5.NF 6. Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.
A11.7	Activity 2: Dividing by Powers of 10	
A11.15	Activity 3: Using Decimals to Calculate Sale Prices	
A11.21	Activity 4: Multiplying Decimals	
A11.29	Independent Worksheet 1: Thinking about Tenths, Hundredths & Thousandths	
A11.31	Independent Worksheet 2: Very Large and Very Small Numbers in Context	
A11.33	Independent Worksheet 3: Multiplying & Dividing by Powers of Ten	
A11.35	Independent Worksheet 4: Using Landmark Fractions & Percents to Multiply by Decimals	
A11.37	Independent Worksheet 5: Multiplying Two Decimal Numbers	

SET B1 ALGEBRA: DIAGRAMS & SKETCHES		
Page	**Name**	**Common Core State Standards**
B1.1	Activity 1: The Carnival	5.OA 2. Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.
B1.7	Independent Worksheet 1: Padre's Pizza	
B1.11	Independent Worksheet 2: Choosing Equations & Diagrams	

Activities & Common Core State Standards (cont.)

SET C1 GEOMETRY: TRIANGLES & QUADRILATERALS		
Page	**Name**	**Common Core State Standards**
C1.1	Activity 1: Classifying Triangles	5.G 3. Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. 5.G 4. Classify two-dimensional figures in a hierarchy based on properties.
C1.13	Activity 2: Sorting & Classifying Quadrilaterals	
C1.25	Activity 3: Finding the Perimeter and Area of a Parallelogram	
C1.35	Activity 4: Three Mathematical Ideas	
C1.43	Independent Worksheet 1: More Geoboard Triangles	
C1.45	Independent Worksheet 2: Color & Construct Triangles	
C1.47	Independent Worksheet 3: Classifying Quadrilaterals	
C1.51	Independent Worksheet 4: Quad Construction	
C1.53	Independent Worksheet 5: Perimeter & Area Puzzles	
C1.55	Independent Worksheet 6: Ebony's Quilt	

SET D2 MEASUREMENT: VOLUME		
Page	**Name**	**Common Core State Standards**
D2.1	Activity 1: Introducing Volume	5.MD 3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement. 5.MD 4. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. 5.MD 5. Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.
D2.7	Activity 2: More Paper Boxes	
D2.11	Independent Worksheet 1: Volume Review	
D2.15	Independent Worksheet 2: The Camping Trip	

Activities & Recommended Timings

(Activities Listed in Recommended Teaching Order)

REPLACE AND ADD TO SELECTED SESSIONS IN BRIDGES, UNIT 3			
Page	**Set, Strand & Topic**	**Name**	**Recommended Timing**
C1.1	Set C1 Geometry: Triangles & Quadrilaterals	Activity 1: Classifying Triangles	Replaces Unit 3, Session 3
C1.43	Set C1 Geometry: Triangles & Quadrilaterals	Independent Worksheet 1: More Geoboard Triangles	Inserted as homework after Set C1, Activity 1
C1.13	Set C1 Geometry: Triangles & Quadrilaterals	Activity 2: Sorting & Classifying Quadrilaterals	Replaces Unit 3, Session 4
C1.45	Set C1 Geometry: Triangles & Quadrilaterals	Independent Worksheet 2: Color & Construct Triangles	Inserted as homework after Set C1, Activity 2
C1.25	Set C1 Geometry: Triangles & Quadrilaterals	Activity 3: Finding the Perimeter and Area of a Parallelogram	Inserted after Set C1, Activity 2
C1.47	Set C1 Geometry: Triangles & Quadrilaterals	Independent Worksheet 3: Classifying Quadrilaterals	Inserted as homework after Set C1, Activity 3
C1.35	Set C1 Geometry: Triangles & Quadrilaterals	Activity 4: Three Mathematical Ideas	Inserted after Set C1, Activity 3
C1.51	Set C1 Geometry: Triangles & Quadrilaterals	Independent Worksheet 4: Quad Construction	Inserted as homework after Set C1, Activity 4
C1.53	Set C1 Geometry: Triangles & Quadrilaterals	Independent Worksheet 5: Perimeter & Area Puzzles	Inserted as homework after Unit 3, Session 7
C1.55	Set C1 Geometry: Triangles & Quadrilaterals	Independent Worksheet 6: Ebony's Quilt	Inserted as homework after Unit 3, Session 6
D2.1	Set D2 Measurement: Volume	Activity 1: Introducing Volume	Inserted after Session 20 in Unit 3
D2.7	Set D2 Measurement: Volume	Activity 2: More Paper Boxes	Inserted after Set D2, Activity 1
D2.11	Set D2 Measurement: Volume	Independent Worksheet 1: Volume Review	Inserted after Set D2, Activity 2
D2.15	Set D2 Measurement: Volume	Independent Worksheet 1: The Camping Trip	Inserted after Set D2, Activity 2

REPLACE SELECTED SESSIONS IN BRIDGES, UNIT 5			
Page	**Set, Strand & Topic**	**Name**	**Recommended Timing**
A4.1	Set A4 Number & Operations: Long Division	Activity 1: Introducing the Standard Algorithm	Replaces Unit 5, Session 12 (Appears in Unit 5 between Sessions 5 and 6)
A4.11	Set A4 Number & Operations: Long Division	Activity 2: Extending the Standard Algorithm	Replaces Unit 5, Session 13 (Appears in Unit 5 after Set A4, Activity 1)

REPLACE AND ADD TO SELECTED SESSIONS IN BRIDGES, UNIT 6			
Page	**Set, Strand & Topic**	**Name**	**Recommended Timing**
A6.1	Set A6 Number & Operations: Fraction Concepts	Activity 1: Simplify & Compare	Replaces Unit 6, Session 3
A6.19	Set A6 Number & Operations: Fraction Concepts	Independent Worksheet 1: Using the GCF to Simplify Fractions	Inserted as homework after Set A6, Activity 1
A6.9	Set A6 Number & Operations: Fraction Concepts	Activity 2: Same-Sized Pieces	Replaces Unit 6, Session 4
A6.21	Set A6 Number & Operations: Fraction Concepts	Independent Worksheet 2: Finding the Least Common Denominator	Inserted as homework after Unit 6, Session 5
A6.23	Set A6 Number & Operations: Fraction Concepts	Independent Worksheet 3: LCM and GCF	Inserted as homework after Unit 6, Session 7
A9.1	Set A9 Number & Operations: Multiplying Fractions	Activity 1: Geoboard Perimeters	Inserted after Unit 6, Session 19

Activities & Recommended Timings (cont.)

REPLACE AND ADD TO SELECTED SESSIONS IN BRIDGES, UNIT 6			
Page	**Set, Strand & Topic**	**Name**	**Recommended Timing**
A9.11	Set A9 Number & Operations: Multiplying Fractions	Activity 2: Fraction Multiplication Story Problems	Inserted after Set A9, Activity 1
A9.19	Set A9 Number & Operations: Multiplying Fractions	Activity 3: Using the Area Model for Multiplying Fractions	Inserted after Set A9, Activity 2
A9.25	Set A9 Number & Operations: Multiplying Fractions	Activity 4: Generalizations about Multiplying Fractions	Inserted after Set A9, Activity 3
A9.33	Set A9 Number & Operations: Multiplying Fractions	Independent Worksheet 1: Picturing Fraction Multiplication	Inserted as homework after Set A9, Activity 3
A11.1	Set A11 Number & Operations: Multiplying Decimals	Activity 1: Multiplying by Powers of 10	Inserted after Set A9, Activity 4
A9.35	Set A9 Number & Operations: Multiplying Fractions	Independent Worksheet 2: More Fraction Multiplication	Inserted as homework after Set A11, Activity 1
A9.37	Set A9 Number & Operations: Multiplying Fractions	Independent Worksheet 3: Fraction Stories	Consider using this sheet to assess students' skills with multiplying fractions.
A11.7	Set A11 Number & Operations: Multiplying Decimals	Activity 2: Dividing by Powers of 10	Inserted after Set A11, Activity 1
A11.29	Set A11 Number & Operations: Multiplying Decimals	Independent Worksheet 1: Thinking about Tenths, Hundredths, and Thousandths	Inserted as homework after Set A11, Activity 2
A11.31	Set A11 Number & Operations: Multiplying Decimals	Independent Worksheet 2: Very Small & Very Large Numbers in Context	Inserted as homework after Set A11, Activity 2
A11.15	Set A11 Number & Operations: Multiplying Decimals	Activity 3: Using Decimals to Calculate Sale Prices	Inserted after Set A11, Activity 2
A11.33	Set A11 Number & Operations: Multiplying Decimals	Independent Worksheet 3: Multiplying & Dividing by Powers of 10	Inserted as homework after Set A11, Activity 3
A11.21	Set A11 Number & Operations: Multiplying Decimals	Activity 4: Multiplying Decimals	Inserted after Set A11, Activity 4
A11.35	Set A11 Number & Operations: Multiplying Decimals	Independent Worksheet 4: Using Landmark Fractions & Percents to Multiply by Decimals	Inserted as homework after Set A11, Activity 4
A11.37	Set A11 Number & Operations: Multiplying Decimals	Independent Worksheet 5: Multiplying Two Decimal Numbers	Consider using this sheet to assess students' skills with multiplying decimals.

REPLACE AND ADD TO SELECTED SESSIONS IN BRIDGES, UNIT 7			
Page	**Set, Strand & Topic**	**Name**	**Recommended Timing**
A10.1	Set A10 Number & Operations: Integers	Activity 1: Introducing Integers	Inserted between Sessions 3 & 4 in U7
A10.29	Set A10 Number & Operations: Integers	Independent Worksheet 1: Negative & Positive Temperatures	Inserted as homework after Set A10, Activity 1
A10.13	Set A10 Number & Operations: Integers	Activity 2: Integer Tug O' War	Inserted after Set A10, Activity 1
A10.31	Set A10 Number & Operations: Integers	Independent Worksheet 2: Temperature & Elevation Riddles	Inserted as homework after Set A10, Activity 2
A10.23	Set A10 Number & Operations: Integers	Activity 3: Four-Quadrant Battleship	Inserted after Set A10, Activity 2
A10.33	Set A10 Number & Operations: Integers	Independent Worksheet 3: Shapes on a 4-Quadrant Grid	Inserted as homework after Set A10, Activity 3
B1.1	Set B1 Algebra: Diagrams & Equations	Activity 1: The Carnival	Replaces Unit 7, Session 15
B1.7	Set B1 Algebra: Diagrams & Equations	Independent Worksheet 1: Padre's Pizza	Inserted as homework after Set B1, Activity 1
B1.11	Set B1 Algebra: Diagrams & Equations	Independent Worksheet 2: Choosing Equations & Diagrams	Inserted as homework after Unit 5, Session 16

Unit Three Planner (Bridges & CCSS Grade 5 Supplement Sets C1 & D2)

SESSION 1	SESSION 2	SESSION 5	SUPPLEMENT	SUPPLEMENT
Problems & Investigations Which Is Bigger? **Work Sample**	**Problems & Investigations** Dividing a Rectangle **Home Connection 22** Shape Puzzles **Note**: Sessions 3 & 4 have been omitted to make room for Supplement activities.	**Assessment** Unit Three Pre-Assessment	**Supplement Set C1 Geometry: Triangles & Quadrilaterals** Activity 1: Classifying Triangles **Home Connection Supp Set C1 Independent Worksheet 1:** More Geoboard Triangles	**Supplement Set C1 Geometry: Triangles & Quadrilaterals** Activity 2: Sorting & Classifying Quadrilaterals **Home Connection Supp Set C1 Independent Worksheet 2:** Color & Construct Triangles
SUPPLEMENT	**SUPPLEMENT**	**SESSION 6**	**SESSION 7**	**SESSION 8**
Supplement Set C1 Geometry: Triangles & Quadrilaterals Activity 3: Finding the Perimeter and Area of a Parallelogram **Home Connection Supp Set C1 Independent Worksheet 3:** Classifying Quadrilaterals	**Supplement Set C1 Geometry: Triangles & Quadrilaterals** Activity 4: Three Mathematical Ideas **Home Connection Supp Set C1 Independent Worksheet 4:** Quad Construction	**Problems & Investigations** Pattern Block Angles **Home Connection 24** Thinking about Quadrilaterals	**Problems & Investigations** Angle Measures Triangles & Quadrilaterals **Home Connection Supp Set C1 Independent Worksheet 5:** Perimeter & Area Puzzles	**Problems & Investigations** *Sir Cumference and the Great Knight of Angleland* **Home Connection 25** Finding Angle Measures
SESSION 9	**SESSION 10**	**SESSION 11**	**SESSION 12**	**SESSION 13**
Problems & Investigations Angle Measure: From Pattern Blocks to Protractors **Work Sample**	**Problems & Investigations** Parallels, Perpendiculars, and Angles **Home Connection 26** Protractor Practice & Clock Angles	**Problems & Investigations** Congruence **Home Connection Supp Set C1 Ind. Worksheet 6:** Ebony's Quilt	**Problems & Investigations** Symmetry **Work Sample** **Home Connection 27** Reflections, Congruence, and Symmetry	**Problems & Investigations** Guess My Polygon
SESSION 14	**SESSION 16**	**SESSION 17**	**SESSION 18**	**SESSION 19**
Problems & Investigations Writing Polygon Riddles **Home Connection 28** Area Bingo Practice **Note**: Session 15 has been ommitted to make room for Supplement activities.	**Work Places** 3A Area Bingo 3B Polygon Riddles **Work Sample**	**Problems & Investigations** Similarity **Home Connection 29** Drawing Similar Figures	**Problems & Investigations** Building 3–Dimensional Figures	**Problems & Investigations** Similar Solids **Work Sample** **Home Connection 30** Net Picks
SESSION 20	**SUPPLEMENT**	**SUPPLEMENT**	**SUPPLEMENT**	**SESSION 21**
Problems & Investigations Volume **Work Sample**	**Supplement Set D2 Measurement: Volume** Activity 1: Introducing Volume	**Supplement Set D2 Measurement: Volume** Activity 2: More Paper Boxes	**Supplement Set D2 Measurement: Volume** Ind. Worksheets 1 & 2: Volume Review and The Camping Trip	**Problems & Investigations** Surface Area **Work Sample** **Home Connection 31** Volume & Surface Area
SESSION 22				
Assessment Unit 3 Post-Assessment				

Unit Five Planner (Bridges & CCSS Grade 5 Supp. Set A4)

SESSION 1	SESSION 2	SESSION 3	SESSION 4	SESSION 5
Problems & Investigations Graphing Shirt Colors	**Assessment** Unit Five Pre-Assessment	**Problems & Investigations** Pet Survey **Home Connection 42** Bar & Circle Graphs	**Problems & Investigations** Creating Double Bar Graphs	**Problems & Investigations** More about Names & Double Bar Graphs **Home Connection 43** Presidents' Names
SUPPLEMENT	**SUPPLEMENT**	**SESSION 6**	**SESSION 7**	**SESSION 8**
Supplement Set A4 Number & Operations: Long Division Activity 1: Introducing the Standard Algorithm	**Supplement Set A4 Number & Operations: Long Division** Activity 2: Extending the Standard Algorithm	**Problems & Investigations** What Is Probability?	**Problems & Investigations** The Odd Coin Game	**Problems & Investigations** A Closer Look at the Odd Coin Game **Home Connection 44** Brianna's Routes
SESSION 9	**SESSION 10**	**SESSION 11**	**SESSION 14**	**SESSION 15**
Problems & Investigations Briana's Routes	**Problems & Investigations** Pascal's Triangle **Home Connection 45** Another Spinner Experiment	**Problems & Investigations** The Odd/Even Dice Game **Work Sample** **Note** Sessions 12 & 13 have been omitted to make room for Supplement activities.	**Problems & Investigations** Secret Sacks, Part 1 of 2	**Problems & Investigations** Secret Sacks, Part 2 of 2 **Note** Sessions 16–18 have been omitted to make room for Supplement activities.
SESSION 19				
Assessment Unit Five Post-Assessment				

Unit Six Planner (Bridges & CCSS Grade 5 Supplement Sets A6, A9 & A11)

SESSION 1	SESSION 2	SUPPLEMENT	SUPPLEMENT	SESSION 5
Assessment Unit Six Pre-Assessment	**Problems & Investigations** Fractions Are Quotients **Work Sample** **Home Connection 49** Interpreting Remainders	**Supplement Set A6 Number & Operations: Fraction Concepts** Activity 1: Simplify & Compare **Home Connection Supp Set A6 Ind. Worksheet 1:** Using the Greatest Common Factor to Simplify Fractions	**Supplement Set A6 Number & Operations: Fraction Concepts** Activity 2: Same-Sized Pieces **Home Connection 50** Equivalent Fractions on a Clock	**Problems & Investigations** Adding & Subtracting Fractions, Part 1 of 2 **Home Connection Supp Set A6 Ind. Worksheet 2:** Finding the Least Common Denominator
SESSION 6	**SESSION 7**	**SESSION 8**	**SESSION 9**	**SESSION 10**
Problems & Investigations Adding & Subtracting Fractions, Part 2 of 2 **Work Sample** **Home Connection 51** The Smaller the Better Fraction Game	**Work Places** 6A Spin, Add & Compare Fractions **Home Connection Supp Set A6 Ind. Worksheet 3:** LCM and GCF	**Problems & Investigations** Shifting into Decimals: The Great Wall of Base Ten **Home Connection 52** Cafeteria Problems	**Problems & Investigations** Modeling, Reading & Comparing Decimals	**Problems & Investigations** Fractions, Money, Decimals & Division **Home Connection 53** Modeling, Reading & Comparing Decimals
SESSION 11	**SESSION 12**	**SESSION 13**	**SESSION 14**	**SESSION 15**
Problems & Investigations Thousandths and Ten Thousandths **Home Connection 54** More Decimal Work	**Problems & Investigations** Decimal & Fraction Equivalencies	**Problems & Investigations** Decimals on a Number Line **Home Connection 55** Decimal Sense & Nonsense	**Problems & Investigations** Adding & Subtracting Decimals **Work Sample**	**Problems & Investigations** Modeling Percent **Home Connection 56** Working with Decimals
SESSION 16	**SESSION 17**	**SESSION 18**	**SESSION 19**	**SUPPLEMENT**
Problems & Investigations The Number Line Game	**Work Places** 6B Number Line Game 6C Roll & Compare Decimals 6D Sporting Percentages (Challenge) **Home Connection 57** Finding Percents	**Work Places** Unit 6 Work Places **Home Connection 58** Unit 6 Review	**Assessment** Unit Six Post-Assessment	**Supplement Set A9 Number & Operations: Multiplying Fractions** Activity 1: Geoboard Perimeters

Unit Six Planner (Bridges & CCSS Grade 5 Supplement Sets A6, A9 & A11) (cont.)

SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT	SUPPLEMENT
Supplement Set A9 Number & Operations: Multiplying Fractions Activity 2: Fraction Multiplication Story Problems	**Supplement Set A9 Number & Operations: Multiplying Fractions** Activity 3: Using the Area Model for Multiplying Fractions	**Supplement Set A9 Number & Operations: Multiplying Fractions** Activity 4: Fraction Stories **Home Connection Supp Set A9, Independent Worksheet 1:** Picturing Fraction Multiplication	**Supplement Set A11 Number & Operations: Multiplying Decimals** Activity 1: Multiplying by Powers of 10 **Home Connection Supp Set A9, Independent Worksheet 2:** More Fraction Multiplication **Note** Consider using Supp Set A9, Independent Worksheet 3: Fraction Stories, to assess students' skills with multiplying fractions.	**Supplement Set A11 Number & Operations: Multiplying Decimals** Activity 2: Dividing by Powers of 10 **Home Connection Supp Set A11, Independent Worksheet 1:** Thinking about Tenths, Hundredths & Thousandths and Independent **Worksheet 2:** Very Small & Very Large Numbers in Context
SUPPLEMENT	**SUPPLEMENT**			
Supplement Set A11 Number & Operations: Multiplying Decimals Activity 3: Using Decimals to Calculate Sale Prices **Home Connection Supp Set A11, Independent Worksheet 3:** Multiplying & Dividing by Powers of Ten	**Supplement Set A11 Number & Operations: Multiplying Decimals** Activity 4: Multiplying Decimals **Home Connection Supp Set A11, Independent Worksheet 4:** Using Landmark Fractions & Percents to Multiply by Decimals	**Note** Consider using Supp Set A11, Independent Worksheet 5: Multiplying Two Decimal Numbers, to assess students' skills with multiplying decimals.		

Unit Seven Planner (Bridges & CCSS Grade 5 Supplement Sets A10 & B1)

SESSION 1	SESSION 2	SESSION 3	SUPPLEMENT	SUPPLEMENT
Problems & Investigations The Operations Game **Home Connection 59** The Operations Game	**Problems & Investigations** Exploring Equations	**Assessment** Unit Seven Pre-Assessment **Home Connection 60** Operations, Equations & Puzzles	**Supplement Set A10 Number & Operations: Integers** Activity 1: Introducing Integers **Home Connection Supp Set A10 Ind. Worksheet 1:** Negative & Positive Temperatures	**Supplement Set A10 Number & Operations: Integers** Activity 2: Integer Tug O' War **Home Connection Supp Set A10 Ind. Worksheet 2:** Temperature & Elevation Riddles
SUPPLEMENT	**SESSION 4**	**SESSION 5**	**SESSION 6**	**SESSION 7**
Supplement Set A10 Number & Operations: Integers Activity 3: 4-Quadrant Battleship **Home Connection Supp Set A10 Ind. Worksheet 3:** Shapes on a 4-Quadrant Grid	**Problems & Investigations** A Tale of Two Patterns, part 1 of 2	**Problems & Investigations** A Tale of Two Patterns, part 2 of 2 **Work Sample** **Home Connection 61** More Tile Patterns	**Problems & Investigations** Pattern Posters	**Problems & Investigations** Anthony's Problem **Work Sample**
SESSION 8	**SESSION 9**	**SESSION 10**	**SESSION 11**	**SESSION 12**
Problems & Investigations The King's Chessboard **Work Sample** **Home Connection 62** Thinking About The King's Chessboard	**Problems & Investigations** The Function Machine Game	**Problems & Investigations** Modeling Situations **Home Connection 63** The Function Machine Strikes Again	**Problems & Investigations** Secret Numbers	**Problems & Investigations** More Secret Numbers **Work Sample** **Home Connection 64** The Lemonade Stand
SESSION 13	**SESSION 14**	**SUPPLEMENT**	**SESSION 16**	
Problems & Investigations Solving Problems & Making Posters	**Problems & Investigations** Completing & Sharing Our Posters **Home Connection 65** Picturing Problems	**Supplement Set B1 Algebra: Diagrams & Equations** Activity 1: The Carnival **Home Connection Supp Set B1 Ind. Worksheet 1:** Padre's Pizza	**Assessment** Unit Seven Post-Assessment **Home Connection Supp Set B1 Ind. Worksheet 2:** Choosing Equations & Diagrams	

Grade 5 CCSS Supplement Materials List

MANIPULATIVES	ITEM #	A4	A6	A9	A10	A11	B1	C1	D2
Color Tile (3 sets of 400)*	T400T			√					
Red linear pieces (5 sets)*	LUR36			√	√				
Black linear pieces (1 set)*	LU				√				
Base 10 pieces (class set)*	PGT					√			
Overhead Base 10 pieces*	OH10					√			
Clear geoboards & bands (class set plus 1)*	G15B			√				√	
More/Less cubes (15)*	Not yet assigned		√						
Dice numbered 1–6 and 4–9 (15 of each)*	D45NUM				√				
Blank dice or wood cubes (15)	CW75				√				
Overhead double spinner overlay*	SPOH-TEMP		√						
Transparent spinner overlays (15)*	SPOHS				√				
Game markers*	M400				√				
Rulers that show inches & centimeters (class set)*	RLC		√					√	√
Protractors (class set)*	PRO180							√	
Word Resource Cards*	BWRC								√
Centimeter Cubes (2 buckets of 1,000)*	CW-1CM								√
Student Math Journals*	BSJ				√				√

All manipulatives available from Math Learning Center. Those items marked with an asterisk are included in the Grade 5 Bridges Grade Level Package.

GENERAL MATERIALS (PROVIDED BY THE TEACHER)	A4	A6	A9	A10	A11	B1	C1	D2
Computers/Internet Access					Opt			
Computer projection equipment					Opt			
Overhead or document camera	√	√	√	√	√	√	√	√
Blank overhead transparencies if you are using an overhead projector rather than a doc camera	4	5	10	4	9	4	1	1
8.5" x 11" white copy paper, sheets per student	4	10	7	3	13	9	23	8
8.5" x 11" colored copy paper, sheets per student				2				
8.5" x 11" lined or grid paper, sheets per student	2		3			1		
9" x 12" and 12" x 18" construction paper		√	√					
1 1/2" x 2" sticky notes				√				
3" x 5" index cards (3 per student)							√	
Overhead pens (black, blue, red)	√		√	√			√	
Scissors, class set			√				√	√
Scotch tape (several rolls)							√	√
Regular pencils	√	√	√			√	√	
Colored pencils, crayons, felt markers			√	√				
Counting on Frank, by Rod Clement								Opt

BRIDGES IN MATHEMATICS 5

GRADE 5 SUPPLEMENT

Set A4 Numbers & Operations: Long Divison

Includes

Skills & Concepts

- ★ fluently and accurately divide up to a 4-digit number by 1- and 2-digit divisors accurately using the standard long division algorithm
- ★ estimate quotients to approximate solutions and determine reasonableness of answers in problems involving up to 2-digit divisors
- ★ determine and interpret the mean of a small data set of whole numbers

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P0509

Bridges in Mathematics Grade 5 Supplement
Set A4 Numbers & Operations: Long Division

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P0509

Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set A4 ★ Activity 1

ACTIVITY

Introducing the Standard Algorithm

Overview

Chances are, many of your students are using the strategies taught in Unit Four with pretty good success by now. There are times, however, when the multiplication menu is not the most efficient or effective method to divide one number by another. This activity introduces the standard algorithm for long division as another method.

Skills & Concepts

★ fluently and accurately divide up to a 4-digit number by 1- and 2-digit divisors accurately using the standard long division algorithm

★ estimate quotients to approximate solutions and determine reasonableness of answers in problems involving up to 2-digit divisors

★ determine and interpret the mean of a small data set of whole numbers

You'll need

★ Schools in Two Towns (pages A4.5 and A4.6, run one copy of each sheet on a transparency)

★ More Long Division Problems (page A4.7, run one copy on a transparency)

★ Using the Standard Algorithm for Long Division (pages A4.8 and A4.9, run a class set)

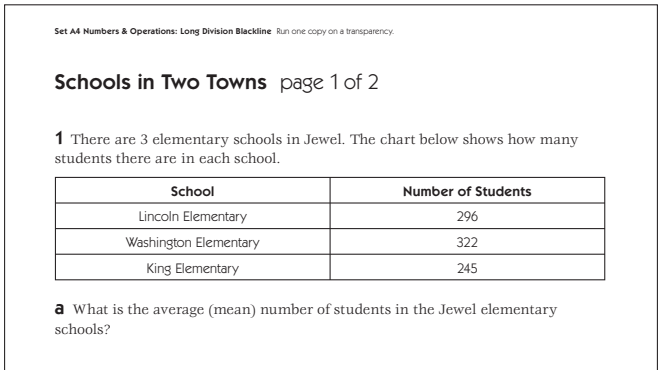
★ a piece of paper to mask parts of the transparency

★ overhead pens

★ Student Math Journals or 1 piece of lined or grid paper per student

Instructions for Introducing the Standard Algorithm

1. Let students know that you are going to introduce a strategy for long division that may be new to some of them, and familiar to others. Place the top portion of the first overhead on display as students get out their journals and pencils.



Set A4 Numbers & Operations: Long Division Blackline Run one copy on a transparency.

Schools in Two Towns page 1 of 2

1 There are 3 elementary schools in Jewel. The chart below shows how many students there are in each school.

School	Number of Students
Lincoln Elementary	296
Washington Elementary	322
King Elementary	245

a What is the average (mean) number of students in the Jewel elementary schools?

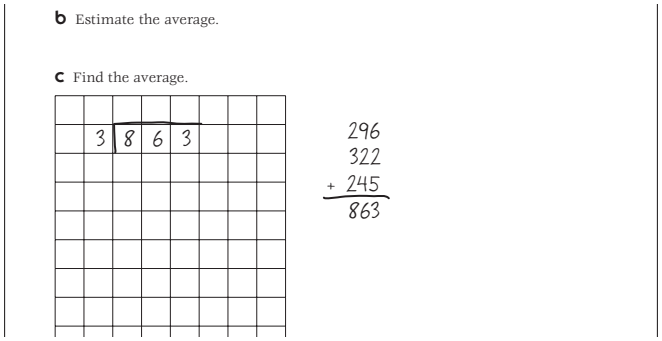
2. Read the information on the overhead with the class. Review the definition of the term *mean*, and ask students to record an estimate in their journals, along with a brief explanation of their thinking. After a minute or two, ask them to pair-share their estimates. Then call on volunteers to share their estimates with the class and explain their thinking.

Activity 1 Introducing the Standard Algorithm (cont.)

Marcus *I said the average is going to be around 280. The first school is almost 300. The second one is more than 300, but the third school is a little less than 250. I think the third school is going to bring the average down to around 280.*

Elisha *I pretty much agree with Marcus, but I think the average is going to be around 275.*

3. Now show the bottom portion of the overhead. Review with students how to find the mean by adding and then dividing. Ask them to add the three numbers in their journals, but go no further for now. Have them raise their hands when they have the total. When most hands are raised, call on a few students to share their answers. When there is general consensus that the total is 863, work with student input to record the division problem on the grid that has been provided.



4. Think with students about how using the multiplication menu would play out for this problem. What if you started with 10 × 3, then 20 × 3, then 5 × 3, as you have so many times in solving long division problems this year. Would this information be useful and helpful? Does it seem as if the multiplication menu would be an effective and efficient strategy for solving this problem? Let students pair-share for a minute about these questions.

5. Then explain that there is another strategy that might be easier in this situation. It is called the "standard algorithm" for long division because it is a common paper-and-pencil method for finding a quotient. When people use this strategy, they work with the numbers in the divisor separately. Tell students you are going to demonstrate the strategy. Ask them to watch closely to see if they can understand what you are doing. Challenge them to watch for some of the differences and likenesses between the standard algorithm and the multiplication menu strategy.

Teacher *First I look at the 8 in 863 and think, "8 divided by 3 is more than 2, just not more than 3, because 2 × 3 is 6, and 3 × 3 is too much." So I write a 2 in the hundreds place. Then I write 6 under the 8 and subtract. That's 2, so I bring down the 6. Now I divide 26 by 3. I get 8 with 2 left over since 8 × 3 is 24. So I write an 8 in the tens place and subtract 24 from 26. Does it look like the average is going to be close to your estimate?*

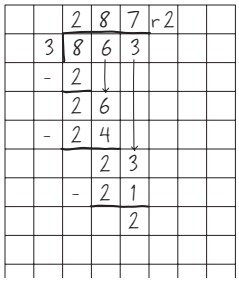
Students *I've seen this way to divide from my sister.*
It looks like it's going to come out to two eighty-something.
I think maybe 275 is a little too low.

6. Continue until the problem is complete. Then discuss the remainder with the students. What does a remainder of 2 mean in this context? Would it make best sense to express the remainder as a whole number, a decimal, or a fraction? Why?

Activity 1 Introducing the Standard Algorithm (cont.)

Students *You can't cut up the 2. These are kids, not cookies!*
If you put exactly the same number of kids in each school, there would be 287 in one school and 288 in the other two.

c Find the average.



296
322
+ 245
863

The average number of students is 287.

The is a remainder of 2. It's kids, so we'll leave the number whole

7. Ask students to compare the answer with their estimates.
- Is 287 with a remainder of 2 a reasonable answer?
- Why or why not?

Invite them to comment on the long division algorithm as well.
- How does it compare with the multiplication menu?
- Do they think this strategy would be equally useful in all contexts?
- Why or why not?

8. After students have had a chance to share their thinking, display the second overhead. Repeat the steps described above, but this time, ask students to work the problem with you in their journals.

Set A4 Numbers & Operations: Long Division Blackline Run one copy on a transparency.

Schools in Two Towns page 2 of 2

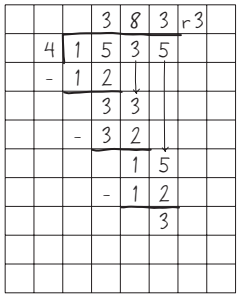
2 There are 4 elementary schools in Emerald. The chart below shows how many students there are in each school.

School	Number of Students
Sarah Goode Elementary	397
Hayes Elementary	423
Carver Elementary	229
Grover Elementary	486

a Do you think that the average number of students in the Emerald schools is greater or less than the average number of students in the Jewel Schools? Why?

b Estimate the average.

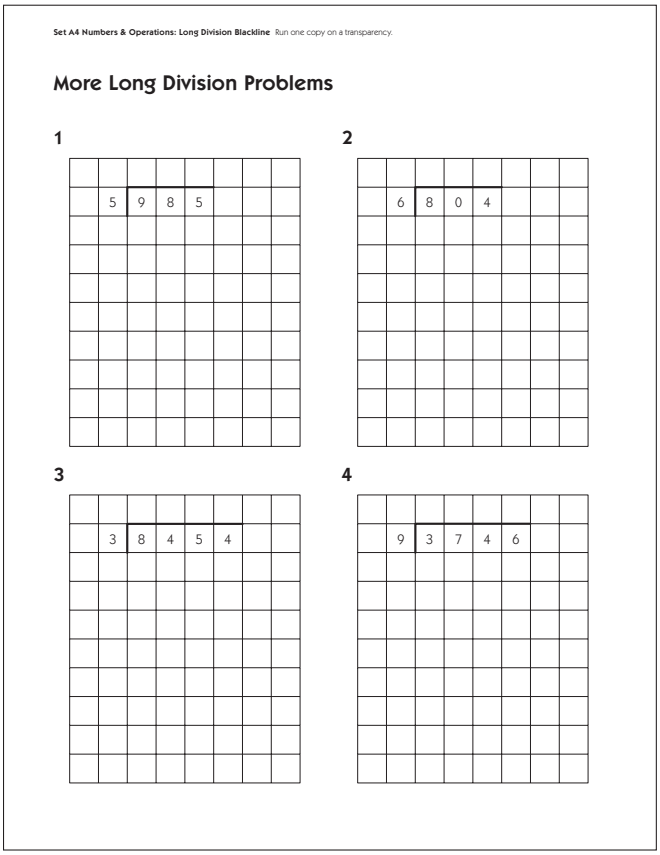
c Find the average.



397
423
229
+ 486
1535

Activity 1 Introducing the Standard Algorithm (cont.)

9. Now display the problems on the More Long Division Problems overhead one at a time. Each time, ask students to generate a word problem to match, and record an estimate in their journals, along with a brief explanation of their thinking. You can also ask them apply what they know about divisibility to predict whether or not there will be a remainder. Have them record each problem in their journals, using the grid lines to help align the numbers correctly, and work it as you do so at the overhead. If some of your students are already very familiar with the algorithm, you might let them take turns leading the class at the overhead.



Set A4 Numbers & Operations: Long Division Blackline Run one copy on a transparency.

More Long Division Problems

1

	5	9	8	5			

2

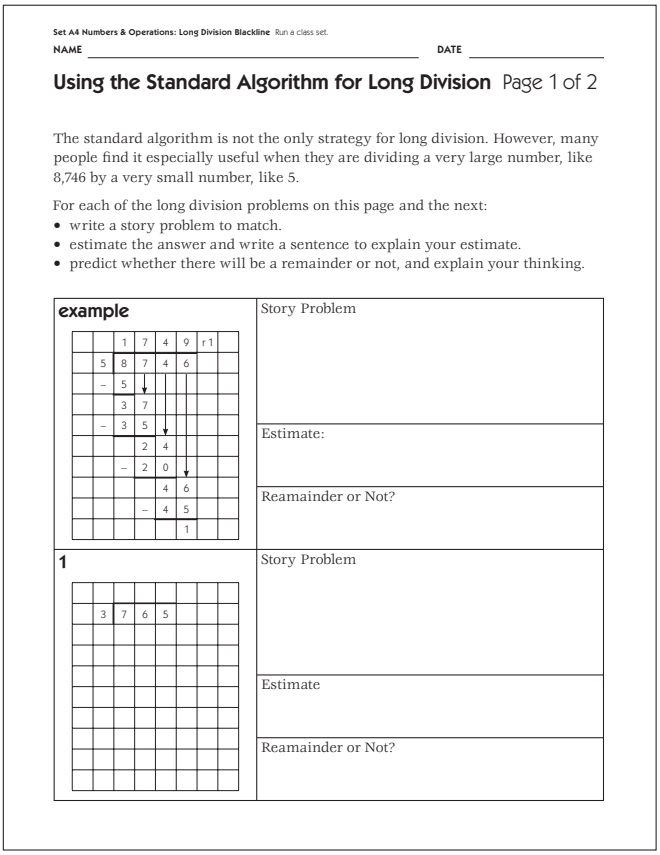
	6	8	0	4			

3

	3	8	4	5	4		

4

	9	3	7	4	6		



Set A4 Numbers & Operations: Long Division Blackline Run a class set.

NAME _____ DATE _____

Using the Standard Algorithm for Long Division Page 1 of 2

The standard algorithm is not the only strategy for long division. However, many people find it especially useful when they are dividing a very large number, like 8,746 by a very small number, like 5.

For each of the long division problems on this page and the next:
- write a story problem to match.
- estimate the answer and write a sentence to explain your estimate.
- predict whether there will be a remainder or not, and explain your thinking.

example

		1	7	4	9	r 1
	5	8	7	4	6	
	–	5				
		3	7			
	–	3	5			
			2	4		
		–	2	0		
				4	6	
			–	4	5	
					1	

Story Problem

Estimate:

Reamainder or Not?

1

	3	7	6	5		

Story Problem

Estimate

Reamainder or Not?

10. Finally, give students each a copy of Using the Standard Algorithm for Long Division. Review the instructions on the first sheet with the class. When students understand what to do, let them go to work. Depending on the strengths and needs of your students, you might give them the choice of working on the sheet independently or working as a smaller group with you.

Schools in Two Towns page 1 of 2

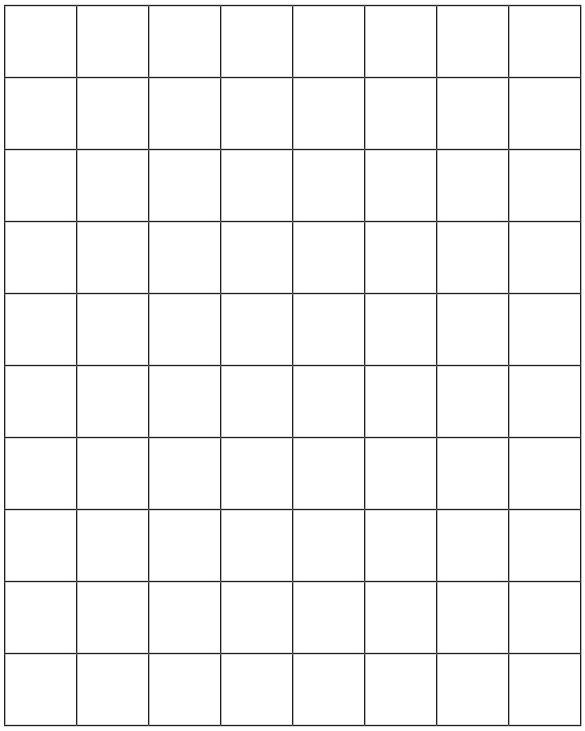
1 There are 3 elementary schools in Jewel. The chart below shows how many students there are in each school.

School	Number of Students
Lincoln Elementary	296
Washington Elementary	322
King Elementary	245

a What is the average (mean) number of students in the Jewel elementary schools?

b Estimate the average.

c Find the average.



Schools in Two Towns page 2 of 2

2 There are 4 elementary schools in Emerald. The chart below shows how many students there are in each school.

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Hayes Elementary	423
Carver Elementary	229
Grover Elementary	486

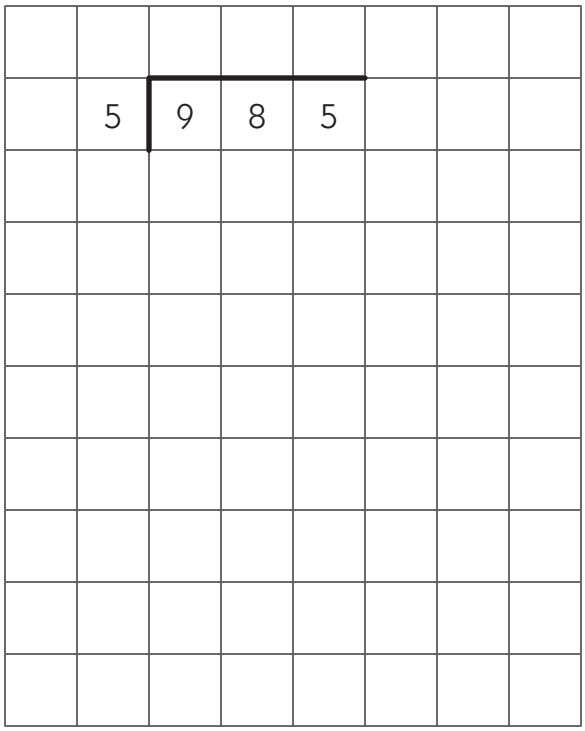
a Do you think that the average number of students in the Emerald schools is greater or less than the average number of students in the Jewel Schools? Why?

b Estimate the average.

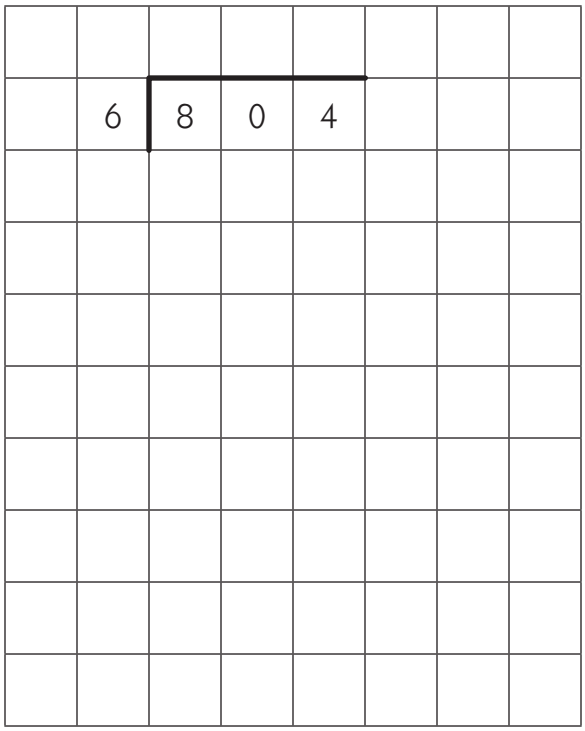
c Find the average.

More Long Division Problems

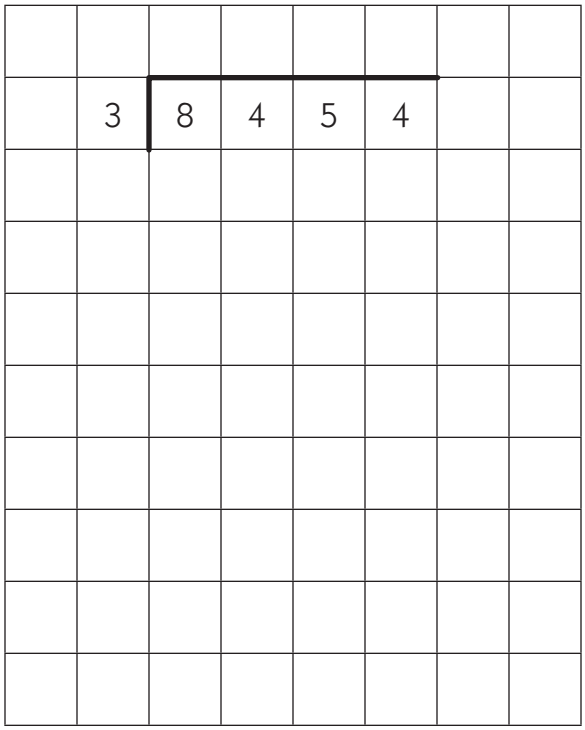
1



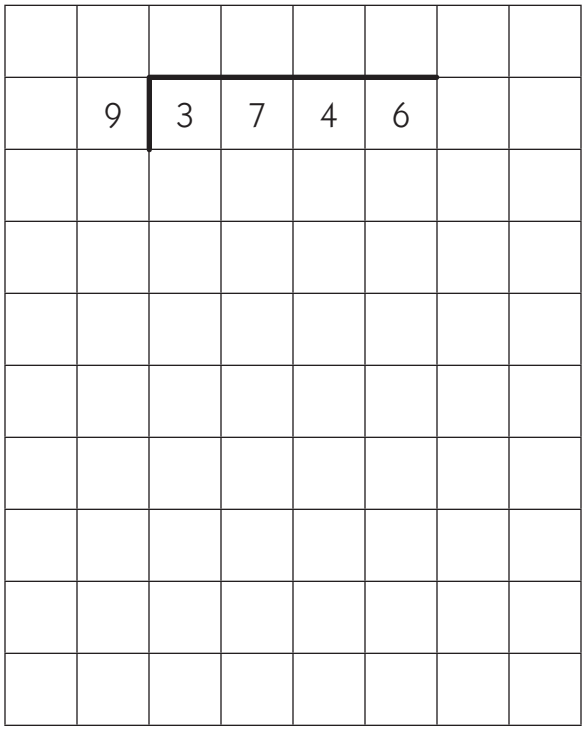
2



3



4



NAME _____ **DATE** _____

Using the Standard Algorithm for Long Division Page 1 of 2

The standard algorithm is not the only strategy for long division. However, many people find it especially useful when they are dividing a very large number, like 8,746 by a very small number, like 5.

For each of the long division problems on this page and the next:

- write a story problem to match.
- estimate the answer and write a sentence to explain your estimate.
- predict whether there will be a remainder or not, and explain your thinking.

example

		1	7	4	9	r 1	
	5	8	7	4	6		
	–	5	↓	↓	↓		
		3	7	↓	↓		
	–	3	5	↓	↓		
			2	4	↓		
		–	2	0	↓		
				4	6		
			–	4	5		
					1		

Story Problem

Estimate:

Remainder or Not?

1

	3	7	6	5			

Story Problem

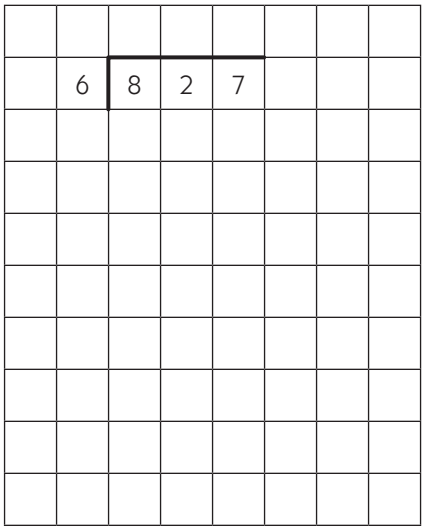
Estimate

Remainder or Not?

NAME _____ **DATE** _____

Using the Standard Algorithm for Long Division Page 2 of 2

2

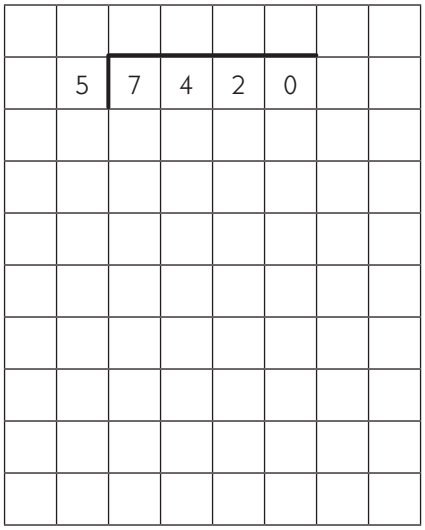


Story Problem

Estimate:

Remainder or Not?

3



Story Problem

Estimate

Remainder or Not?

Set A4 ★ Activity 2

ACTIVITY

Extending the Standard Algorithm

Overview

Students use the standard algorithm to divide 3- and 4-digit numbers by 2-digit numbers. In the process, they explore the idea of using a "mini" multiplication menu if and when needed.

Skills & Concepts

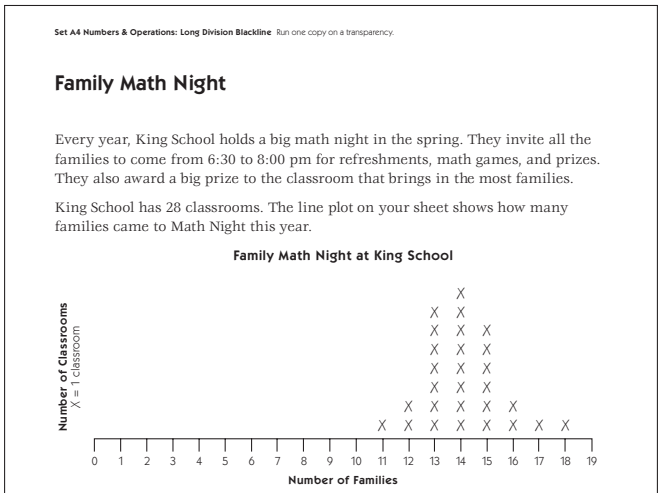
- ★ fluently and accurately divide up to a 4-digit number by 1- and 2-digit divisors accurately using the standard long division algorithm
- ★ estimate quotients to approximate solutions and determine reasonableness of answers in problems involving up to 2-digit divisors
- ★ read and interpret a line plot
- ★ determine and interpret the mean of a small data set of whole numbers

You'll need

- ★ Family Math Night (page A4.15, run one copy on a transparency)
- ★ Family Math Night Worksheet (pages A4.16 and A4.17, run a class set)
- ★ a piece of paper to mask parts of the overhead
- ★ overhead pens
- ★ Student Math Journals or 1 piece of lined or grid paper per student

Instructions for Extending the Standard Algorithm

1. Open the activity by explaining that the class is going to think some more about strategies for handling long division problems today. Then place the top portion of the Family Math Night overhead on display. Read the text with the class, and give students a minute or two to examine the line plot quietly. Ask them to think of at least two observations they can share with a partner in a minute.



Set A4 Numbers & Operations: Long Division Blackline Run one copy on a transparency.

Family Math Night

Every year, King School holds a big math night in the spring. They invite all the families to come from 6:30 to 8:00 pm for refreshments, math games, and prizes. They also award a big prize to the classroom that brings in the most families.

King School has 28 classrooms. The line plot on your sheet shows how many families came to Math Night this year.

Family Math Night at King School

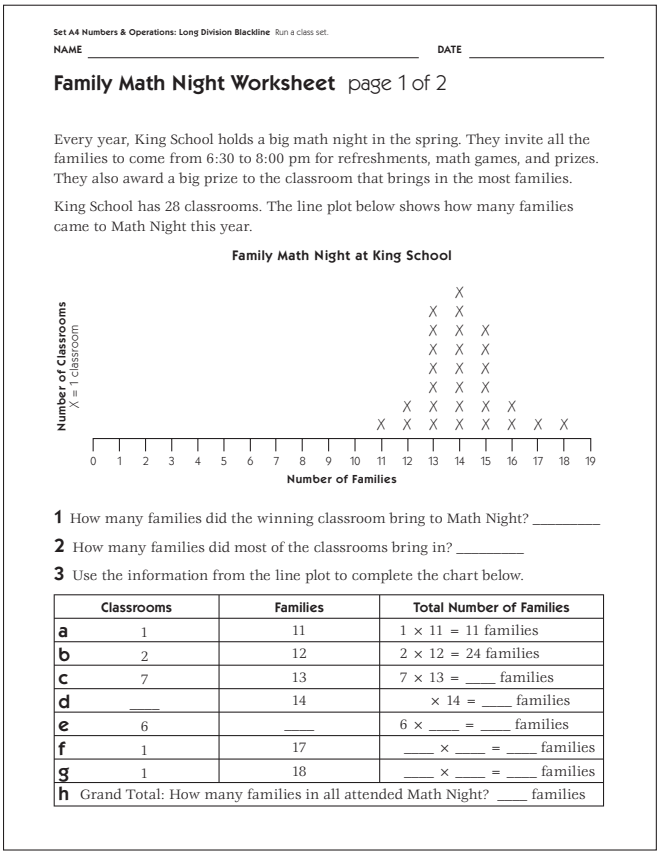
Activity 2 Extending the Standard Algorithm (cont.)

2. Have students pair-share their observations about the line plot. Then pose the following questions about the line plot.

- What information does the line plot provide?
- Who might be interested in this information?
- What does each x stand for? (a classroom)
- How many classrooms brought 14 families to Math Night? (8 classrooms)
- How many families was that in all? (112 families)
- About how many families in all came to Math Night?
- Can you find the exact total by counting up the x's? Why not?
- What do you need to do to find the total number of families that came to Math Night?

Be sure students understand that they can't find the total number of families by simply counting the x's on the line plot, because each x stands for a classroom. There are 6 x's above the 15, which means that 6 classrooms brought in 15 families each. 6 × 15 is 90, and that's only part of the total.

3. Now give students each a copy of the Family Math Night Worksheets, and display the prompt toward the bottom of the Family Math Night overhead that instructs students to use the information on theline plot to answer the questions on their sheets. Be sure students undertand they need to stop after question 4b on the second sheet.



Set A4 Numbers & Operations: Long Division Blackline Run a class set.

NAME _____ DATE _____

Family Math Night Worksheet page 1 of 2

Every year, King School holds a big math night in the spring. They invite all the families to come from 6:30 to 8:00 pm for refreshments, math games, and prizes. They also award a big prize to the classroom that brings in the most families.

King School has 28 classrooms. The line plot below shows how many families came to Math Night this year.

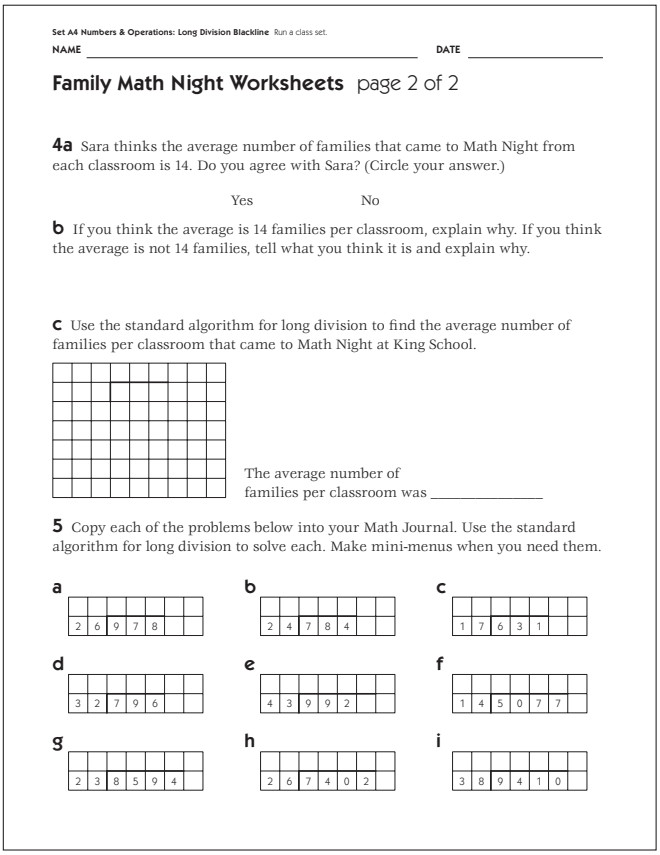
Family Math Night at King School

1 How many families did the winning classroom bring to Math Night? _____

2 How many families did most of the classrooms bring in? _____

3 Use the information from the line plot to complete the chart below.

	Classrooms	Families	Total Number of Families
a	1	11	1 × 11 = 11 families
b	2	12	2 × 12 = 24 families
c	7	13	7 × 13 = ____ families
d	____	14	× 14 = ____ families
e	6	____	6 × ____ = ____ families
f	1	17	____ × ____ = ____ families
g	1	18	____ × ____ = ____ families
h	Grand Total: How many families in all attended Math Night? ____ families		



Set A4 Numbers & Operations: Long Division Blackline Run a class set.

NAME _____ DATE _____

Family Math Night Worksheets page 2 of 2

4a Sara thinks the average number of families that came to Math Night from each classroom is 14. Do you agree with Sara? (Circle your answer.)

Yes No

b If you think the average is 14 families per classroom, explain why. If you think the average is not 14 families, tell what you think it is and explain why.

c Use the standard algorithm for long division to find the average number of families per classroom that came to Math Night at King School.

The average number of families per classroom was _____

5 Copy each of the problems below into your Math Journal. Use the standard algorithm for long division to solve each. Make mini-menus when you need them.

a 2 6 9 7 8

b 2 4 7 8 4

c 1 7 6 3 1

d 3 2 7 9 6

e 4 3 9 9 2

f 1 4 5 0 7 7

g 2 3 8 5 9 4

h 2 6 7 4 0 2

i 3 8 9 4 1 0

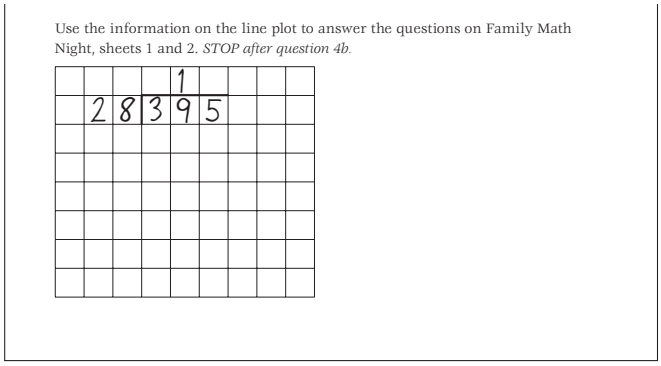
4. Read the information on the overhead to the class, and review the worksheets with them. When they understand what to do, let them go to work. Encourage them to share and compare their answers to problems 3, 4a, and 4b, and use scratch paper to make or check their calculations. If their solutions don't match, challenge them to work together until they can come to consensus.

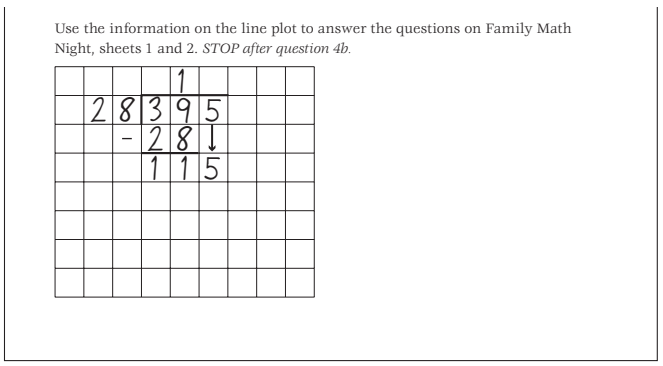
Activity 2 Extending the Standard Algorithm (cont.)

5. Circulate to provide support as students are working. Ask students who finish early to double-check their answers to 3, 4a, and 4b, and then find a quiet task to do until their classmates have completed their sheets through question 4b.

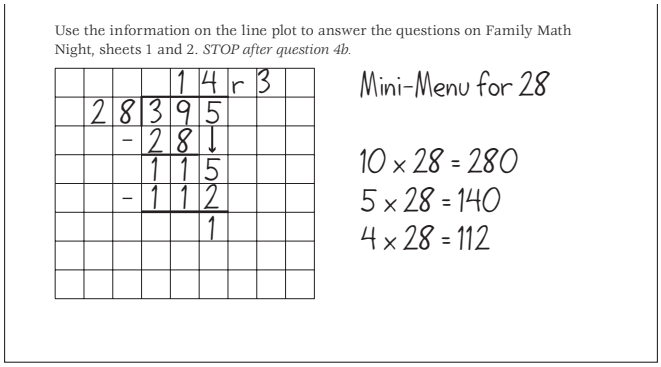
6. When most students have completed their sheets through 4b, reconvene the class. Confirm with the group that the total number of families is 395, and ask students to explain what they will need to do to find the average number of families per classroom. Set up the division problem on the overhead grid while students do so on their worksheets. Then ask them to set their sheets aside for a few minutes and work the problem as a class while you record at the overhead.

> ***Teacher*** *We're going to use the long division algorithm we learned during the last activity, so I'm going to look at the numbers in the dividend one by one. How many times will 28 go into 3?*
>
> ***Students*** *It doesn't.*
> *None at all!*
> *You can't divide 3 by 28, but you can divide 39 by 28.*
> *Yep, 28 goes into 39 one time. Two times 28 is 56, so 2 is way too much.*
>
> ***Teacher*** *Okay, so I'll write a 1 above the 9 to show that we've divided 39 by 28. Then I'll subtract 28 from 395. Uh oh, I think I'm in trouble now. I got 115 when I brought down the 5. I don't have any idea how many times 28 goes into 115.*





7. When 115 remains, suggest making a mini-menu for 28 so you don't have to solve the problem by trial and error. Work with input from the students to jot a quick menu to the side. We find ten times and five times the divisor to be useful in nearly every situation, and many students will use the information to quickly ascertain that 4 × 28 will bring them closest to 115.



Activity 2 Extending the Standard Algorithm (cont.)

8. When you have finished working the problem at the overhead, ask students to replicate your work on their sheets. What did the average number of families per classroom turn out to be? Were their estimates close? Should the remainder of 3 be left as a whole number, or converted to a fraction or a decimal? Why?

> ***Students*** *You can't split up families.*
> *You have to the leave the remainder whole.*
> *It's like each classroom brought 14 families, and then 3 of the rooms had 15 if you take the average.*

9. Before students complete the rest of the second sheet, erase the grid at the bottom of the overhead. Write 684 ÷ 23 into the grid, ask students to copy the problem into their journals, and work it with you, reviewing each step carefully. Chances are, students will agree that a mini-menu is helpful for this problem as soon as they get to the second step, 224 ÷ 23.

10. Repeat step 9 with several other problems. Here are some possibilities:

509 ÷ 19 835 ÷ 23 5,604 ÷ 17 6,003 ÷ 24

11. When most students are working comfortably with the algorithm, have them complete their second worksheet, or give them time to do so during a designated seatwork period the following day.

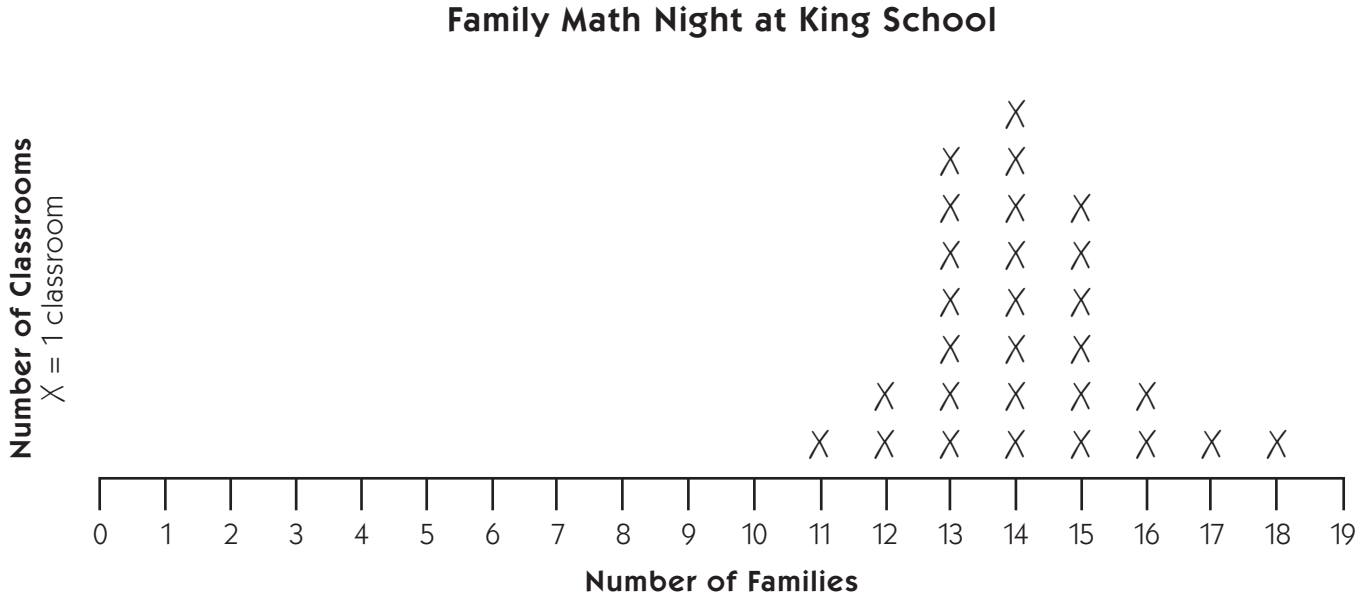
Extensions

- Home Connections 52, 60 and 61 all offer more practice with long division. Ask students to use the long division algorithm to solve the problems on these sheets.
- Encourage students to experiment with the full-blown multiplication menu, the long division algorithm, and the mini-menu strategy you introduced today. When is each strategy most useful? Is the standard algorithm for long division always the most efficient and effective?
- Ask students to solve a small set of 3–4 long division problems twice or three times a week during seatwork periods throughout the rest of the school year.

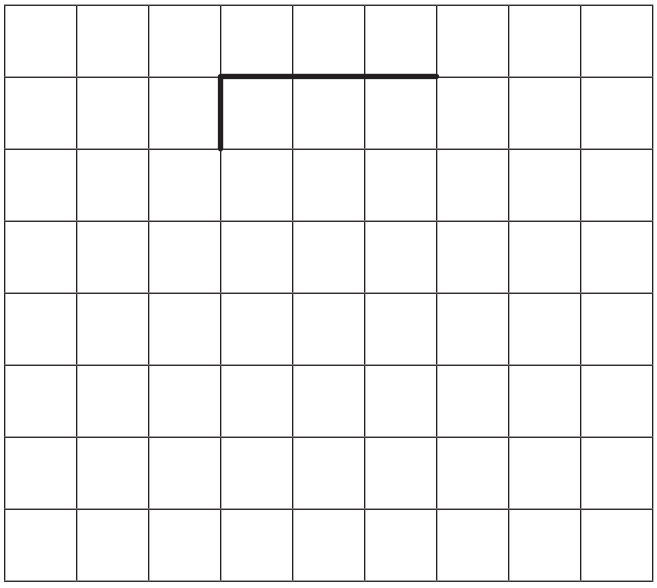
Family Math Night

Every year, King School holds a big math night in the spring. They invite all the families to come from 6:30 to 8:00 pm for refreshments, math games, and prizes. They also award a big prize to the classroom that brings in the most families.

King School has 28 classrooms. The line plot on your sheet shows how many families came to Math Night this year.



Use the information on the line plot to answer the questions on Family Math Night, sheets 1 and 2. *STOP after question 4b.*



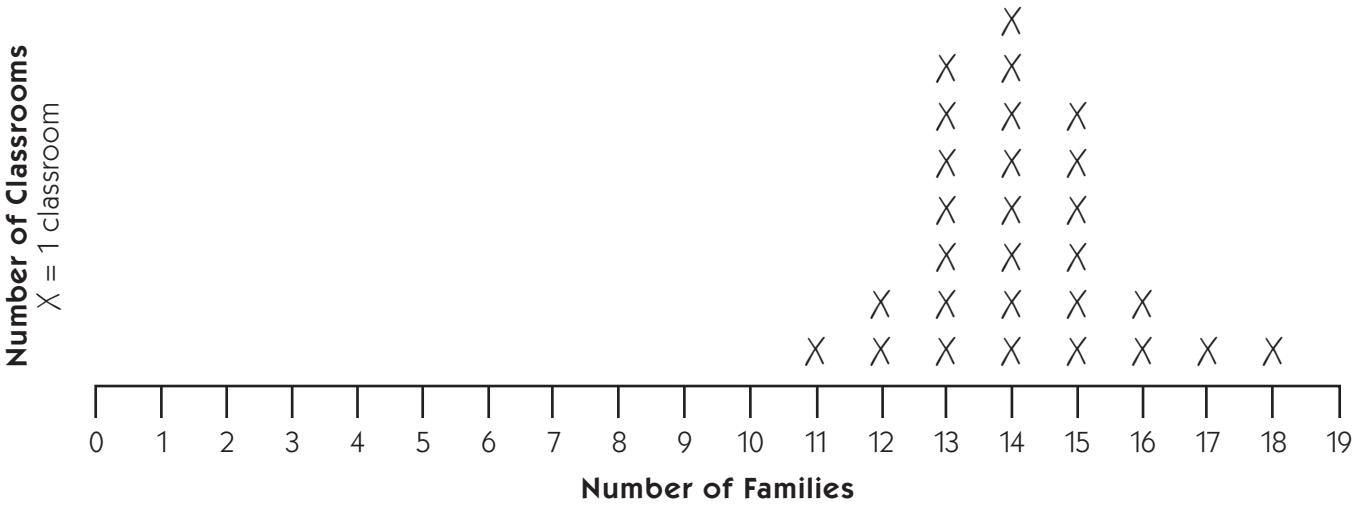
NAME _____ **DATE** _____

Family Math Night Worksheet page 1 of 2

Every year, King School holds a big math night in the spring. They invite all the families to come from 6:30 to 8:00 pm for refreshments, math games, and prizes. They also award a big prize to the classroom that brings in the most families.

King School has 28 classrooms. The line plot below shows how many families came to Math Night this year.

Family Math Night at King School



1 How many families did the winning classroom bring to Math Night? _____

2 How many families did most of the classrooms bring in? _____

3 Use the information from the line plot to complete the chart below.

	Classrooms	Families	Total Number of Families
a	1	11	1 × 11 = 11 families
b	2	12	2 × 12 = 24 families
c	7	13	7 × 13 = ____ families
e	____	14	× 14 = ____ families
e	6	____	6 × ____ = ____ families
f	1	17	____ × ____ = ____ families
g	1	18	____ × ____ = ____ families
h	Grand Total: How many families in all attended Math Night? ____ families		

NAME _____ **DATE** _____

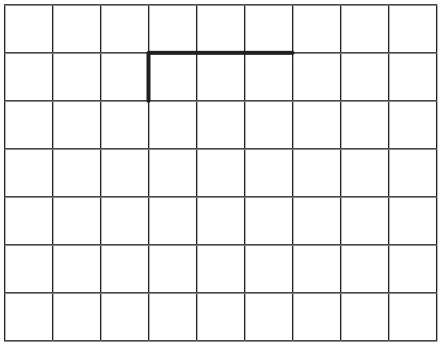
Family Math Night Worksheets page 2 of 2

4a Sara thinks the average number of families that came to Math Night from each classroom is 14. Do you agree with Sara? (Circle your answer.)

Yes No

b If you think the average is 14 families per classroom, explain why. If you think the average is not 14 families, tell what you think it is and explain why.

c Use the standard algorithm for long division to find the average number of families per classroom that came to Math Night at King School.



The average number of families per classroom was _____

5 Copy each of the problems below into your Math Journal. Use the standard algorithm for long division to solve each. Make mini-menus when you need them.

a

2	6	9	7	8		

b

2	4	7	8	4		

c

1	7	6	3	1		

d

3	2	7	9	6		

e

4	3	9	9	2		

f

1	4	5	0	7	7	

g

2	3	8	5	9	4	

h

2	6	7	4	0	2	

i

3	8	9	4	1	0	

BRIDGES IN MATHEMATICS 5

GRADE 5 SUPPLEMENT

Set A6 Numbers & Operations: Fraction Concepts

Includes

Skills & Concepts

- ★ compare fractions
- ★ given two fractions with unlike denominators, rewrite the fractions with a common denominator
- ★ determine the greatest common factor and the least common multiple of two or more whole numbers
- ★ simplify fractions using common factors
- ★ fluently and accurately subtract fractions (find the difference)
- ★ estimate differences of fractions to predict solutions to problems or determine reasonableness of answers.
- ★ solve single- and multi-step word problems involving subtraction of fractions and verify their solutions

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P0310

Bridges in Mathematics Grade 5 Supplement
Set A6 Numbers & Operations: Fraction Concepts

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P0310

Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set A6 ★ Activity 1

ACTIVITY

Simplify & Compare

Overview

During this activity, students learn to simplify fractions by finding the greatest common factor of the numerator and the denominator. Then the teacher introduces a game to provide more practice with these new skills. Simplify & Compare can be used as a partner game once it has been introduced to the class, or played several times as a whole group.

Skills & Concepts

★ determine the greatest common factor of two whole numbers

★ simplify fractions using common factors

You'll need

★ Simplify & Compare Game Board (page A6.7, run one copy on a transparency)

★ Simplify & Compare Record Sheets (page A6.8, run a class set)

★ students' fraction kits (see Advance Preparation)

★ 1 $^1/_2$″ x 12″ construction paper strips, class set plus a few extra in each of the following colors: white, light brown, purple, green, orange, pink, blue, and yellow

★ class set of 6″ x 9″ manila or legal size envelopes

★ class set of scissors

★ class set of rulers

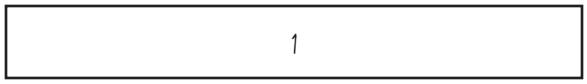
★ overhead double spinner

★ a more/less cube

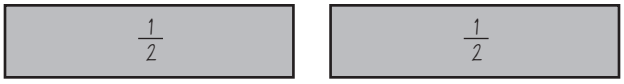
★ overhead pens

Advance Preparation: Making Construction Paper Fraction Kits

Give each student a set of 5 construction paper strips, one each in the following colors: white, light brown, purple, green, and orange. Reserve a set of strips for yourself as well. Holding up the white strip, label it with a 1 as students do the same on their white strips.



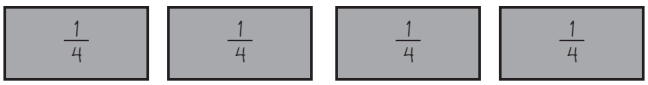
Ask students to fold their light brown strip in half and cut it along the fold line as you do the same with your light brown strip. Ask students to identify the value of these two pieces relative to the white strip. Then have them label each light brown piece ½.



Note If some of your students are already quite proficient with fractions, you might increase the challenge level of this activity by asking them to predict the length in inches of each fractional part as they cut and fold their strips.

Now ask students to fold the purple strip in half and then in half again. Before they unfold the strip, ask students to pair-share the number of segments they'll see and the value of each, relative to the white strip. Then ask them to unfold the strip, check their predictions, cut along the fold lines, and label each part, as you do the same with your purple strip.

Activity 1 Simplify & Compare (cont.)



Next, ask students to fold their green strip in half, in half again, and in half a third time. Before they unfold it, have them pair-share their ideas about how many segments they'll see and how the size of each will compare to the white strip. Some students might believe there will be 8 segments, while others are equally convinced that there will be 6. In either case, ask students to explain their thinking, although there's no need to reach consensus right now. When students unfold their green strips, they'll see 8 segments. If there's been debate beforehand, you might continue the discussion as students cut and label each of the green pieces.

> ***Teacher*** *So we got 8 parts instead of 6, even though we only folded the green strip 3 times. Why is that?*
>
> ***Students*** *Because you can see when you fold it that it's half the size of a purple piece.*
> *I think what's doubling is the number of pieces. Every time you fold the strip, you get double the number of pieces you got the last time, like 2 is double 1, 4 is double 2, and 8 is double 4.*
> *So it is a doubling pattern, just different from how some of us thought.*

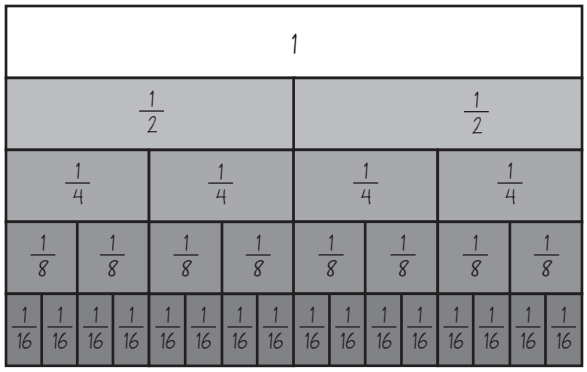
Once they have cut out and labeled the eighths, ask students to consider how the purple pieces (the fourths) compare to the whole and half strips. Students' responses may provide some sense of their current understandings (and misconceptions) about fractions.

> ***Students*** *The purple ones, the fourths, are half the size of the halves.*
> *Yeah, a fourth is like half of a half.*
> *Right! It's like a half folded in half again.*
> *If you put 2 of the fourths together, they're the same as a half.*
>
> ***Teacher*** *That's very interesting. So how could we complete this equation?* $1/4 + 1/4 =$
>
> ***Students*** *It's* $1/2$.
> *You can see the answer if you put 2 of the purples together.*
>
> ***Teacher*** *I've had students tell me the answer is* $2/8$. *What do you think of that?*
>
> ***Students*** *Maybe they didn't understand about fractions.*
> *Maybe they didn't have these strips to look at.*
> *I know what they did. They added the numbers on top and the numbers on the bottom.*
>
> ***Teacher*** *Why doesn't it work to do it that way?*
>
> ***Students*** *It's hard to explain. I think fractions don't work the same as regular numbers.*
> *I think it's because they're pieces, like parts of something else. I mean, if you added 2 of the white strips together, you'd get 2 because 1 + 1 is 2. But if you add 2 fourths together, it makes a larger piece—a half.*
> *And if you show two-eighths, two of the green pieces together, you can see it's not the same as one-fourth plus one-fourth.*

Now ask students to fold their orange strip in half 4 times. Again, ask them to make predictions about the number of segments they'll see when they unfold the strip and how big each segment will be relative to the others they've cut and labeled. After a bit of discussion, have them cut the orange strip along the folds and label each piece.

Activity 1 Simplify & Compare (cont.)

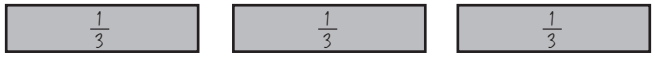
Finally, ask students to work in pairs to arrange *one* of their sets as shown on the next page. Give them a couple minutes to pair-share mathematical observations about the pieces, and then invite volunteers to share their thinking with the class.



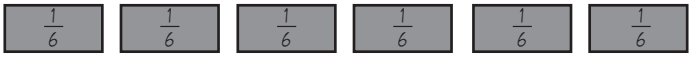
Students *The number of pieces in each row doubles. It goes 1, 2, 4, 8, then 16.*
Whatever the number is on the bottom, that's how many there are of that piece, like there are 4 fourths, 8 eighths, and 16 sixteenths.
And they all match up. You can see that 2 fourths make a half, 4 eighths make a half, and 8 sixteenths make a half.
Remember when you said that you had some kids who thought that if you added $\frac{1}{4} + \frac{1}{4}$ *you'd get* $\frac{2}{8}$*? But you can see that* $\frac{2}{8}$ *is the same as* $\frac{1}{4}$*.*
There's stuff that doesn't match up too, like there's no bigger piece that's exactly the same size as $\frac{3}{16}$ *or* $\frac{3}{8}$*.*

Making Thirds, Sixths, and Twelfths to Add to the Fraction Kits

Next, give each student a set of 3 new construction paper strips, one each in the following colors: pink, blue, and yellow. Ask students to use their rulers to find and mark thirds on the pink strip before they fold and cut. Then ave them label each piece with the fraction $\frac{1}{3}$.



Now ask students to fold the blue strip in thirds and then in half. Before they unfold the strip, ask them to pair-share the number of segments they will see and the value of each relative to the white strip. Then ask them to unfold the strip, check their predictions, cut it along the fold lines, and label each part.



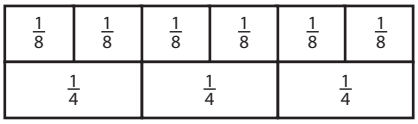
Finally, ask the students to describe and then try any methods they can devise to fold the yellow strip into twelfths. Let them experiment for a few minutes. Some students may reason that they will be able to make twelfths by folding the strip into thirds, then in half, and then in half again. Others may use their rulers, reasoning that if the length of the whole is 12 inches, each twelfth must be 1". Still others may work entirely by trial and error and will need an extra yellow strip or two. When they are finished, give students each an envelope to store all their fraction pieces. (It's fine to fold the white strip so it will fit.)

Activity 1 Simplify & Compare (cont.)

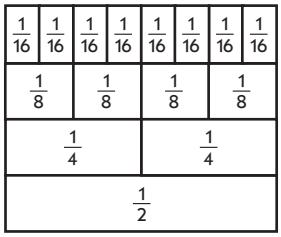
Instructions for Simplify & Compare

1. Explain that students are going to use their fraction kits to learn more about fractions and play a new game today. Have them take all the fraction strips out of their envelopes and stack them in neat piles by size on their desks.

2. Write the fraction $^6/_8$ at the overhead. Read it with the students and ask them to build the fraction with their pieces. Then challenge them to lay out an equivalent fraction with fewer pieces, all the same size as one another. Most children will set out three fourths in response. If some students set out one half and one fourth, remind them that all the pieces in the equivalent fraction have to be the same size.



3. Ask students to share any observations they can make about the two sets of pieces. Record the equation $^6/_8 = {}^3/_4$ on the overhead, and have students return the pieces they have just used to their stacks. Then write $^8/_{16}$, and have students show this fraction with their pieces. When most have finished, ask them to build all the equivalent fractions they can find, using only same-sized pieces for each one. Give them a minute to work and talk with one another, and then invite volunteers to share their results.



Students *I got $\frac{8}{16}$, $\frac{4}{8}$, $\frac{2}{4}$, and $\frac{1}{2}$.*
They're all the same as $\frac{1}{2}$.
When you use bigger pieces, you don't need as many.

4. Write a series of numbers and arrows on the board to represent the sequence. Ask students to pair-share any observations they can make about the sequence of fractions, and then have volunteers share their ideas with the class. Can they find and describe any patterns? How do the numbers relate to one another? Which requires the fewest pieces to build?

$$\frac{8}{16} \rightarrow \frac{4}{8} \rightarrow \frac{2}{4} \rightarrow \frac{1}{2}$$

Students *The numbers on the top, the numerators, go 8, 4, 2, and 1. It's like they keep getting cut in half.*
It's the same with the numbers on the bottom. 16 ÷ 2 is 8. 8 ÷ 2 is 4. 4 ÷ 2 is 2.
A half was the fastest way to build the fraction.
I knew $\frac{8}{16}$ was a half to begin with because 8 is half of 16.
Every number on the top is half of the number on the bottom.

5. Explain that $^1/_2$ is the simplest way to show $^8/_{16}$ because *the numerator (1) and denominator (2) have no common factors other than 1.*

6. Remind students that *a factor is a whole number that divides exactly into another number.* One way people find factors is to think of the pairs of numbers that can be multiplied to make a third number. Work with input from the students to list the factors of 8 and 16.

Factors of 8 are 1, 2, 4, and 8. You can divide 8 by each of these numbers.

1 x 8 = 8 2 x 4 = 8

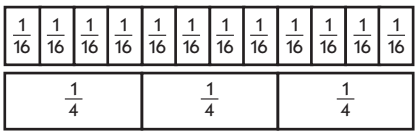
Factors of 16 are 1, 2, 4, 8, and 16. You can divide 16 by each of these numbers.

1 x 16 = 16 2 x 8 = 16 4 x 4 = 16

7. Work with input from the class to identify and circle the factors 8 and 16 have in common: 1, 2, 4, and 8. Then draw students' attention back to $^{1}/_{2}$. What are the factors of 1 and 2? What factors do the two numbers have in common? Only 1, so there's no way to simplify the fraction any further.

8. Explain that you can find the simplest form of a fraction by building it with the fewest number of pieces. But you can also simplify a fraction by identifying the *greatest common factor*, or the biggest number by which you can divide both the numerator and the denominator. Write $^{12}/_{16}$ on the board. Can this fraction be simplified? Ask students to pair-share ideas about the largest number by which both 12 and 16 can be divided. When they have identified 4 as the greatest common factor of 12 and 16, record the operation shown below at the overhead, and ask students to confirm it with their pieces. Is it true that $^{12}/_{16}$ cannot be built with any fewer pieces than 3 fourths?

$$\frac{12 \div 4}{16 \div 4} = \frac{3}{4} \qquad \frac{12}{16} = \frac{3}{4}$$



9. Repeat step 8 with $^{10}/_{12}$, $^{3}/_{16}$, and $^{12}/_{8}$. Students will note that $^{3}/_{16}$ cannot be simplified because 3 and 16 have no factors in common other than 1. They will also discover that $^{12}/_{8}$ simplifies to $^{3}/_{2}$ and then converts to a mixed number, $1^{1}/_{2}$.

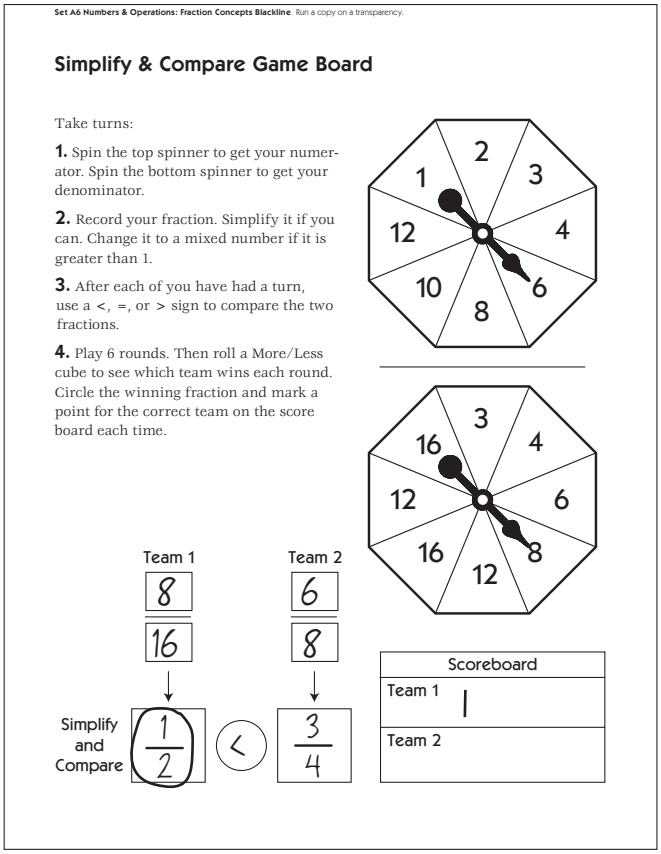
10. Now explain that you're going to play a new game with students that will give them more opportunities to simplify fractions by finding the greatest common factor. Ask them to carefully re-stack all their fraction strips by size while you place the Simplify & Compare game board on display at the overhead. Give students a few moments to examine it quietly, and then read the game rules with the class. Explain that they are going to play as Team 2, and you will play as Team 1. You will play a trial round so everyone can learn the rules, and then play the whole game with them.

11. Place the double spinner overlay on top of the spinners, spin both, and record the results under "Team 1". Work with students to simplify your fraction by finding the greatest common factor for the numerator and denominator. Invite them to check the results with their fraction pieces as well.

12. Invite a volunteer up to the overhead to spin for the class. Record the students' fraction under "Team 2" and work with their input to simplify it. Then ask students to compare their fraction with yours. If they are not sure which fraction is greater, have them build both with their fraction pieces. Use a <, >,

or = sign to show the results. Then have a second volunteer roll the more/less cube to determine the winner. Circle the winning fraction on the overhead.

> ***Teacher*** *I really lucked out on this first trial. I thought you were going to win because* $\frac{3}{4}$ *is greater than* $\frac{1}{2}$*, but Kendra rolled "less" instead of "more".*



13. Once the trial round is completed, erase the overhead. Give students each a copy of the Simplify & Compare record sheet and play 6 rounds with the class. You will need to erase the overhead between each round, but students will have a record of the complete game on their sheets. At the end of the game, have students take turns rolling the more/less cube for each pair of fractions. Have them circle the winning fraction for each round, fill in the scoreboard on their papers, and determine the winning team. If any of the pairs of fractions are equal, both teams score a point for the round.

Extensions

- Play Simplify & Compare several times with the class. The game provides an engaging context in which to practice simplifying and comparing fractions, and you don't have to play all 6 rounds at once.
- Run extra copies of the record sheet and game board, and have the students play the game in pairs. Encourage them to use their fraction kits to confirm their answers if necessary.

INDEPENDENT WORKSHEET

Use Set A6 Independent Worksheets 1 and 3 to provide students more practice simplifying fractions by finding the greatest common factor for the numerator and denominator.

Simplify & Compare Game Board

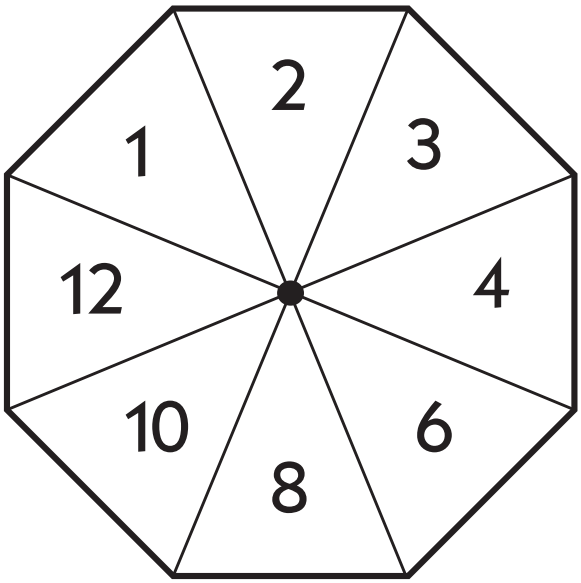
Take turns:

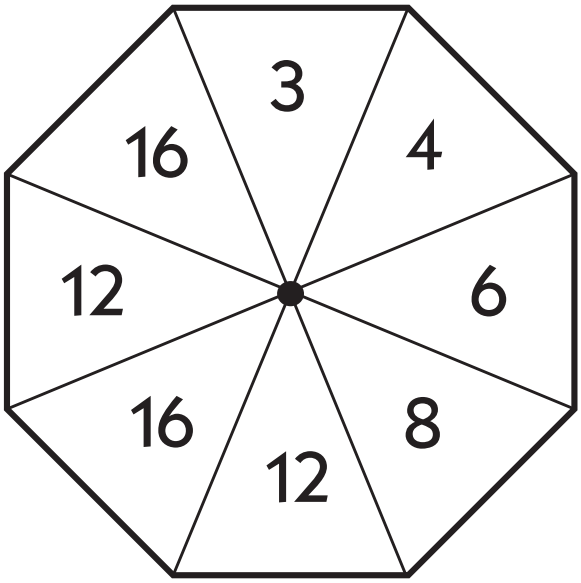
1 Spin the top spinner to get your numerator. Spin the bottom spinner to get your denominator.

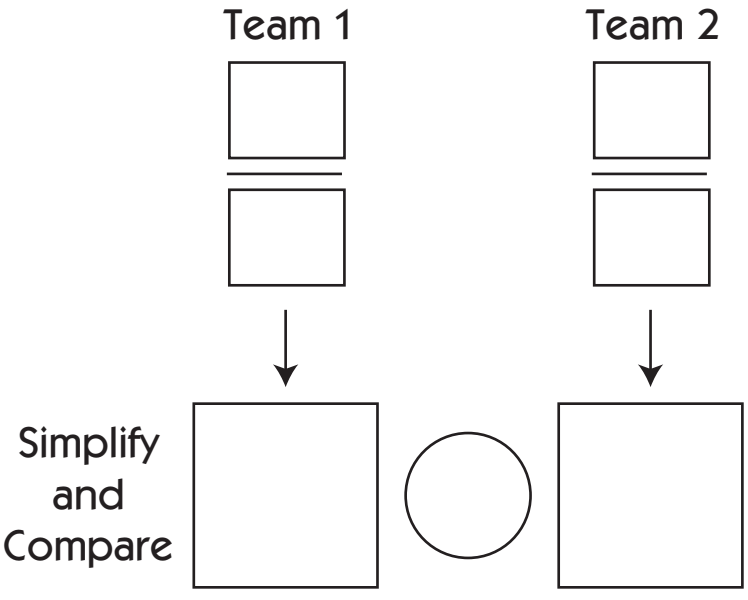
2 Record your fraction. Simplify it if you can. Change it to a mixed number if it is greater than 1.

3 After each of you have had a turn, use a <, =, or > sign to compare the two fractions.

4 Play 6 rounds. Then roll a More/Less cube to see which team wins each round. Circle the winning fraction and mark a point for the correct team on the score board each time.





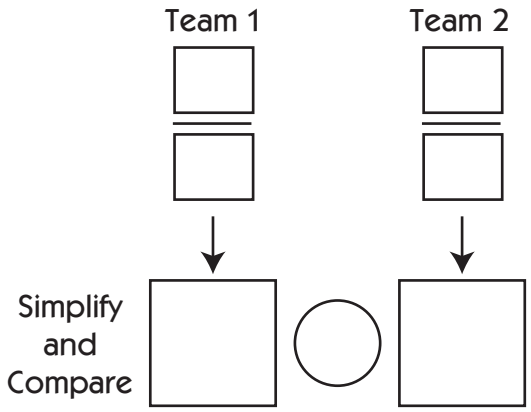


Scoreboard
Team 1
Team 2

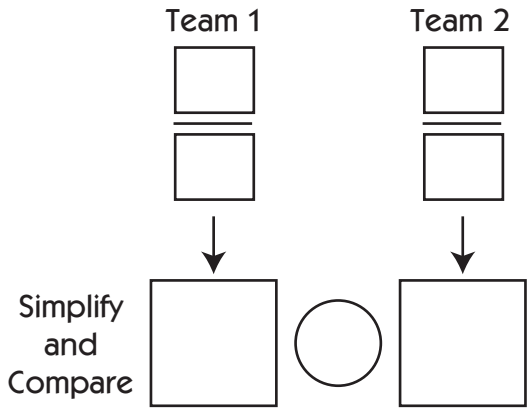
NAME _____ **DATE** _____

Simplify & Compare Record Sheet

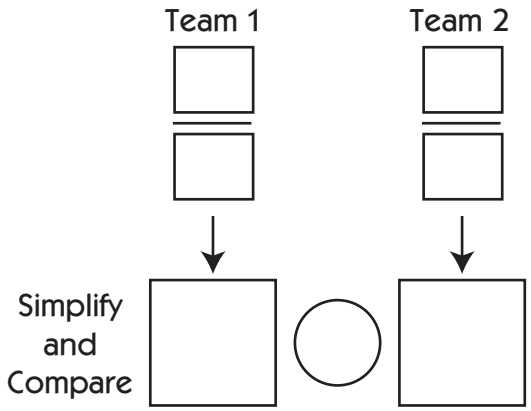
Round 1



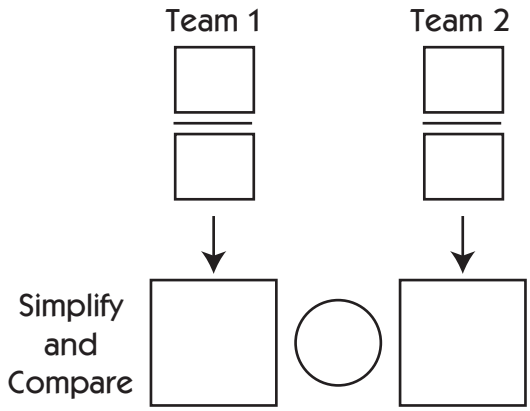
Round 2



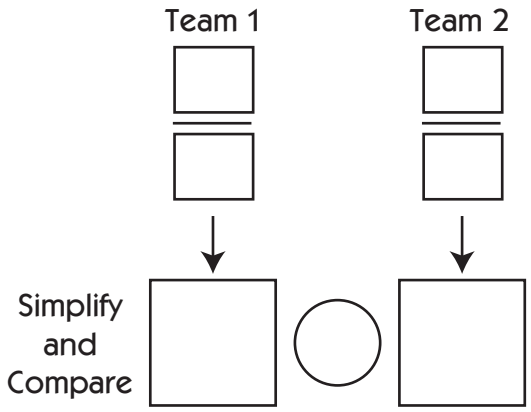
Round 3



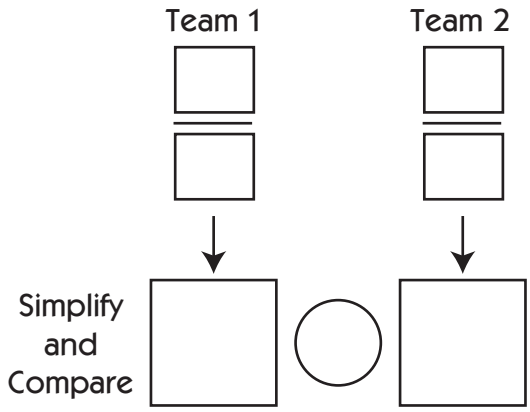
Round 4



Round 5



Round 6



Scoreboard

Team 1	Team 2

Set A6 ★ Activity 2

ACTIVITY

Same-Sized Pieces

Overview

Students use sketches to compare fractions with unlike denominators. The teacher then introduces the idea of finding the least common multiple to rewrite fractions so they have common denominators. Students practice and apply this skill as a whole group and then independently.

Skills & Concepts

★ find the difference between two fractions

★ find the least common multiple of two or more whole numbers

★ given two fractions with unlike denominators, rewrite the fractions with a common denominator

You'll need

★ Square Sandwiches & Bedroom Walls (page A6.14, run one copy on a transparency)

★ Same-Sized Pieces (page A6.15, run a class set)

★ Fraction Equivalents Worksheet (pages A6.16 and A6.17 run a class set)

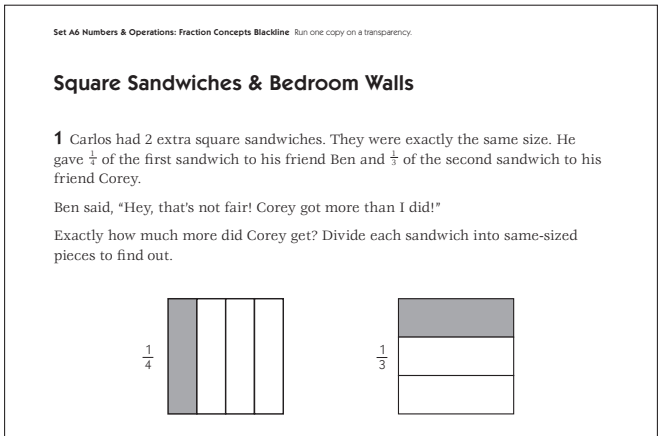
★ piece of paper to mask parts of the overhead

★ overhead pens

★ rulers

Instructions for Same-Sized Pieces

1. Let students know that during this activity the class is going to develop some strategies for comparing fractions. Then display the top portion of the Square Sandwiches overhead. Keep the bottom part of the overhead covered for now.



Set A6 Numbers & Operations: Fraction Concepts Blackline Run one copy on a transparency.

Square Sandwiches & Bedroom Walls

1 Carlos had 2 extra square sandwiches. They were exactly the same size. He gave $\frac{1}{4}$ of the first sandwich to his friend Ben and $\frac{1}{3}$ of the second sandwich to his friend Corey.

Ben said, "Hey, that's not fair! Corey got more than I did!"

Exactly how much more did Corey get? Divide each sandwich into same-sized pieces to find out.

$\frac{1}{4}$ $\frac{1}{3}$

2. Read the text to the class and ask students to pair-share ideas about the situation. Is it true that Corey got more than Ben? Exactly how much more did Corey get? How might dividing each of the sandwiches into same-sized pieces help students solve the problem?

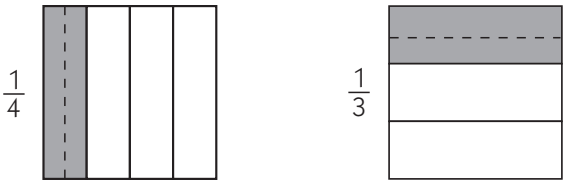
Activity 2 Same-Sized Pieces (cont.)

Students *A third is more than a fourth, but it's hard to tell how much more.*
If you could cut both of the sandwiches into smaller pieces, you could maybe count up the pieces to see how many more of them are in a third.
I don't get it!
I think we're supposed to figure out a way to cut the sandwiches so they both have the same number of pieces. Right now, the first sandwich is cut into 4 pieces. The second sandwich is cut into 3 pieces. How could we make more cuts so they both have the same number?

3. Give students each a copy of the Same-Sized Pieces blackline. Note with students that there are 2 copies of the sandwich squares so they can try at least two different ideas. Some children might want to cut out and fold the sandwich squares, while others may want to draw lines on the squares.

4. After they have had a few minutes to work ask students to share their thinking and compare their answers with neighbors. Then invite several volunteers to share their thinking at the overhead.

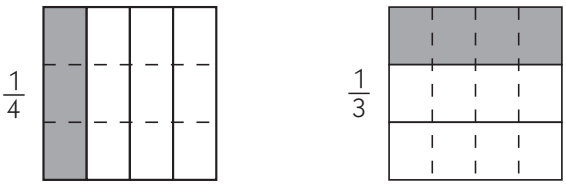
Nick *I saw that if you divide each section of the first sandwich up and down you would get 8 pieces so Ben got $^{2}/_{8}$ of a sandwich. I divided the other sandwich with a line across and saw that you would get 6 pieces and two of those would be the same as the third, so Corey got $^{2}/_{6}$ of a sandwich. Sixths are bigger than eighths, so $^{2}/_{6}$ is more than $^{2}/_{8}$.*



Jade *But that still doesn't tell us how much more Corey got than Ben. I thought we were supposed to make both sandwiches into the same sized pieces.*

Teacher *How did you solve the problem, Jade?*

Jade *Well, I kind of thought about how fourths and thirds go together, and I realized you could cut both of the sandwiches into 12 pieces, like this.*



Teacher *Let's look at the situation again. Should we end up with more pieces all the same size for each sandwich like Nick did or should we cut both sandwiches so they both have the same number of pieces, like Jade did? Talk to the person next to you about this.*

Steven *It's easier to compare if both sandwiches are cut the same. I did the same thing as Jade. You can see that Corey got $^{4}/_{12}$ of a sandwich, and Ben only got $^{3}/_{12}$. Corey got $^{1}/_{12}$ more than Ben did.*

Activity 2 Same-Sized Pieces (cont.)

5. Summarize the sandwich situation by writing the following equations on the board or overhead. How do fourths, thirds, and twelfths relate to one another? Ask students to pair-share ideas, and then call on volunteers to share with the class.

$$\frac{1}{4} = \frac{3}{12} \qquad \frac{1}{3} = \frac{4}{12} \qquad \frac{3}{12} < \frac{4}{12}$$

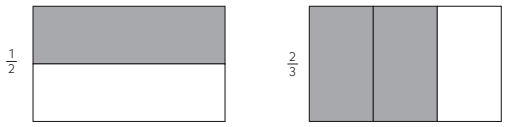
Students *If you can figure out how to make both things, like the sandwiches, into pieces that are the same, you can tell who has more.*
You can cut fourths and thirds into twelfths.
3 and 4 both go into 12. Also, you can get to 12 if you count by 3's and if you count by 4's.

Teacher *So, 3 and 4 are both factors of 12, and 12 is a multiple of 3 and a multiple of 4.*

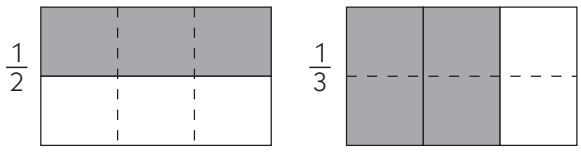
6. Show the next problem on the overhead. Read it with the class and clarify the situation as needed.

2 Jasmine and Raven were painting 2 walls in Jasmine's bedroom. The 2 walls were exactly the same size. Jasmine painted $\frac{1}{2}$ of the first wall. Raven painted $\frac{2}{3}$ of the other wall.

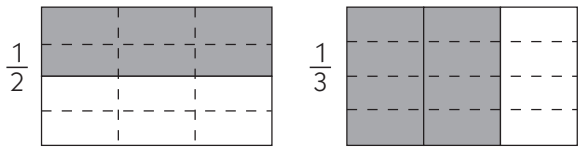
Exactly how much more did Raven paint than Jasmine? Divide each wall into same-sized pieces to find out. Is there more than one answer?



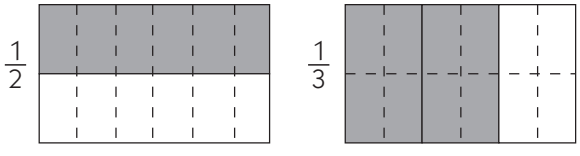
7. Give students a few minutes to solve the problem by experimenting with the rectangles at the bottom of their Same-Sized Pieces blackline. Encourage children who finish quickly to generate a second, and even third solution. Ask them to check their ideas and solutions with others nearby, and then invite several volunteers to the overhead to share their thinking with the class.



LaTonya's Way



Greg's Way



Sam's Way

LaTonya *This is so cool! I just split the halves into thirds and the thirds into halves, and got sixths for both walls. Raven painted one more sixth of her wall.*

Activity 2 Same-Sized Pieces (cont.)

Greg *I did sixths at first, and then I split them up into twelfths. Jasmine painted $^{6}/_{12}$ of her wall, and Jasmine painted $^{8}/_{12}$ of her wall.*

Sam *I did the same thing as Sam, but I cut the pieces the other way.*

8. Chances are, your students will discover that the amount of wall space each girl painted can be compared by cutting the rectangles into sixths, twelfths, perhaps even eighteenths or twenty-fourths. Summarize their findings by writing equations similar to the ones below on the board or overhead. Ask students to share their ideas about how sixths and twelfths relate to halves and thirds.

$$\frac{1}{2} = \frac{3}{6} \qquad \frac{2}{3} = \frac{4}{6} \qquad \frac{3}{6} < \frac{4}{6}$$

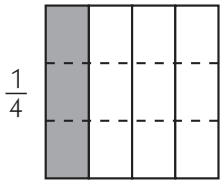
$$\frac{1}{2} = \frac{6}{12} \qquad \frac{2}{3} = \frac{8}{12} \qquad \frac{6}{12} < \frac{8}{12}$$

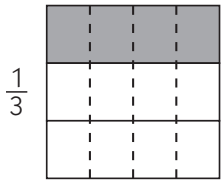
9. Explain that in order to compare, add, or subtract fractions that have different denominators, such as $^{1}/_{4}$ and $^{1}/_{3}$ or $^{1}/_{2}$ and $^{2}/_{3}$, people usually rewrite both fractions so they have the same denominator. Most students will readily agree that rewriting $^{1}/_{2}$ as $^{3}/_{6}$ and rewriting $^{2}/_{3}$ as $^{4}/_{6}$ makes it possible to compare the two with complete accuracy. Furthermore, people usually look for the lowest or least common denominator; in this case sixths rather than twelfths, eighteenths, or twenty-fourths.

While it is possible to find the least common denominator for two fractions by dividing them into smaller pieces as students have been doing today, one can also find the least dommon denominator by finding the least common multiple of the denominators. Write $^{1}/_{4}$ and $^{1}/_{3}$ on the board. Work with student input to identify the denominators and find the least common multiple of 4 and 3 by skip counting. Record the work as shown below.

$\frac{1}{(4)}$ $\frac{1}{(3)}$ 4, 8, (12) 3, 6, 9, (12) 12 is the least common multiple of 4 and 3.

10. Ask students to consider what the equivalent of $^{1}/_{4}$ and $^{1}/_{3}$ would be in twelfths. How many twelfths are there in each of these fractions? Have them re-examine the squares they divided at the beginning of the activity. Then show them how to get the same results by multiplying the numerator and denominator of $^{1}/_{4}$ and $^{1}/_{3}$ by 3 and 4 respectively.





$\frac{1 \times 3}{4 \times 3} = \frac{3}{12}$ $\frac{1 \times 4}{3 \times 4} = \frac{4}{12}$

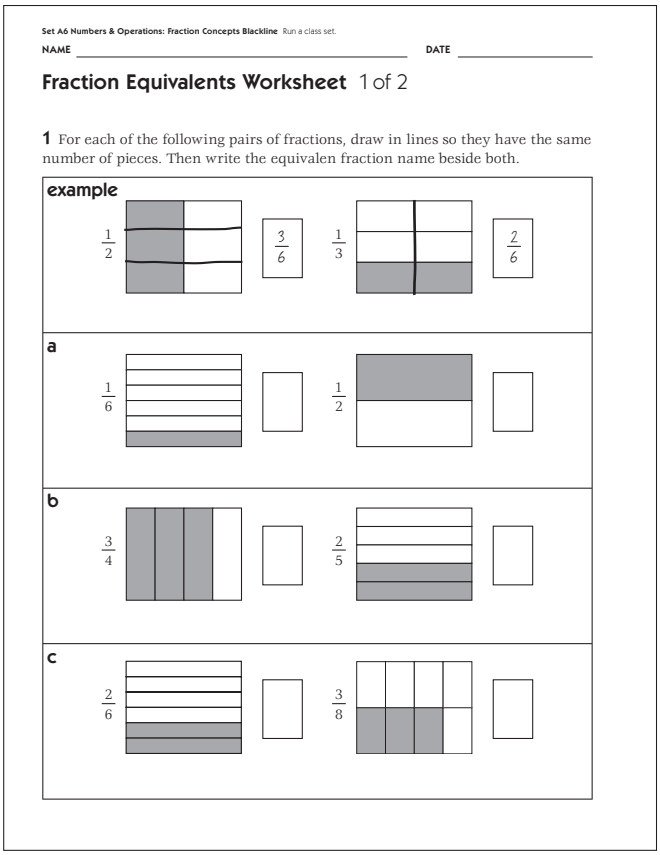
11. Now write $^{1}/_{2}$ and $^{2}/_{3}$ on the board. Work with student input to find the least common multiple of 2 and 3, and then multiply the numerator and denominator of $^{1}/_{2}$ by 3 and the numerator and denominator of $^{2}/_{3}$ by 3.

$$\frac{1 \times 3}{2 \times 3} = \frac{3}{6} \qquad \frac{2 \times 2}{3 \times 3} = \frac{4}{6}$$

Activity 2 Same-Sized Pieces (cont.)

12. Write $^1/_4$ and $^2/_6$ on the board. Which of the two fractions is greater? Exactly how much greater? Ask students to work in pairs to find the least common multiple of 4 and 6, and use the information to rewrite $^1/_4$ and $^2/_6$ so they have a common denominator. After they have had a minute or two to work, ask volunteers to share their solutions and strategies with the class.

13. Repeat step 12 with two or three other pairs of fractions. Possibilities include $^2/_6$ and $^3/_8$, $^3/_4$ and $^7/_{12}$, and $^3/_5$ and $^4/_6$. Then give students each a copy of the Fraction Equivalents Worksheets. Review both sheets with the class and clarify as needed. When students understand what to do, have them go to work. Encourage them to help one another, and circulate to provide help as needed. You might also want to give students a choice of working on the sheet independently, or working with you in a more supported small group setting.



Set A6 Numbers & Operations: Fraction Concepts Blackline Run a class set.

NAME _____ DATE _____

Fraction Equivalents Worksheet 1 of 2

1 For each of the following pairs of fractions, draw in lines so they have the same number of pieces. Then write the equivalen fraction name beside both.

example

$\frac{1}{2}$ $\frac{3}{6}$ $\frac{1}{3}$ $\frac{2}{6}$

a

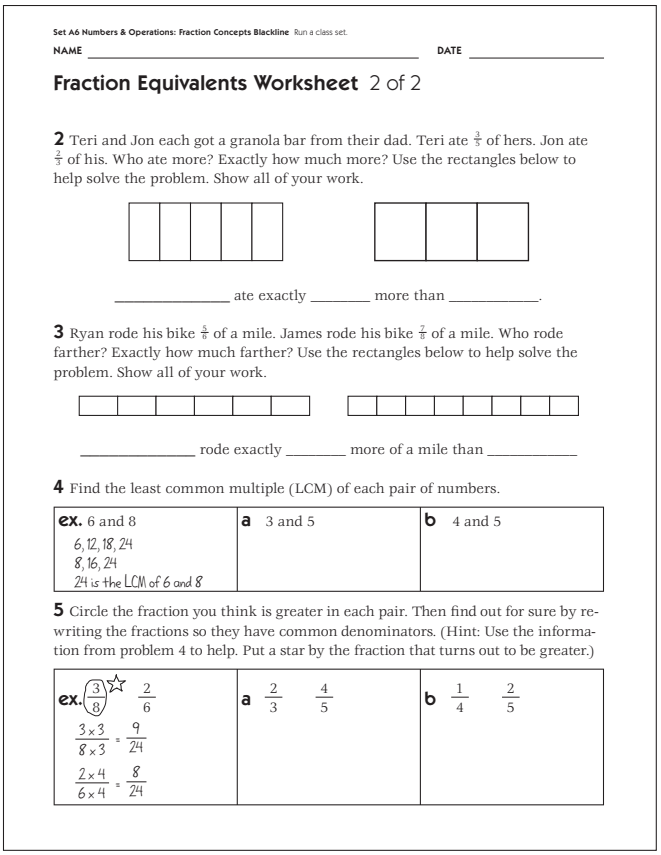
$\frac{1}{6}$ $\frac{1}{2}$

b

$\frac{3}{4}$ $\frac{2}{5}$

c

$\frac{2}{6}$ $\frac{3}{8}$



Set A6 Numbers & Operations: Fraction Concepts Blackline Run a class set.

NAME _____ DATE _____

Fraction Equivalents Worksheet 2 of 2

2 Teri and Jon each got a granola bar from their dad. Teri ate $\frac{3}{5}$ of hers. Jon ate $\frac{2}{3}$ of his. Who ate more? Exactly how much more? Use the rectangles below to help solve the problem. Show all of your work.

_____ ate exactly _____ more than _____.

3 Ryan rode his bike $\frac{5}{6}$ of a mile. James rode his bike $\frac{7}{8}$ of a mile. Who rode farther? Exactly how much farther? Use the rectangles below to help solve the problem. Show all of your work.

_____ rode exactly _____ more of a mile than _____

4 Find the least common multiple (LCM) of each pair of numbers.

ex. 6 and 8	a 3 and 5	b 4 and 5
6, 12, 18, 24 8, 16, 24 24 is the LCM of 6 and 8		

5 Circle the fraction you think is greater in each pair. Then find out for sure by rewriting the fractions so they have common denominators. (Hint: Use the information from problem 4 to help. Put a star by the fraction that turns out to be greater.)

ex. $\frac{3}{8}$ ☆ $\frac{2}{6}$ $\frac{3\times3}{8\times3} = \frac{9}{24}$ $\frac{2\times4}{6\times4} = \frac{8}{24}$	a $\frac{2}{3}$ $\frac{4}{5}$	b $\frac{1}{4}$ $\frac{2}{5}$

INDEPENDENT WORKSHEET

Use Set A6 Independent Worksheets 2 and 3 to provide students more practice finding the difference between two fractions by rewriting them so they have common denominators.

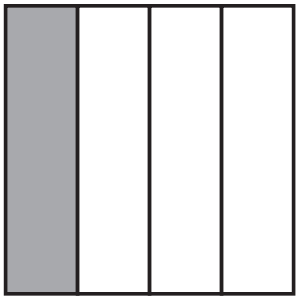
Square Sandwiches & Bedroom Walls

1 Carlos had 2 extra square sandwiches. They were exactly the same size. He gave $\frac{1}{4}$ of the first sandwich to his friend Ben and $\frac{1}{3}$ of the second sandwich to his friend Corey.

Ben said, "Hey, that's not fair! Corey got more than I did!"

Exactly how much more did Corey get? Divide each sandwich into same-sized pieces to find out.

$\frac{1}{4}$

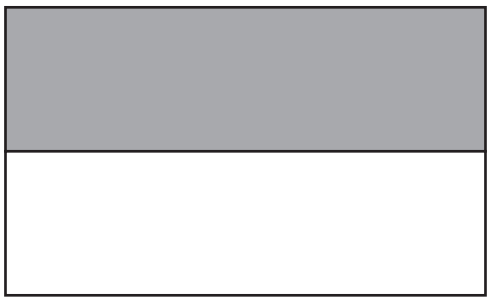


$\frac{1}{3}$

2 Jasmine and Raven were painting 2 walls in Jasmine's bedroom. The 2 walls were exactly the same size. Jasmine painted $\frac{1}{2}$ of the first wall. Raven painted $\frac{2}{3}$ of the other wall.

Exactly how much more did Raven paint than Jasmine? Divide each wall into same-sized pieces to find out. Is there more than one answer?

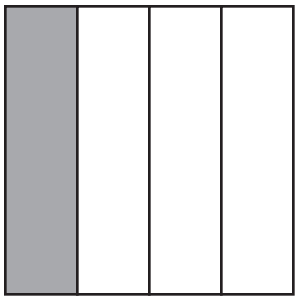
$\frac{1}{2}$

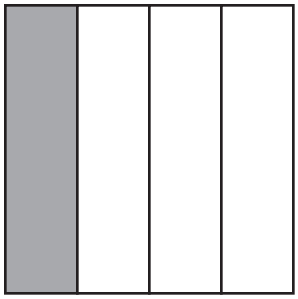


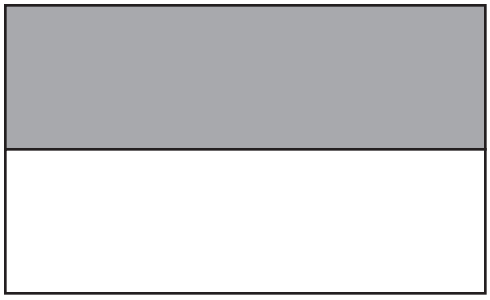
$\frac{2}{3}$

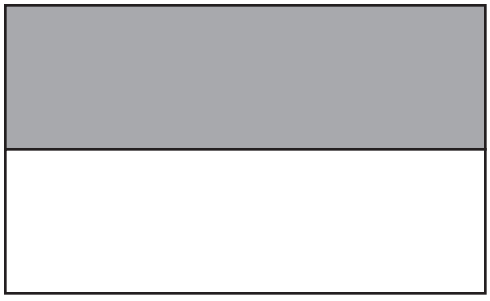
NAME _____ **DATE** _____

Same-Sized Pieces







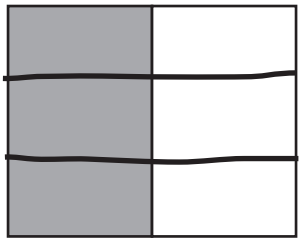


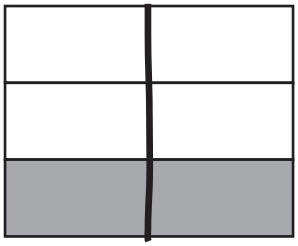
NAME _____ **DATE** _____

Fraction Equivalents Worksheet 1 of 2

1 For each of the following pairs of fractions, draw in lines so they have the same number of pieces. Then write the equivalen fraction name beside both.

example

$\frac{1}{2}$  $\frac{3}{6}$

$\frac{1}{3}$  $\frac{2}{6}$

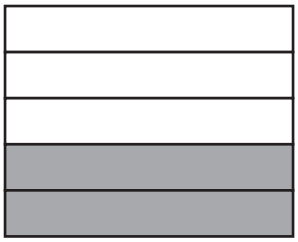
a

$\frac{1}{6}$  $\frac{\quad}{\quad}$

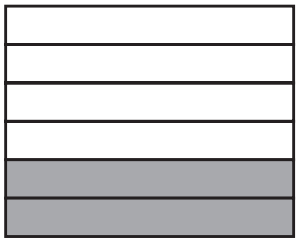
$\frac{1}{2}$  $\frac{\quad}{\quad}$

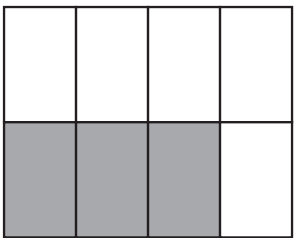
b

$\frac{3}{4}$  $\frac{\quad}{\quad}$

$\frac{2}{5}$  $\frac{\quad}{\quad}$

c

$\frac{2}{6}$  $\frac{\quad}{\quad}$

$\frac{3}{8}$  $\frac{\quad}{\quad}$

NAME _____ **DATE** _____

Fraction Equivalents Worksheet 2 of 2

2 Teri and Jon each got a granola bar from their dad. Teri ate $\frac{3}{5}$ of hers. Jon ate $\frac{2}{3}$ of his. Who ate more? Exactly how much more? Use the rectangles below to help solve the problem. Show all of your work.

_____ ate exactly _____ more than _____.

3 Ryan rode his bike $\frac{5}{6}$ of a mile. James rode his bike $\frac{7}{8}$ of a mile. Who rode farther? Exactly how much farther? Use the rectangles below to help solve the problem. Show all of your work.

_____ rode exactly _____ more of a mile than _____

4 Find the least common multiple (LCM) of each pair of numbers.

ex. 6 and 8 6, 12, 18, 24 8, 16, 24 24 is the LCM of 6 and 8	**a** 3 and 5	**b** 4 and 5

5 Circle the fraction you think is greater in each pair. Then find out for sure by re-writing the fractions so they have common denominators. (Hint: Use the information from problem 4 to help. Put a star by the fraction that turns out to be greater.)

ex. $\frac{3}{8}$ ☆ $\frac{2}{6}$ $\frac{3 \times 3}{8 \times 3} = \frac{9}{24}$ $\frac{2 \times 4}{6 \times 4} = \frac{8}{24}$	**a** $\frac{2}{3}$ $\frac{4}{5}$	**b** $\frac{1}{4}$ $\frac{2}{5}$

NAME _____ **DATE** _____

Set A6 ★ Independent Worksheet 1

INDEPENDENT WORKSHEET

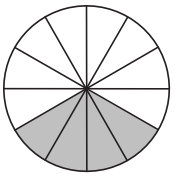
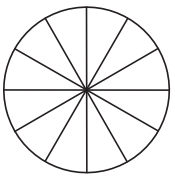
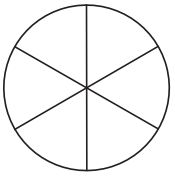
Using the Greatest Common Factor to Simplify Fractions

1 Write all the factors of each number below. Try to think of the factors in pairs.

ex. 2 1, 2 **a** 4 _____ **b** 8 _____

c 3 _____ **d** 6 _____ **e** 12 _____

2 You can simplify a fraction by dividing the numerator and the denominator by the same number. If you divide the numerator and denominator by the largest factor they have in common (the greatest common factor), you can show the fraction in its simplest form. Look carefully at the example below. Then fill in the rest of the table.

Fraction	Factors of the Numerator (Top Number)	Factors of the Denominator (Bottom Number)	Greatest Common Factor	Divide to Get the Simplest Form	Picture and Equation
ex. $\frac{4}{12}$	1, 2, (4)	1, 2, 3, (4), 6, 12	4	$\frac{4 \div 4}{12 \div 4} = \frac{1}{3}$	 $\frac{4}{12} = \frac{1}{3}$
a $\frac{8}{12}$				$\frac{8 \div}{12 \div} = \_\_$	 $\frac{8}{12} = \_\_$
b $\frac{4}{6}$				$\frac{4 \div}{6 \div} = \_\_$	 $\frac{4}{6} = \_\_$

(Continued on back.)

Independent Worksheet 1 Using the Greatest Common Factor to Simplify Fractions (cont.)

3 Find the greatest common factor of each pair of numbers below.

example 6 and 16 Factors of 6 1, (2) 3, 6 Factors of 16 1, (2) 4, 8, 16 Greatest Common Factor of 6 and 16 2	**a** 6 and 21 Factors of 6 _____ Factors of 21 _____ Greatest Common Factor of 6 and 21 _____
b 8 and 24 Factors of 8 _____ Factors of 24 _____ Greatest Common Factor of 8 and 24 _____	**c** 18 and 24 Factors of 18 _____ Factors of 24 _____ Greatest Common Factor of 18 and 24 _____

4 Use your answers from problem 3 to simplify these fractions.

example $\frac{6 \div 2}{16 \div 2} = \frac{3}{8}$ $\frac{6}{16} = \frac{3}{8}$	**a** $\frac{6}{21}$
b $\frac{8}{24}$	**c** $\frac{18}{24}$

5 A fraction is in its simplest form when its numerator and denominator have no common factor other than 1. Look at the fractions below.

- Circle the fractions that can be simplified.
- Put a line under the fractions that are already in simplest form.

$\frac{3}{6}$ $\frac{5}{8}$ $\frac{4}{10}$ $\frac{12}{15}$ $\frac{2}{7}$ $\frac{8}{14}$ $\frac{3}{13}$

6 Choose three of the fractions in problem 5 that can be simplified. Simplify them below. Show your work.

NAME _____ **DATE** _____

Set A6 ★ Independent Worksheet 2

INDEPENDENT WORKSHEET

Finding the Least Common Denominator

Which is greater, $\frac{2}{3}$ or $\frac{4}{5}$? Exactly how much difference is there between these two fractions? If you want to compare, add, or subtract two fractions, it is easier if you rewrite them so they both have the same denominator.

To do this:

- Find the least common multiple of the denominators of the fractions.

  multiples of 3 3, 6, 9, 12, 15
  multiples of 5 5, 10, 15
  The least common multiple of 3 and 5 is 15.

- Multiply the numerator and denominator of each fraction by the same number so the denominators are equal.

$\frac{2 \times 5}{3 \times 5} = \frac{10}{15}$ $\frac{4 \times 3}{5 \times 3} = \frac{12}{15}$ $\frac{4}{5}$ is greater than $\frac{2}{3}$ by exactly $\frac{2}{15}$

1 Find the least common multiple (LCM) of each pair of numbers.

ex. 4 and 10	**a** 5 and 6	**b** 2 and 7
4, 8, 12, 16, 20 10, 20 20 is the LCM of 4 and 10		

2 Circle the fraction you think is greater in each pair. Then find out for sure by rewriting the fractions so they have common denominators. Hint: Use the information from problem 1 to help. Put a star by the fraction that turns out to be greater.

ex. $\frac{3}{4}$ ☆ $\frac{7}{10}$ $\frac{3 \times 5}{4 \times 5} = \frac{15}{20}$ $\frac{7 \times 2}{10 \times 2} = \frac{14}{20}$	**a** $\frac{4}{5}$ $\frac{5}{6}$	**b** $\frac{1}{2}$ $\frac{4}{7}$

(Continued on back.)

Independent Worksheet 2 Finding the Least Common Denominator (cont.)

3 Find the least common multiple (LCM) of each pair of numbers.

a 5 and 10	**b** 6 and 9	**c** 5 and 7

4 Circle the fraction you think is greater in each pair. Then find out for sure by rewriting the fractions so they have common denominators. Hint: Use the information from problem 3 to help. Put a star by the fraction that turns out to be greater.

a $\frac{2}{5}$ $\frac{3}{10}$	**b** $\frac{4}{6}$ $\frac{7}{9}$	**c** $\frac{4}{5}$ $\frac{5}{7}$

5 Erica swam $\frac{6}{8}$ of a mile on Monday. She swam $\frac{10}{12}$ of a mile on Tuesday. Did she swim farther on Monday or Tuesday. Exactly how much farther? Use numbers, words, and/or labeled sketches to solve this problem. Show all your work.

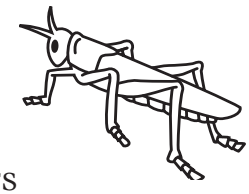
Erica swam exactly _____ of a mile farther on _____.

Set A6 ★ Independent Worksheet 3

INDEPENDENT WORKSHEET

LCM & GCF

1 Two grasshoppers are hopping up the stairs. Gary starts at the bottom and hops up 3 stairs at a time. First he lands on step 3, then step 6, and so on. Grace starts at the bottom and hops up 4 stairs at a time. First she lands on step 4, then step 8, and so on.



a The staircase has 24 steps. On which steps will both grasshoppers land? Use labeled sketches, numbers, and/or words to solve the problem. Show your work.

Both grasshoppers will land on steps _____.

b What is the first step on which both grasshoppers will land? _____
This is the least common multiple of 3 and 4.

2 Find the least common multiple (LCM) of each pair of numbers.

ex. 6 and 8	**a** 4 and 9	**b** 5 and 8	**c** 6 and 14
6, 12, 18, 24 8, 16, 24 24 is the LCM of 6 and 8			

3 Circle the fraction you think is greater in each pair. Then find out for sure by rewriting the fractions so they have common denominators. Hint: Use the information from problem 2 to help. Put a star by the fraction that turns out to be greater.

ex. (5/6) ☆ 6/8	**a** 3/4 7/9	**b** 2/5 3/8	**c** 4/6 9/14
$\frac{5\times4}{6\times4} = \frac{20}{24}$ $\frac{6\times3}{8\times3} = \frac{18}{24}$			

(Continued on back.)

Independent Worksheet 3 LCM & GCF (cont.)

4 You can use the greatest common factor (GCF) to help simplify fractions.

Find the greatest common factor of each pair of numbers.

ex. 12 and 24 Factors of 12 are 1, 2, 3, 4, 6, (12) Factors of 24 are 1, 2, 3, 4, 6, 8, (12), 24 12 is the GCF of 12 and 24	**a** 8 and 20
b 12 and 18	**c** 10 and 15

5 Use your answers from problem 4 to simplify these fractions.

ex. $\frac{12 \div 12}{24 \div 12} = \frac{1}{2}$ $\quad \frac{12}{24} = \frac{1}{2}$	**a** $\frac{8}{20}$
b $\frac{12}{18}$	**c** $\frac{10}{15}$

6 Ebony got $\frac{3}{4}$ of a yard of red ribbon and $\frac{10}{12}$ of a yard of purple ribbon. Which piece of ribbon was longer? Exactly what fraction of a yard longer was it? Use numbers, words, and/or labeled sketches to solve this problem. Make sure your answer is in simplest form.

The _____ piece of ribbon was exactly _____ of a yard longer than the _____ piece of ribbon.

BRIDGES IN MATHEMATICS 5

GRADE 5 SUPPLEMENT

Set A9 Number & Operations: Multiplying Fractions

Includes

Skills & Concepts

- ★ add fractions with unlike denominators
- ★ find the perimeter of regions with an area smaller than 1
- ★ estimate the results of operations performed on fractions and use the estimate to determine the reasonableness of the final answer
- ★ find the product of two unit fractions with small denominators using an area model
- ★ multiply fractions using the standard algorithm
- ★ explain the relationship of the product relative to the factors when multiplying fractions

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P0310

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Set A9 Number & Operations: Multiplying Fractions

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P0310

Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set A9 ★ Activity 1

ACTIVITY

Geoboard Perimeters

Overview

In preparation for using the area model to multiply one fraction by another, students investigate the perimeter of the largest square that can be formed on the geoboard, as well as the perimeters of smaller regions on the geoboard.

Skills & Concepts

★ add fractions with unlike denominators

★ find the perimeter of regions with an area smaller than 1

You'll need

★ Rectangle Review (page A9.7, run 1 copy on a transparency)

★ Geoboard Perimeters (page A9.8, run 1 copy on a transparency)

★ Geoboard Perimeters (page A9.9, run a class set double-sided, plus a few extra)

★ overhead geoboard and rubber bands

★ overhead pens

★ 2–3 blank transparencies

★ a piece of paper to mask portions of the overhead

★ $5\frac{3}{4}'' \times \frac{1}{4}''$ strips of red construction paper (10–12 per student)

★ geoboards and rubber bands (class set)

★ tile and red linear units available as needed

★ pencils and scissors

Instructions for Geoboard Perimeters

1. Open the activity by explaining to the class that you are going to start a series of lessons on multiplying fractions. To get started, you are going to review the area model for multiplication. Then place the Rectangle Review transparency on display at the overhead. Review the information together, and ask students to pair-share responses to the questions:
• What is the area of the rectangle on the overhead?
• What information do you need in order to determine the area of the rectangle?

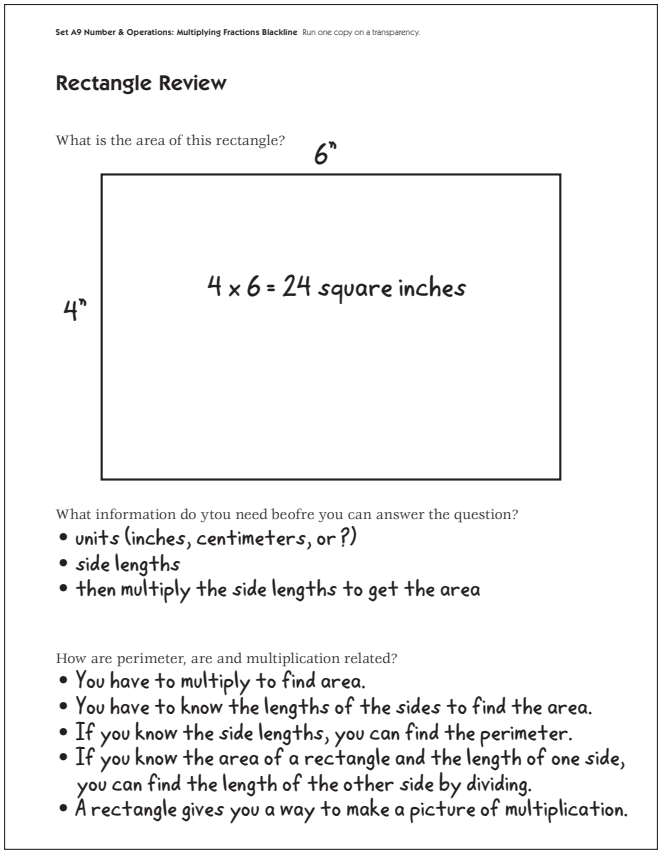
2. Have a few volunteers share their thinking with the class. As the discussion proceeds, guide students to review the connection between perimeter, area, and multiplication.

> ***Students*** *We think it's about 28 square inches.*
> *We said it could be maybe be about 150 square centimeters.*
> *We can't tell, because we don't know how long the sides are.*
> *We don't even know if they're in inches or centimeters.*
>
> ***Teacher*** *Why do you need to know the side lengths to find the area of the rectangle?*

Activity 1 Geoboard Perimeters (cont.)

Students *Because you get area by multiplying length times width. You need to know how many squares will fit into the rectangle. Like, if we know that 7 squares fit across the top, and 4 squares fit along the side, we would know the area is 4 times 7, and that's 28. But it depends on the size of the squares. If they're little, like square centimeters, the area could be more than 100.*

3. After some discussion, have a volunteer come up to the overhead and measure the side lengths of the rectangle in inches. Then work with input from the class to label the rectangle and summarize students' comments on the transparency.



Set A9 Number & Operations: Multiplying Fractions Blackline Run one copy on a transparency.

Rectangle Review

What is the area of this rectangle?

6"

4"

4 x 6 = 24 square inches

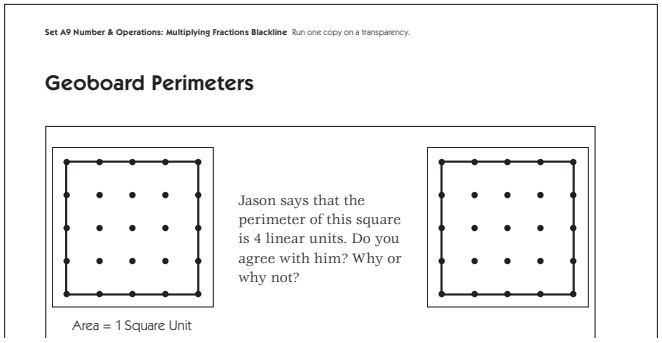
What information do ytou need beofre you can answer the question?

- units (inches, centimeters, or ?)
- side lengths
- then multiply the side lengths to get the area

How are perimeter, are and multiplication related?

- You have to multiply to find area.
- You have to know the lengths of the sides to find the area.
- If you know the side lengths, you can find the perimeter.
- If you know the area of a rectangle and the length of one side, you can find the length of the other side by dividing.
- A rectangle gives you a way to make a picture of multiplication.

4. Next, display the top portion of the Geoboard Perimeters transparency as helpers give students each a geoboard and some rubber bands. Read the information on the transparency together and ask students to replicate the square on their own geoboard. If the area of that square is 1 unit, what is the length of each side, and what is the perimeter of the square? Give students a minute to pair-share ideas, and then call for and record their answers.



Set A9 Number & Operations: Multiplying Fractions Blackline Run one copy on a transparency.

Geoboard Perimeters

Jason says that the perimeter of this square is 4 linear units. Do you agree with him? Why or why not?

Area = 1 Square Unit

Activity 1 Geoboard Perimeters (cont.)

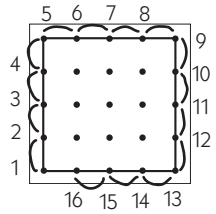
Teacher *Now that you've had a minute to think about the question, let's record your answers here on the whiteboard. What did you decide?*

Students *We don't agree with Jason. We think the perimeter of that square is 16.*
That's what we got too.
We agree with Jason. We think the perimeter is 4.

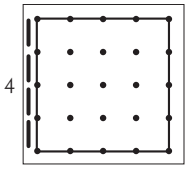
5. After you have recorded students' answers, invite individuals or student pairs to the overhead to demonstrate their thinking. Set a blank acetate on top of your transparency and then re-position it as needed, so that several different students can mark on it to show how they determined the perimeter of the square in question.

Teacher *Any different ideas? No? Who'd like to convince us of their reasoning? You can mark on the transparency to show what you did to get your answer.*

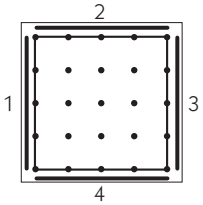
Jon *We said it was 16 instead of 4. We started in the corner of the board and just counted the pegs all the way around. It came out to 16.*



Ariel *We did kind of the same thing as Jon and Omid, but we looked at the spaces instead of the pegs. It looked like each side of the square was 4, and we know that 4 x 4 is 16, so we said the perimeter of the square is 16.*



Gabe *We think the perimeter is 4. We said if the area of the whole square is 1, then each side must be 1. So that means the perimeter of the square is 4, like this: 1, 2, 3, 4.*

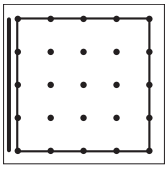


Jasmine *We agree with Gabe and Raven. See, if each of the little squares was worth 1, then the perimeter would be 16, but the big square is worth 1, so each of the sides must be 1.*

6. When students have had adequate time to discuss and debate the perimeter of the largest square, build the square on your own geoboard at the overhead and display one of the strips of red construction paper you have cut, first holding it up for all to see, and then setting it into the space between the edge and the pegs of the board. Then invite students' comments.

Activity 1 Geoboard Perimeters (cont.)

Teacher *I cut some strips for us to use in considering the perimeter of this square. What do you think?*



Students *Those are like the little red pieces we use with the tiles sometimes.*
It's like a giant red piece.
But those little red pieces are worth 1, so this one must be worth 4.

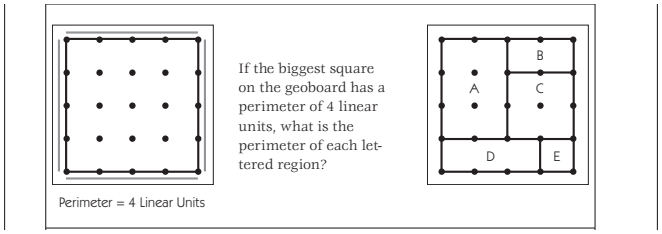
Teacher *How are you thinking about that?*

Kamil *Well, it goes along 4 spaces on the geoboard, so it must be worth 4.*

Hanako *But that's what we were trying to tell you before. That square has an area of 1. It's like 1 giant tile, and that strip is like 1 giant red piece.*

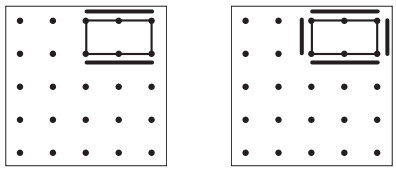
7. Confirm the fact that the red strips you have cut are each worth 1 linear unit. That being the case, what is the perimeter of the largest square on the geoboard? (4 linear units)

8. Now display the middle portion of transparency, which establishes that the perimeter of the largest square is 4 linear units and asks students to determine the perimeter of several different regions on the geoboard.



9. Work with the class to determine the perimeter of Region B. Ask students to remove the large square from their board and build just Region B, as you place a handful of red construction paper strips at each table or cluster of desks. Give students a few minutes to experiment with their strips as they consider the perimeter of this region. Let them know that it is fine to fold and cut the strips if that helps them think about the length of each side of Region B. Then invite 2 or 3 individuals or pairs to the overhead to share their thinking. Ask them to work with a board and strips so their classmates can see what they are talking about as they explain.

Theo *We were pretty stuck at first, but we kept looking at the strips and the rectangle on our board. Then we realized that if you fold one of the strips in half, it fits along the top of the rectangle. Then we knew that the 2 long sides were each worth* $\frac{1}{2}$.

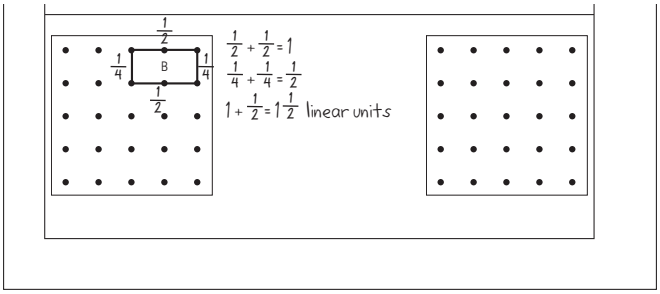


Activity 1 Geoboard Perimeters (cont.)

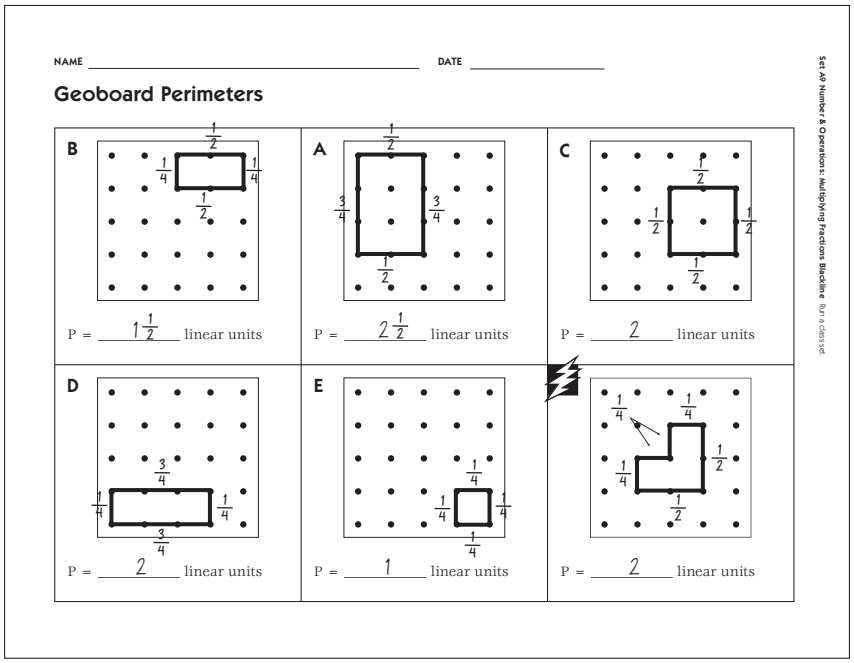
Ichiro *We found out that the small sides are each worth $\frac{1}{4}$ of a linear unit. If you fold one of those strips in half and then in half again, you get fourths. If you cut them up, they fit right along the short sides of the rectangle, like this.*

Kendra *We did the same thing, and then we added them up because that's what you do when you're figuring out the perimeter. We got that it was $1\frac{1}{2}$, and that seems kind of weird. Can you have a perimeter with a fraction in it?*

10. As students share their thinking, use the lower portion of the transparency to label and record the dimensions of Region B. When it has been established that the long sides are each $1/2$ of a linear unit, and the short sides are $1/4$ of a linear unit, work with student input to add the fractions to determine the total perimeter. They will find, in fact, that the perimeters of some, though not all, of the regions are mixed numbers.



11. Now give students each a copy of the Geoboard Perimeters sheet (shown below with the answers and sample responses filled in for your reference). Ask students to sketch Region B, label the length of each side, and record one or more number sentences to show the computations necessary to find the total. Then have them find the area of each of the other regions shown on the transparency: A, C, D, and E.


NAME _____ DATE _____

Geoboard Perimeters

B — P = $1\frac{1}{2}$ linear units

A — P = $2\frac{1}{2}$ linear units

C — P = 2 linear units

D — P = 2 linear units

E — P = 1 linear units

P = 2 linear units

Set A9 Number & Operations: Multiplying Fractions Blackline Run 1 class set.

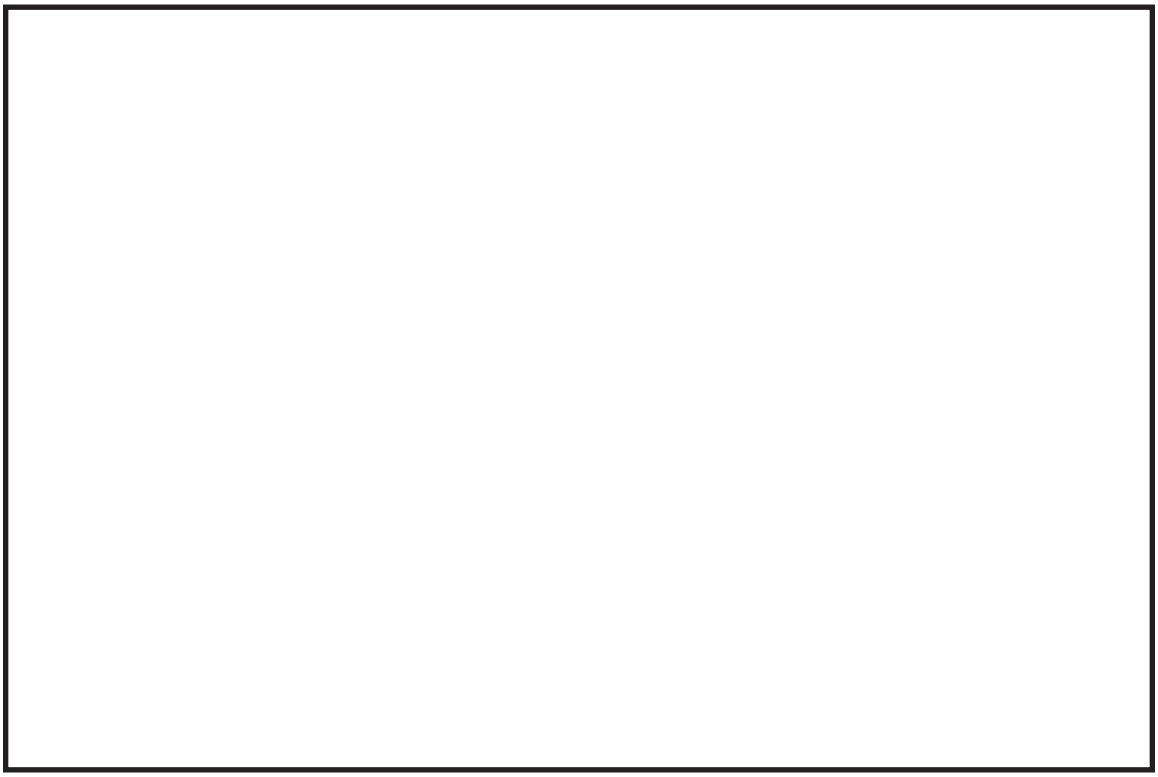
Activity 1 Geoboard Perimeters (cont.)

Extension

Students who determine and record the perimeters of all 5 regions quickly and easily can be asked to build at least two figures (other than any of the regions they've already investigated) that have a perimeter of 2 linear units, two that have a perimeter of $2\frac{1}{2}$ linear units, two with P = 3 linear units, and two with P = $3\frac{1}{2}$ linear units. Each discovery should be recorded the same way the first 5 regions have been, using the last box on the record sheet, as well as the back of the sheet and a second sheet if necessary.

Rectangle Review

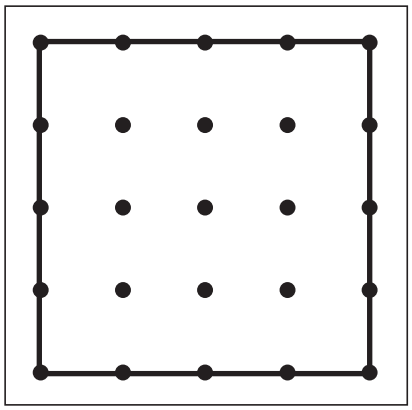
What is the area of this rectangle?



What information do ytou need before you can answer the question?

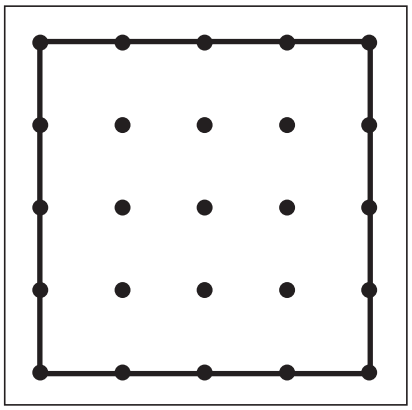
How are perimeter, area and multiplication related?

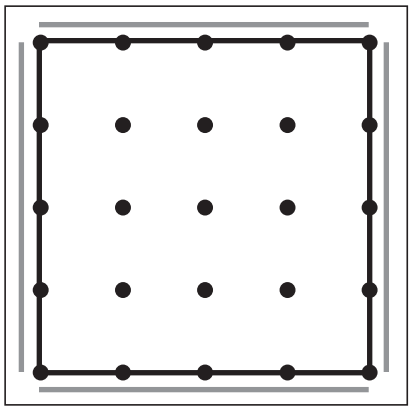
Geoboard Perimeters



Area = 1 Square Unit

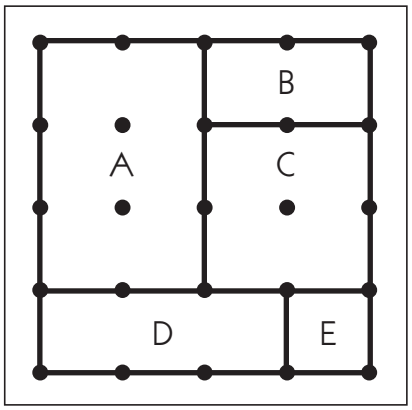
Jason says that the perimeter of this square is 4 linear units. Do you agree with him? Why or why not?

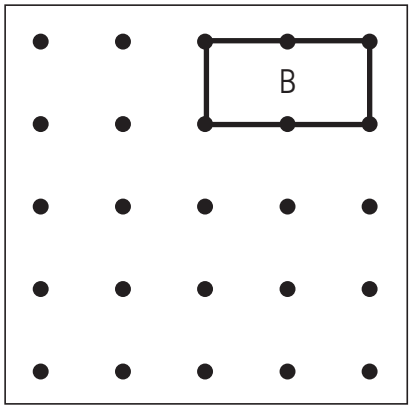


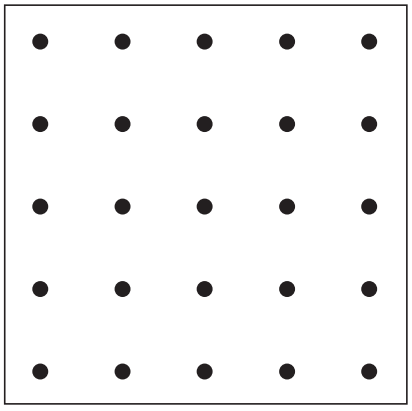


Perimeter = 4 Linear Units

If the biggest square on the geoboard has a perimeter of 4 linear units, what is the perimeter of each lettered region?



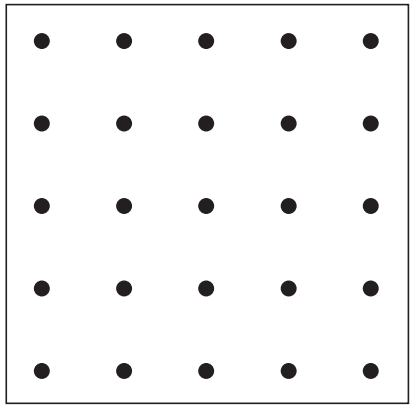




NAME _____ DATE _____

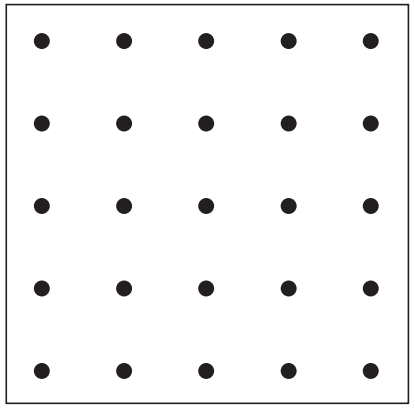
Geoboard Perimeters

B



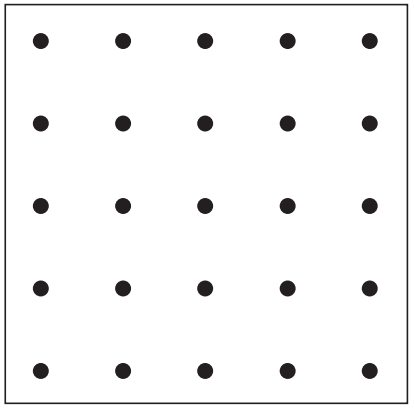
P = _____ linear units

A



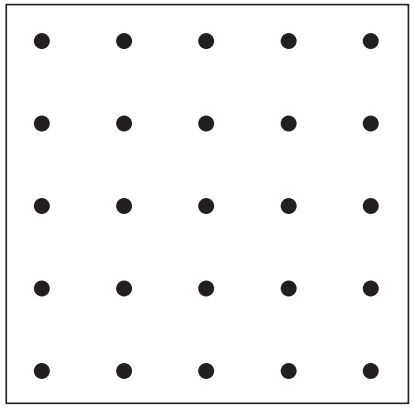
P = _____ linear units

C



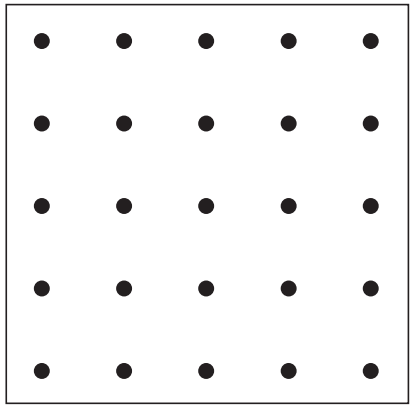
P = _____ linear units

D

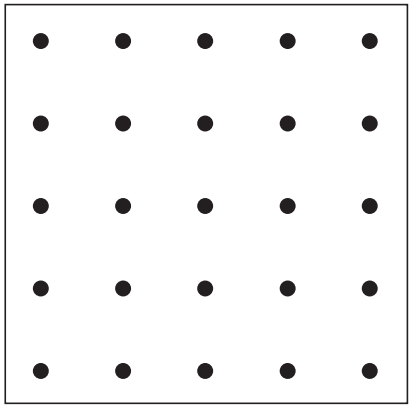


P = _____ linear units

E



P = _____ linear units



P = _____ linear units

Set A9 ★ Activity 2

ACTIVITY

Fraction Multiplication Story Problems

Overview

During this session, students solve several different story problems designed to help them think sensibly about multiplying one fraction by another. Although the expression ¼ × ½ may not carry much meaning for most fifth graders, many students can consider the idea of "a fourth of a half", especially in the context of a story problem supported by visual models. Today's sense-making activities lay the groundwork for using the area model to picture and solve fraction multiplication combinations in the next activity.

Skills & Concepts

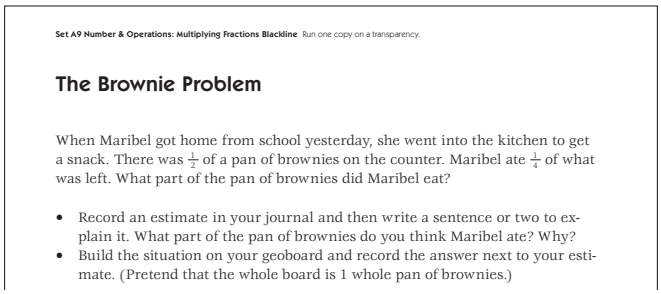
- ★ find the product of two unit fractions with small denominators using an area model
- ★ estimate the results of operations performed on fractions and use the estimate to determine the reasonableness of the final answer
- ★ explain the relationship of the product relative to the factors when multiplying fractions

You'll need

- ★ The Brownie Problem (page A9.17, run 1 copy on a transparency)
- ★ Fraction Multiplication Story Problems (page A9.18, run 1 copy on a transparency)
- ★ overhead geoboard and rubber bands
- ★ overhead pens
- ★ 2-3 blank transparencies
- ★ piece of paper to mask portions of the overhead
- ★ geoboards and rubber bands (class set)
- ★ regular and colored pencils
- ★ Student Math Journals

Instructions for Fraction Multiplication Story Problems

1. Open today's activity by placing the top portion of The Brownie Problem on display as students gather the materials they'll need: geoboards and bands, journals and pencils.



Set A9 Number & Operations: Multiplying Fractions Blackline Run one copy on a transparency.

The Brownie Problem

When Maribel got home from school yesterday, she went into the kitchen to get a snack. There was $\frac{1}{2}$ of a pan of brownies on the counter. Maribel ate $\frac{1}{4}$ of what was left. What part of the pan of brownies did Maribel eat?

- Record an estimate in your journal and then write a sentence or two to explain it. What part of the pan of brownies do you think Maribel ate? Why?
- Build the situation on your geoboard and record the answer next to your estimate. (Pretend that the whole board is 1 whole pan of brownies.)

2. Read the problem at the top of the transparency together, along with the instructions. Then ask students to think privately about the situation, and record an estimate in their journal, along with an ex-

Activity 2 Fraction Multiplication Story Problems (cont.)

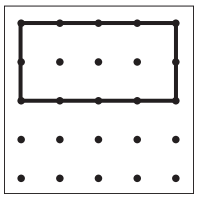
planation. Encourage students who seem puzzled or confused to think in terms of familiar benchmarks. Did Maribel eat more or less than half a pan? Did she eat more or less than a quarter of the pan? Why?

3. After they have had a few minutes to write, ask students to pair-share their estimates and explanations and then work in pairs to build the situation on a geoboard. Students will have different ideas about how to do this, and you may see some misconceptions as you circulate, but give them a few minutes to wrestle with the problem and record answers in their journals.

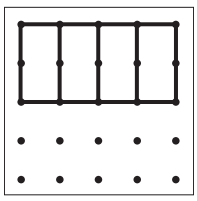
Ask students who finish before their classmates to determine what part of a pan of brownies Maribel would have eaten if there had been three-fourths of a pan left instead of half ($\frac{1}{4}$ of $\frac{3}{4}$ is $\frac{3}{16}$).

4. When most students have either arrived at an answer or done as much as they can with the problem, record all solutions on the whiteboard and then invite 2–3 individuals or pairs to the overhead to share their thinking. Have them bring their geoboards with them so their classmates can see how they built the situation and found their way to an answer.

> ***Teacher*** *Now that you've had a little while to investigate this problem, let's share our answers and then have a few volunteers show us how they modeled the situation on their geoboards. What part of the pan of brownies did Maribel eat?*
>
> ***Students*** *We said she ate $\frac{1}{4}$ of the pan.*
> *We got $\frac{1}{8}$ of the pan.*
> *We got $\frac{2}{16}$.*
>
> ***Teacher*** *Who'd like to share their strategy for building this problem on the geoboard?*
>
> ***Rian*** *We said if the geoboard is the whole pan of brownies, we only need half because that's all that was left. So we made a rectangle on half the board, like this.*

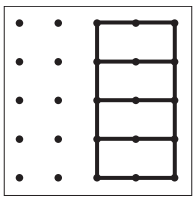


> ***Beth*** *Then we had to find a fourth of that because the problem said she ate a fourth of what was left. So we divided the half into 4 parts, like this. Then we had to think about how big one of those little parts was. We could see that each of the little pieces took up 2 squares, and we know that each square is $\frac{1}{16}$, so we said that she ate $\frac{2}{16}$.*



> ***Darius*** *We built ours the other way, like this. We could see that there would be 8 parts like that if you filled the whole pan, so one of them is $\frac{1}{8}$ of the pan.*

Activity 2 Fraction Multiplication Story Problems (cont.)

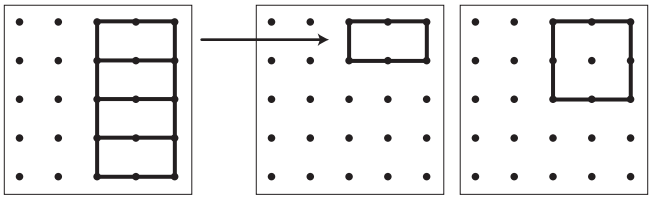


Teacher *Beth and Rian say the answer is $\frac{2}{16}$. Darius and Javier say it's $\frac{1}{8}$. Is there any connection between the two?*

Students *Sure! They're the same thing.*
It's 2 different names for the same fraction.
But I don't get it. The story says Maribel ate $\frac{1}{4}$ of what was left. And each one of those pieces is a fourth, so why are you saying that she ate $\frac{1}{8}$ or $\frac{2}{16}$? We thought the answer was $\frac{1}{4}$.

Teacher *Can anyone respond to Josie's question?*

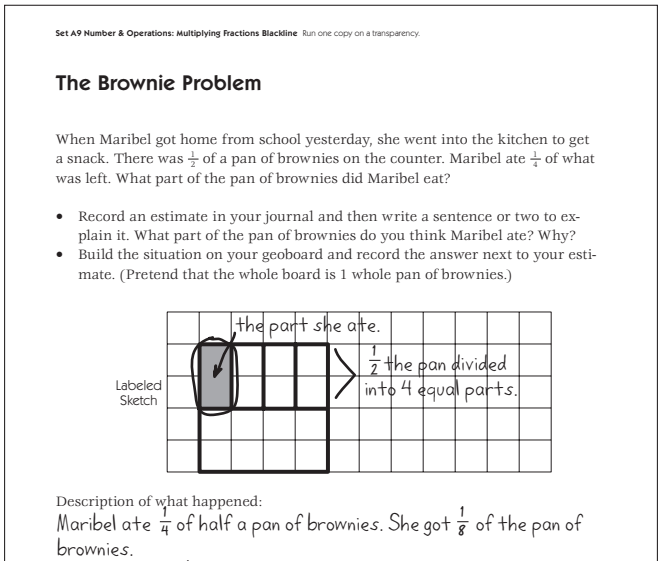
Morgan *Well, you're right. But each of those pieces on the geoboard up there is a fourth of a half a pan, not a fourth of a whole pan. It is okay if I move your rubber bands, Darius?*



See, if you look at just the piece she ate, it's $\frac{1}{8}$ of the board, like Region B, remember? I brought my board up too, and that shows a fourth of the board so you can see the difference. Maribel only got a fourth of what was left, not a fourth of the whole pan.

Josie *I think I see, but this is kind of confusing.*

5. After several students have shared their strategies and there is general consensus that the answer is $\frac{1}{8}$, work with student input to create a sketch of the situation on the grid in the middle section of the transparency, along with a written description of what happened.



Set A9 Number & Operations: Multiplying Fractions Blackline Run one copy on a transparency.

The Brownie Problem

When Maribel got home from school yesterday, she went into the kitchen to get a snack. There was $\frac{1}{2}$ of a pan of brownies on the counter. Maribel ate $\frac{1}{4}$ of what was left. What part of the pan of brownies did Maribel eat?

- Record an estimate in your journal and then write a sentence or two to explain it. What part of the pan of brownies do you think Maribel ate? Why?
- Build the situation on your geoboard and record the answer next to your estimate. (Pretend that the whole board is 1 whole pan of brownies.)

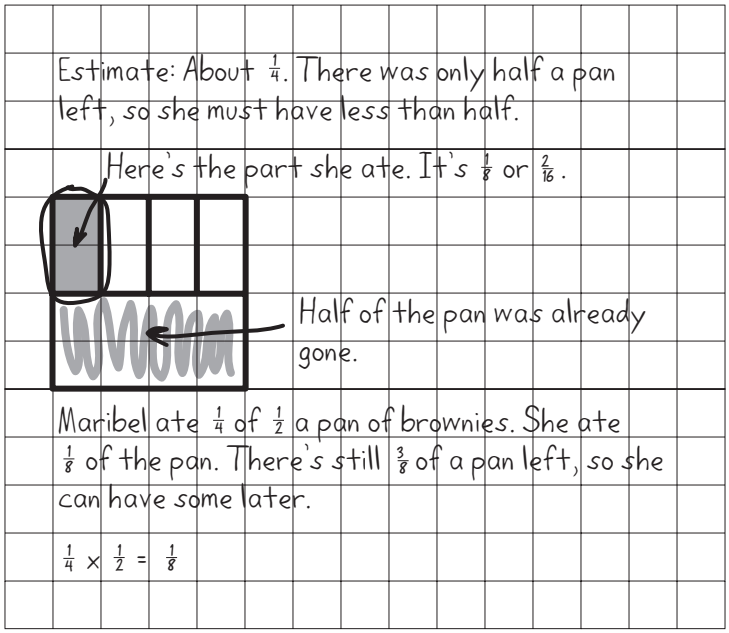
Labeled Sketch

Description of what happened:
Maribel ate $\frac{1}{4}$ of half a pan of brownies. She got $\frac{1}{8}$ of the pan of brownies.

Activity 2 Fraction Multiplication Story Problems (cont.)

6. Then explain that the expression a mathematician would use to represent the situation is $\frac{1}{4} \times \frac{1}{2}$, which is read as, "*one fourth of one half*". Record the full equation below the grid at the overhead. (The expression $\frac{1}{4} \times \frac{1}{2}$ can also be read as, "one fourth *times* one half", but we find that if we encourage our students to read it the other way, it taps into their sense-making abilities much more effectively.)

7. Ask students to make a sketch similar to the one on the overhead in their journal, shading in with a colored pencil the part of the pan of brownies that Maribel ate. Then ask them to write a description of what happened, adding any other observations they have, and an equation to match.



8. Next, place the Fraction Multiplication Story Problems transparency on display at the overhead. Review the instructions at the top with the class.

Activity 2 Fraction Multiplication Story Problems (cont.)

Set A9 Number & Operations: Multiplying Fractions Blackline Run one copy on a transparency.

Fraction Multiplication Story Problems

Here are 5 more fraction multiplication story problems. For each one that you and your partner solve, do the following:

- Write the problem number in your journal.
- Record an estimate. What do you think the answer will be and why?
- Build the situation on your geoboard and then make a labeled sketch of it in your journal.
- Write a description of what happened that includes the answer.
- Write a multiplication equation to match.

1 When Max got home from school yesterday, he went into the kitchen to get a snack. There was $\frac{3}{4}$ of a pan of brownies on the counter. Max ate $\frac{1}{4}$ of what was left. What part of the pan of brownies did Mark eat?

2 Brittany's mom had a big garden last summer. She planted corn and tomatoes in $\frac{1}{2}$ of the garden. She planted lettuce in $\frac{1}{4}$ of the garden. She used $\frac{1}{2}$ of the last $\frac{1}{4}$ of the garden for flowers. How much of the garden did she use for flowers?

3 Dontrelle was getting a new rug for his bedroom. His dad said that the rug would cover $\frac{3}{4}$ of half the floor. How much of the floor did the rug cover?

4 Maria had $\frac{7}{6}$ of a box of candy left from her birthday. She gave half of what she had left to her little sister. How much of the box of candy did her little sister get?

5 Marco had $\frac{3}{8}$ of a pizza left from dinner the night before. He gave half of what he had left to his friend. How much of a pizza did his friend get?

9. There are several ways you might handle the remainder of the activity, depending on the strengths and needs of your class.

- Do one of the five problems as a group. You can re-use the middle portion of the Brownie Problem transparency to record a sketch, written description, and equation to match the situation. After completing one of the problems, have students work in pairs to do the rest, each individual responsible for completing all the steps in his or her journal.
- Allow those students who feel ready to work independently to do so, while you work with the others, going through as many of the problems as time allows.
- Work through as many of the problems at the overhead as time allows with the entire class.

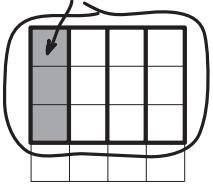
Whether you choose to have student pairs work independently on some or all of these problems or keep the entire class together, ask students to follow each of the steps outlined on the transparency. Writing a description of what happened, including the answer, and an equation to match may be the most challenging part for some of your students. However, if they come away from today's experiences understanding that $\frac{1}{2} \times \frac{1}{4}$ means *half of a fourth*, able to picture such a situation and think about it sensibly, they'll be well on their way to developing the insights they need to understand multiplication of fractions.

Activity 2 Fraction Multiplication Story Problems (cont.)

Here are sample responses to the 5 problems.

1.

The part Max ate



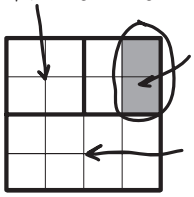
$\frac{3}{4}$ of a pan, split into 4 parts.

Max ate $\frac{1}{4}$ of $\frac{3}{4}$ of a pan of brownies. He got $\frac{3}{16}$ of the pan.

$\frac{1}{4} \times \frac{3}{4} = \frac{3}{16}$

2.

$\frac{1}{4}$ for lettuce



$\frac{1}{2}$ of a fourth for flowers.

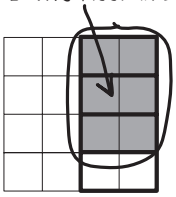
$\frac{1}{2}$ for corn & tomatoes.

Britanny's mom used $\frac{1}{2}$ of a fourth of her garden for flowers. There were flowers in $\frac{1}{8}$ of the garden.

$\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$

3.

$\frac{1}{2}$ the floor in D's room

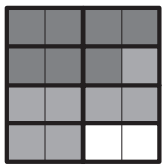


Rug covered $\frac{3}{4}$ of half the room.

The rug covered $\frac{3}{4}$ of $\frac{1}{2}$ the room, so it took up $\frac{3}{8}$ of the floor.

$\frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$

4.



I colored in $\frac{7}{8}$ of the box.

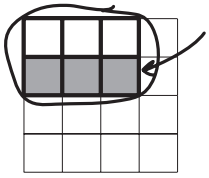
The half the sister got is colored in darker.

The sister got $\frac{1}{2}$ of $\frac{7}{8}$ of a box of candy. She got $\frac{7}{16}$ of the box.

$\frac{1}{2} \times \frac{7}{8} = \frac{7}{16}$

5.

Marco had $\frac{3}{8}$ of a pizza left.



Here's the half his friend got.

Marco's friend got $\frac{1}{2}$ of $\frac{3}{8}$ of a pizza. He got $\frac{3}{16}$ of the pizza.

$\frac{1}{2} \times \frac{3}{8} = \frac{3}{16}$

The Brownie Problem

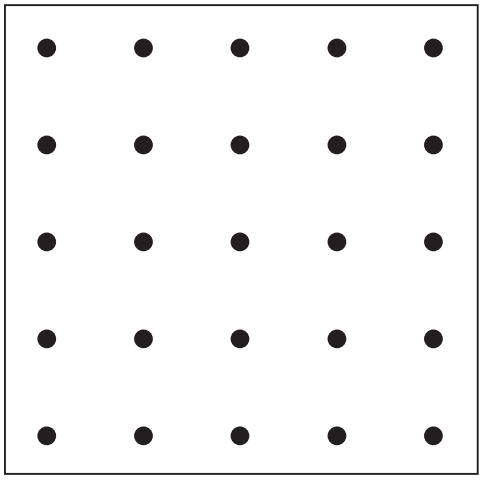
When Maribel got home from school yesterday, she went into the kitchen to get a snack. There was $\frac{1}{2}$ of a pan of brownies on the counter. Maribel ate $\frac{1}{4}$ of what was left. What part of the pan of brownies did Maribel eat?

- Record an estimate in your journal and then write a sentence or two to explain it. What part of the pan of brownies do you think Maribel ate? Why?
- Build the situation on your geoboard and record the answer next to your estimate. (Pretend that the whole board is 1 whole pan of brownies.)

Labeled Sketch

Description of what happened:

Equation: _____



Fraction Multiplication Story Problems

Here are 5 more fraction multiplication story problems. For each one that you and your partner solve, do the following:

- Write the problem number in your journal.
- Record an estimate. What do you think the answer will be and why?
- Build the situation on your geoboard and then make a labeled sketch of it in your journal.
- Write a description of what happened that includes the answer.
- Write a multiplication equation to match.

1 When Max got home from school yesterday, he went into the kitchen to get a snack. There was $\frac{3}{4}$ of a pan of brownies on the counter. Max ate $\frac{1}{4}$ of what was left. What part of the pan of brownies did Mark eat?

2 Brittany's mom had a big garden last summer. She planted corn and tomatoes in $\frac{1}{2}$ of the garden. She planted lettuce in $\frac{1}{4}$ of the garden. She used $\frac{1}{2}$ of the last $\frac{1}{4}$ of the garden for flowers. How much of the garden did she use for flowers?

3 Dontrelle was getting a new rug for his bedroom. His dad said that the rug would cover $\frac{3}{4}$ of half the floor. How much of the floor did the rug cover?

4 Maria had $\frac{7}{8}$ of a box of candy left from her birthday. She gave half of what she had left to her little sister. How much of the box of candy did her little sister get?

5 Marco had $\frac{3}{8}$ of a pizza left from dinner the night before. He gave half of what he had left to his friend. How much of a pizza did his friend get?

Set A9 ★ Activity 3

ACTIVITY

Using the Area Model for Multiplying Fractions

Overview

Students use the area model to multiply fractions, as they build rectangles on their geoboards with fractional dimensions and find the areas. Then students write their own story problems to accompany one or more of the fraction multiplication combinations with which they have worked today.

Skills & Concepts

★ find the product of two unit fractions with small denominators using an area model

★ estimate the results of operations performed on fractions and use the estimate to determine the reasonableness of the final answer

★ explain the relationship of the product relative to the factors when multiplying fractions

You'll need

★ The Brownie Problem from Activity 2 (see Advance Preparation)

★ Journal Page Grid (page A9.24, run 1 copy on a transparency)

★ overhead geoboard and rubber bands

★ overhead pens in several colors, including red

★ a piece of paper to mask portions of the overhead

★ $5\frac{3}{4}''$ x $\frac{1}{4}''$ strips of red construction paper (available to students as needed)

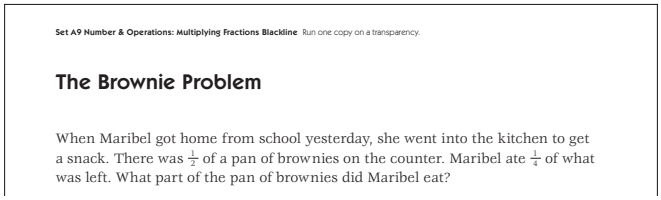
★ regular and colored pencils (each student will need red and one other color)

★ Student Math Journals

Advance Preparation To start this session, you'll need to have The Brownie Problem transparency from Activity 2 filled in with the solution to the original problem. If you used this transparency to model responses to some of the other story problems during the previous activity, erase the work and enter a sketch, written description, and number sentence for the original problem.

Instructions for Using the Area Model for Multiplying Fractions

1. Open today's session by placing a small pile of the $5\frac{3}{4}'' \times \frac{1}{4}''$ red construction paper strips on each table or cluster of desks so students will have easy access to them. Then show the top portion of The Brownie Problem transparency from Activity 2 as students get out their journals, geoboards, and rubber bands.



Set A9 Number & Operations: Multiplying Fractions Blackline Run one copy on a transparency.

The Brownie Problem

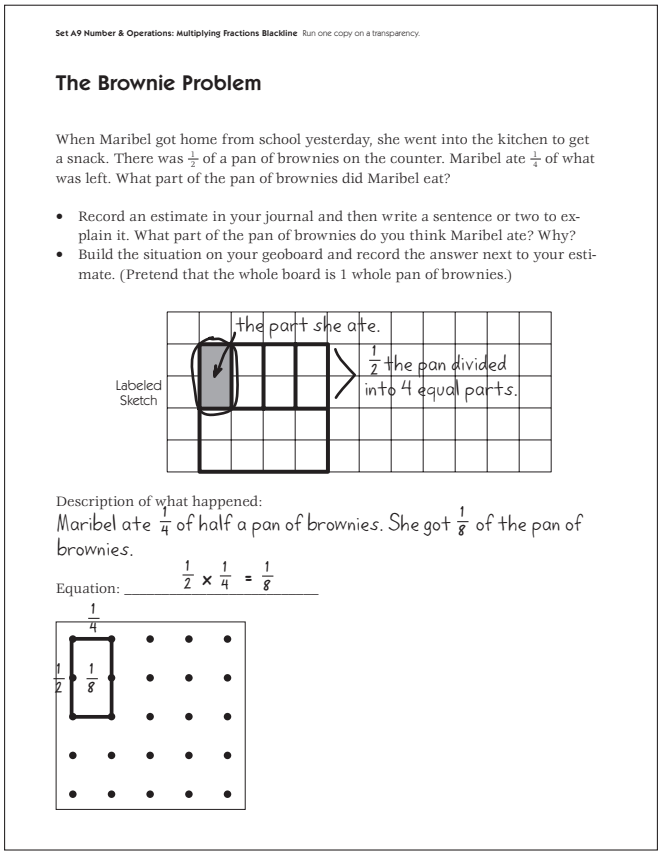
When Maribel got home from school yesterday, she went into the kitchen to get a snack. There was $\frac{1}{2}$ of a pan of brownies on the counter. Maribel ate $\frac{1}{4}$ of what was left. What part of the pan of brownies did Maribel eat?

2. Read the problem with the class and ask students to pair-share the responses they recorded in their journals during the previous activity. Then ask each student to build on his or her geoboard just the part

Activity 3 Using the Area Model for Multiplying Fractions (cont.)

of the pan of brownies Maribel got to eat. What are the dimensions and the area of this rectangle? Give students a minute to pair share, using some of the red construction paper strips to help figure it out if they need to.

3. Then show the entire transparency and invite a student volunteer to the overhead to sketch the rectangle on the geoboard at the bottom of the sheet, labeling the dimensions and area with input from classmates.



Set A9 Number & Operations: Multiplying Fractions Blackline Run one copy on a transparency.

The Brownie Problem

When Maribel got home from school yesterday, she went into the kitchen to get a snack. There was $\frac{1}{2}$ of a pan of brownies on the counter. Maribel ate $\frac{1}{4}$ of what was left. What part of the pan of brownies did Maribel eat?

- Record an estimate in your journal and then write a sentence or two to explain it. What part of the pan of brownies do you think Maribel ate? Why?
- Build the situation on your geoboard and record the answer next to your estimate. (Pretend that the whole board is 1 whole pan of brownies.)

Labeled Sketch

Description of what happened:
Maribel ate $\frac{1}{4}$ of half a pan of brownies. She got $\frac{1}{8}$ of the pan of brownies.

Equation: $\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$

4. Now record the following expression on the Journal Page Grid transparency, as students do so in their journals.

$$\frac{1}{2} \times \frac{1}{2}$$

Ask students to read the expression, using the same language they did during the previous activity: "One half of one half" or "Half of a half". Give them a minute to record an estimate, with the understanding that they may be called upon to explain their thinking. Then call on a student or two to share and explain their estimates.

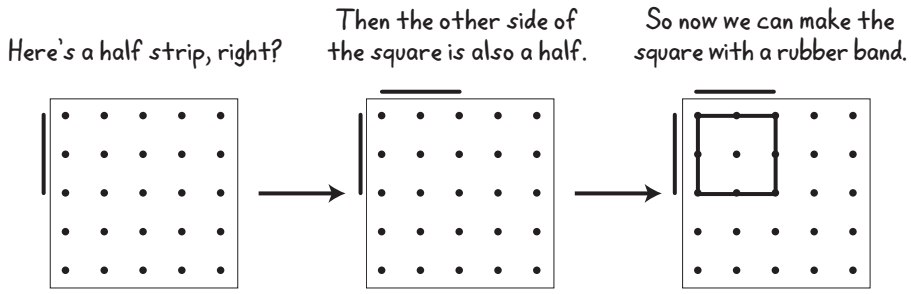
> ***Jasmine*** *I know it's going to be less than a half, because it's only half of a half, so it can't be the whole thing.*
>
> ***Javier*** *I said it was going to be $\frac{1}{4}$, because if you cut $\frac{1}{2}$ in half, you get $\frac{1}{4}$.*

Activity 3 Using the Area Model for Multiplying Fractions (cont.)

5. Next, ask students to build a square with dimensions ½ × ½ on their geoboards, working together to share and compare ideas. If they are not sure how to build the figure, encourage them to use the red construction paper linear strips, remembering that each strip has been assigned a value of 1 linear unit.

Darius *Okay, half of a half. I know it's going to be a fourth, but I'm not sure how to show it on the geoboard. How do you make something that's a half by a half?*

Armin *We can use those red strips, remember? They're like giant linear units, so we can fold one in half and put it next to the geoboard to help.*



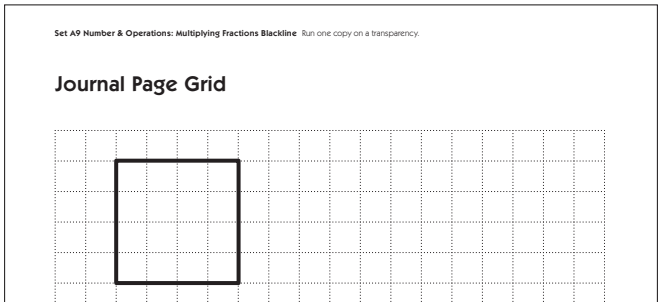
Darius *Oh yeah – it's all coming back to me. And look! A square that's half by a half really does turn out to be one-fourth of the board.*

Kamela *That's because half of a half is a fourth, just like we thought it would be.*

6. When most have completed this task, ask a volunteer to build the figure at the overhead, explaining her thinking as she does so. Then work with student input to make a sketch of the problem on the Journal Page Grid transparency.

Teacher *How can we make a sketch of this problem on the kind of grid paper you have in your journals?*

Justin *First you need to outline a geoboard, like a 4 x 4 square.*


Set A9 Number & Operations: Multiplying Fractions Blackline Run one copy on a transparency.

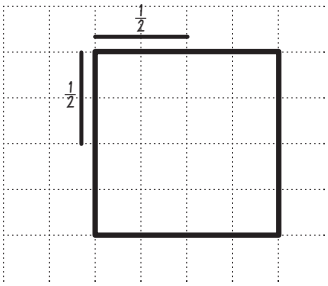
Journal Page Grid

Teacher *And then?*

Raven *Then you need to draw in the dimensions – how long each side of the square is going to be.*

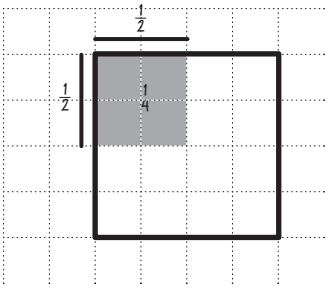
Teacher *Raven, why don't you come up and do that for us. Go ahead and use the red pen to show the dimensions. That way they'll match the color of our linear strips.*

Activity 3 Using the Area Model for Multiplying Fractions (cont.)



Teacher *Thanks, Raven. What should we do now, class?*

Jade *Now just draw in the rectangle and put a label that shows its area, like this. Let's color it in so it shows up better.*



7. Once a sketch of the combination and the solution has been created at the overhead, have students replicate the sketch in their journal, using red colored pencil to show the dimensions and a second color to shade in the square that results.

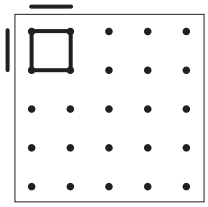
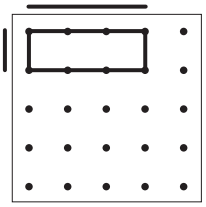
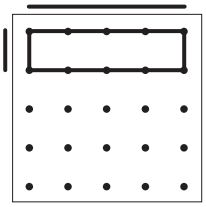
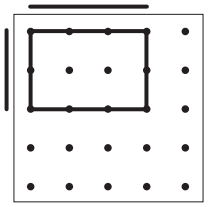
8. Repeat steps 4–7 with the following combinations:

$\frac{1}{4} \times \frac{1}{4}$ $\frac{1}{4} \times \frac{3}{4}$ $\frac{1}{4} \times 1$ $\frac{1}{2} \times \frac{3}{4}$

In each case, have students complete the following steps:

- Read the expression after you've written it on the board, using the word *of* instead of *times*, i.e., "*one fourth of one fourth*" or "*one fourth of three fourths*."
- Record the expression in their journal along with an estimate of the answer.
- Build the combination on their geoboard, working with the students nearest them to share and compare ideas and results. Invite at least one volunteer to the overhead to share his thinking, using his own board. If there is confusion or debate, you may want to have several students share their thinking with the class. Be sure to bring misconceptions into the open so everyone benefits.
- Record both a sketch and the answer in their journal.

Activity 3 Using the Area Model for Multiplying Fractions (cont.)

$\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$  Area = $\frac{1}{16}$	$\frac{1}{4} \times \frac{3}{4} = \frac{3}{16}$  Area = $\frac{3}{16}$	$\frac{1}{4} \times 1 = \frac{1}{4}$  Area = $\frac{1}{4}$	$\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$  Area = $\frac{6}{16}$

9. Conclude the activity by asking students to write a story problem to accompany at least one of the fraction multiplication problems they have done today. Here are several examples of the kinds of story problems we've seen fifth graders write in response to this assignment.

- *My little brother is always coming into my room and bothering me, so finally I got some tape and marked off a fourth of a fourth of the room for him to play in. What part of the room did he get?* ($\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$)

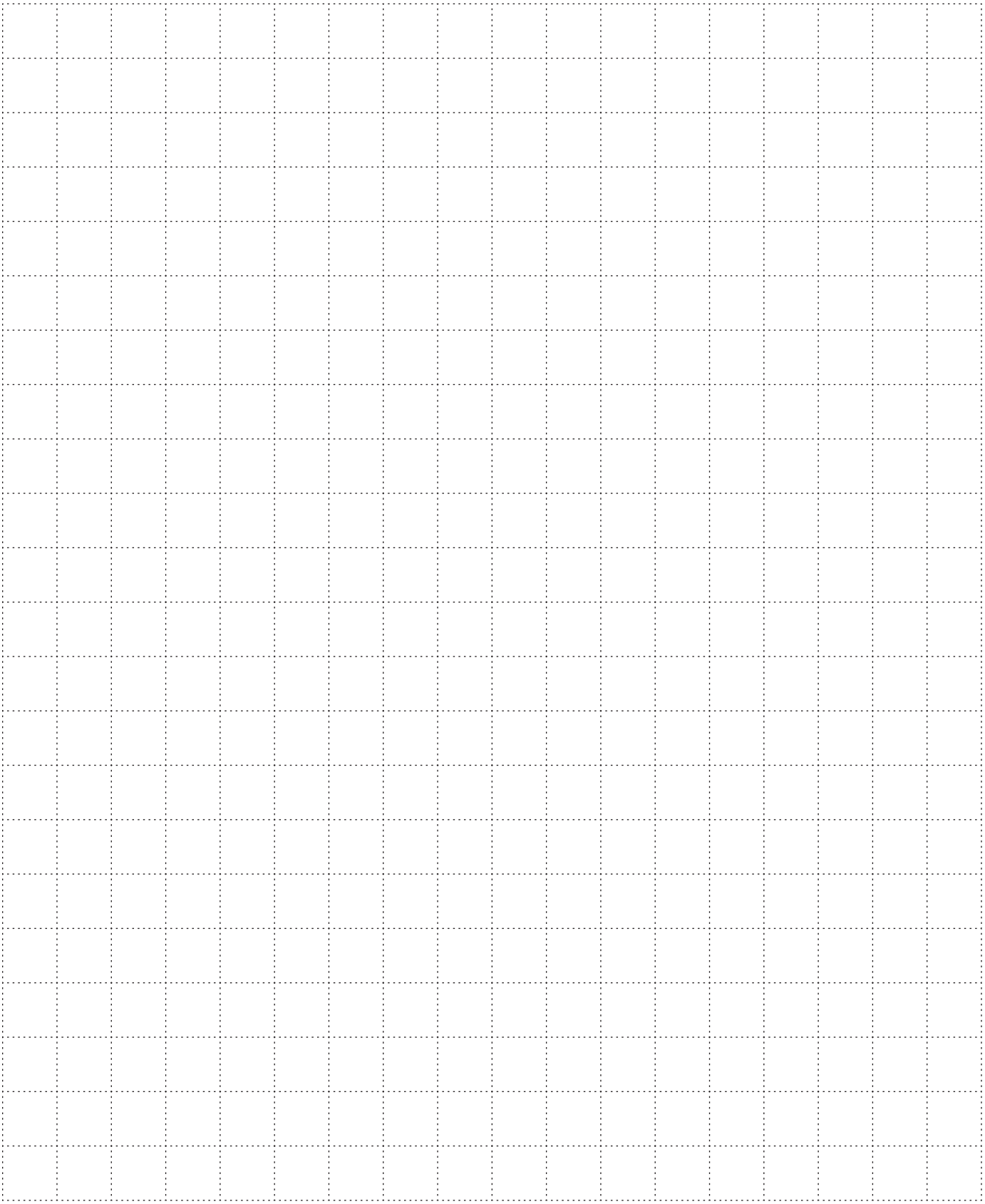
- *My dad said we could set up our volleyball net in the back half of our yard. When we did, it took up* $\frac{3}{4}$ *of the space. How much of the yard did it fill?* ($\frac{3}{4} \times \frac{1}{2} = \frac{6}{16}$).

- *I had* $\frac{3}{4}$ *of a candy bar left. I gave a* $\frac{1}{4}$ *of that to my best friend. How much of my candy bar did she get?* ($\frac{1}{4} \times \frac{3}{4} = \frac{3}{16}$)

Extensions

- Post a display in the hall that shows each multiplication combination, accompanied by a sketch and the student-written story problems that match.
- If there is another fifth grade class in your school using Bridges, have the two classes trade story problems. Each student in your room can solve one of the problems written by a student in the other class, and send back a very complete and detailed record of his or her solution and strategy. (Our students really enjoy seeing how other fifth-graders solve their problems.)

Journal Page Grid



Set A9 ★ Activity 4

ACTIVITY

Generalizations About Multiplying Fractions

Overview

Students sketch and solve a variety of fraction multiplication combinations on grid paper. The teacher then guides them to the generalization that the product of any two fractions can be found by multiplying their numerators and then multiplying their denominators.

Skills & Concepts

★ find the product of two unit fractions with small denominators using an area model

★ multiply fractions using the standard algorithm

★ explain the relationship of the product relative to the factors when multiplying fractions

You'll need

★ Fractions to Multiply (page A9.30, run 1 copy on a transparency)

★ Multiplying Fractions (pages A9.31 & A9.32, run 1 copy of each sheet on a transparency, and a class set)

★ red, blue and black pens for the overhead

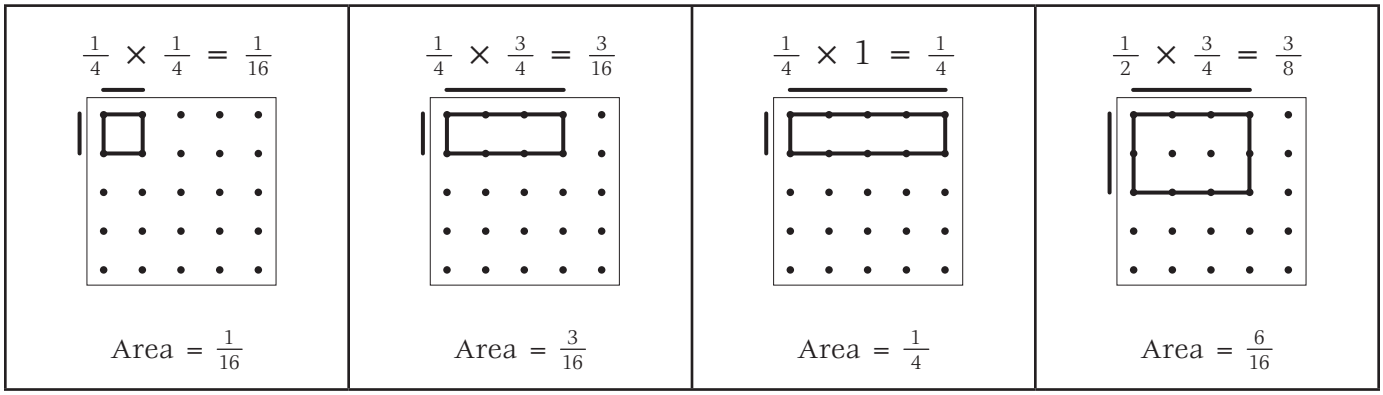
★ paper to mask portions of the transparency

★ Student Math Journals

★ colored pencils

Instructions for Generalizations about Multiplying Fractions

1. Have students open their math journals to the work they did during the previous session. Ask them to pair-share any observations they can make so far about multiplying fractions. After a minute or two, ask volunteers to share their thinking with the class.



Students *When you multiply a fraction by 1, it stays the same, like $\frac{1}{4}$ times 1 is just $\frac{1}{4}$.*
It seems like when you multiply one fraction by another, the answer is always smaller than what you started with.
Yeah, like $\frac{1}{4}$ times $\frac{1}{4}$ is $\frac{1}{16}$. It's kind of weird, because usually when you multiply, you get a bigger answer.
It makes sense if you remember that $\frac{1}{4} \times \frac{1}{4}$ is really one-fourth of a fourth.
I think you can just get the answers by multiplying across.

Activity 4 Generalizations About Multiplying Fractions (cont.)

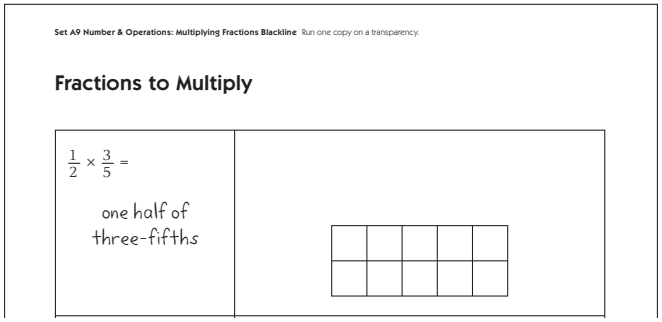
Teacher *Multiplying across? How are you thinking about that, Brianna?*

Brianna *Can I show at the board? Look, we know that a fourth of a fourth is a sixteenth, right? So just multiply 1 times 1, and you get 1, and 4 times 4 and you get 16. Or $\frac{1}{4}$ times $\frac{3}{4}$ is $\frac{3}{16}$. We showed that on our boards yesterday. But look what happens when I write the numbers and multiply across. 1 times 3 is 3, and 4 times 4 is 16!*

$\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$ $\quad$ $\frac{1}{4} \times \frac{3}{4} = \frac{3}{16}$

Teacher *So, you're saying that if you multiply the numerators, and then multiply the denominators, you get the same answers we did when we built and sketched the combinations? That's an interesting observation. Do you think it will work every time? Let's keep the idea in mind as we look at some more problems today.*

2. Explain that you have some more fraction multiplication problems for the class today. Then show the first problem on the Fractions to Multiply transparency. Read the first problem with the students, and work with their input to record the phrase that will help them think sensibly about the combination. Have students pair-share estimates, and ask several volunteers to share their thinking with the class.


Set A9 Number & Operations: Multiplying Fractions Blackline Run one copy on a transparency.

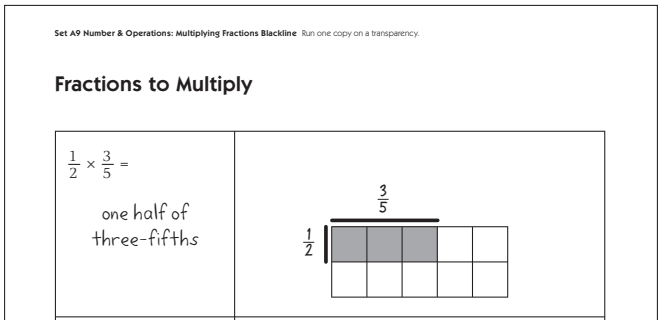
Fractions to Multiply

$\frac{1}{2} \times \frac{3}{5} =$

one half of three-fifths

Students *We know it's going to be less than $\frac{3}{5}$ because it's only half of that.*
We think maybe the answer is going to be $\frac{3}{10}$ because half of one fifth is one tenth, so maybe half of three fifths would be $\frac{3}{10}$.
If you use my idea about multiplying across, you get $\frac{3}{10}$.

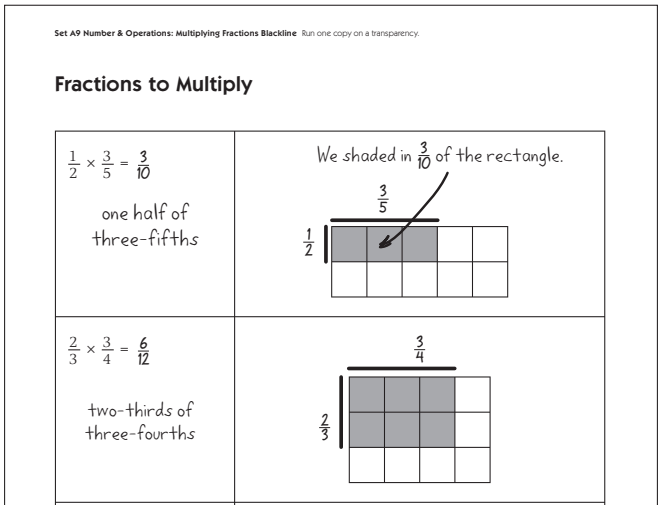
3. Work with input from the class to frame a rectangle on the grid that is $^1/_2$ by $^3/_5$. Then shade in the resulting region, and ask students to identify the area of the rectangle relative to the whole grid.



Activity 4 Generalizations About Multiplying Fractions (cont.)

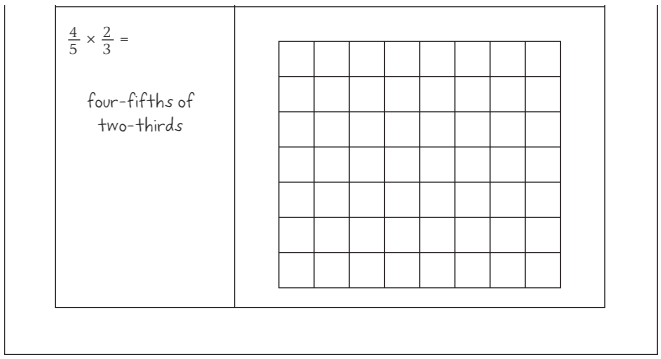
Students *So, the answer is $\frac{3}{5}$, right?*
That doesn't make sense! It should only be half of $\frac{3}{5}$.
But there are 3 boxes colored in and 5 in the row, so it's $\frac{3}{5}$.
Wait a minute! There are 10 boxes in the whole grid. We marked half on one side and $\frac{3}{5}$ along the top, and the part we colored in is $\frac{3}{10}$.

4. When there is general agreement that the answer is $^3/_{10}$, record it on the transparency. Then show the next combination. Read it with the class and write a verbal "translation" below the problem. Have students open their journals to the next available page, record the combination, and outline a 3 × 4 rectangle. Give them a minute or two to solve the problem, sharing and comparing their work with others nearby as they work. Then invite a volunteer to the overhead to share his or her thinking with the class.



Sergio *First I marked $\frac{2}{3}$ on one side of the grid. Then I marked $\frac{3}{4}$ on the other side. When I colored in the area it was 6. That's really $\frac{6}{12}$ because there are 12 boxes in the whole grid.*

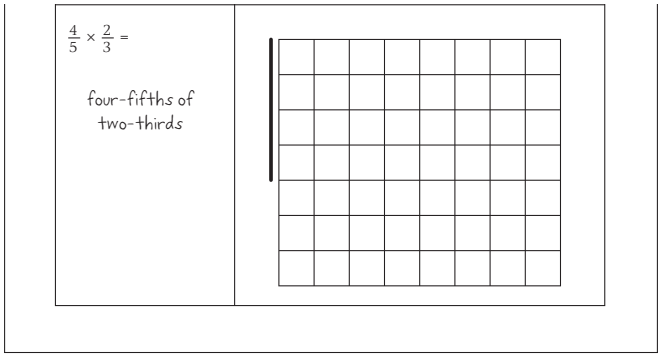
5. Repeat step 4 with the last combination on the transparency, $^4/_5 \times {}^2/_3$. This time, however, students will have to decide what size rectangle to outline before they model the combination.



Teacher *Can someone come up and mark a dimension of $\frac{4}{5}$ along the side of this grid? Maria?*

Maria *Sure! Just mark 4 down the side, like this.*

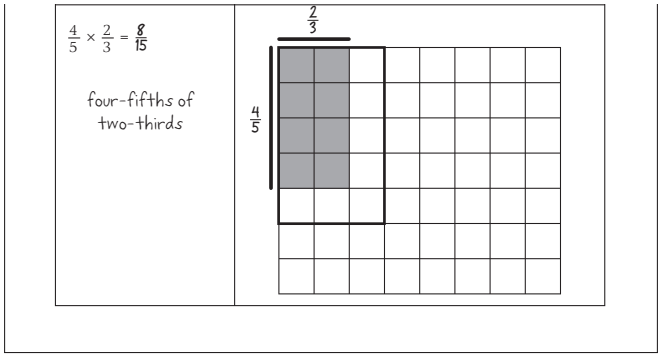
Activity 4 Generalizations About Multiplying Fractions (cont.)



Teacher *Do you all agree that this shows $\frac{4}{5}$ of the side of the grid? Talk with the person next to you for a minute, and then let's hear what you think.*

Students *Yep, we agree. It's 4 down the side.*
We don't agree. There are 7 squares down the side. If you mark 4 of them, it's like $\frac{4}{7}$, not $\frac{4}{5}$.
I think you can't use that whole grid. You have to make one where you can show fifths on one side and thirds on the other.

6. After some discussion, work with input from students to outline a rectangle that will work for this combination. Then mark the dimensions, shade in the region that results, and record the answer at the overhead, as students do so in their journals.



7. Give students each a copy of the Multiplying Fractions sheets and display the corresponding transparencies at the overhead. Review and discuss the tasks with the class. Give students the option of working on these sheets independently, in pairs, or with you.

Activity 4 Generalizations About Multiplying Fractions (cont.)

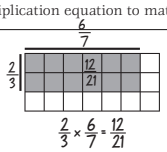
Set A9 Number & Operations: Multiplying Fractions Blackline Run a class set and 1 copy on a transparency.

NAME _____ DATE _____

Multiplying Fractions page 1 of 2

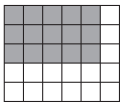
1 Each of the pictures below shows the results of multiplying one fraction by another. Label each of the shaded regions with its dimensions and area . Then write a multiplication equation to match

ex

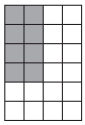


$\frac{2}{3} \times \frac{6}{7} = \frac{12}{21}$

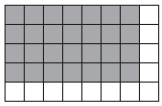
a



b



c



2 Fill in the chart to solve each of the problems below.

Multiplication Expression	Word to Match	Labeled Sketch	Answer
ex $\frac{2}{3} \times \frac{2}{3} =$	two-thirds of two-thirds		$\frac{4}{9}$
a $\frac{3}{4} \times \frac{3}{5} =$			
b $\frac{2}{4} \times \frac{5}{6} =$			

Set A9 Number & Operations: Multiplying Fractions Blackline Run a class set and 1 copy on a transparency.

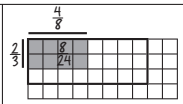
NAME _____ DATE _____

Multiplying Fractions page 2 of 2

3 Solve each of the multiplication problems below. For each:
- outline a rectangle on the grid that will work for both fractions.
- draw and label the dimensions and area, and write the answer.
- write the problem and answer in words.

ex

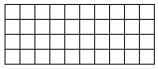
$\frac{2}{3} \times \frac{4}{8} = \frac{8}{24}$



Two-thirds of four-eighths is eight twenty-fourths.

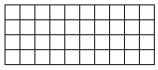
a

$\frac{1}{3} \times \frac{3}{4} =$



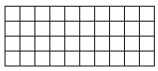
b

$\frac{2}{4} \times \frac{7}{8} =$



c

$\frac{2}{3} \times \frac{8}{10} =$



4 Sara says that to multiply two fractions, all you have to do is multiply one numerator by the other, and multiply one denominator by the other. Do you agree? Why or why not?

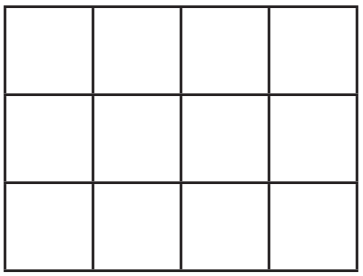
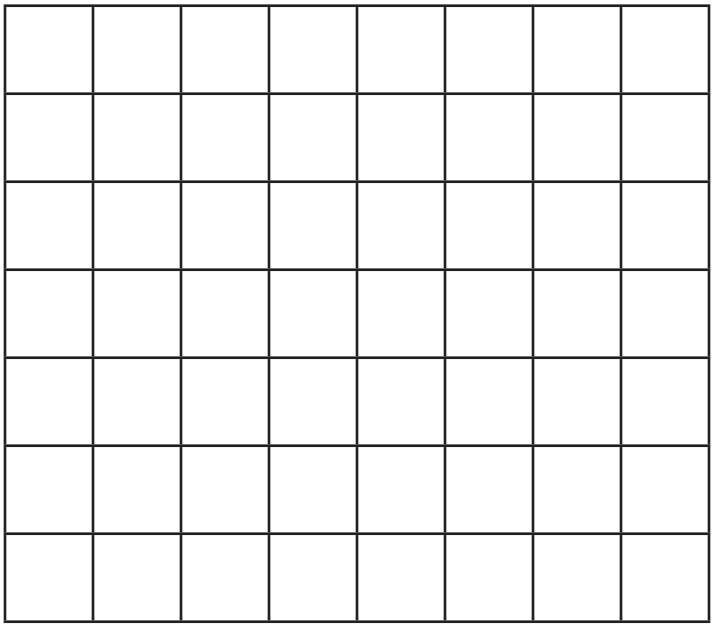
8. After students have completed the worksheets, discuss the fourth problem with the group, and guide them to the generalization that the product of two fractions is found by multiplying the numerators and then multiplying the denominators. Also, ask students to explain why the product of two fractions is smaller than either of the factors.

> ***Students*** *Multiplying two fractions is like finding a fraction of a fraction. Half of a half has to be smaller than a half.*
> *Or, like if you find a fourth of a half, it's only an eighth.*
> *It goes the other way, too. A half of a fourth is an eighth.*

INDEPENDENT WORKSHEETS

See Set A9 Independent Worksheets 1–3 for more practice with multiplying fractions.

Fractions to Multiply

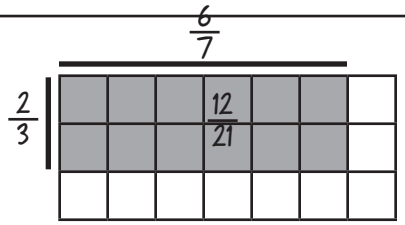
$\frac{1}{2} \times \frac{3}{5} =$	
$\frac{2}{3} \times \frac{3}{4} =$	
$\frac{4}{5} \times \frac{2}{3} =$	

NAME _____ **DATE** _____

Multiplying Fractions page 1 of 2

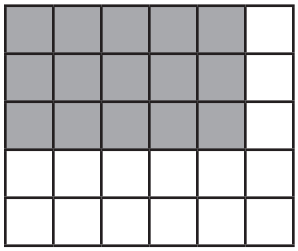
1 Each of the pictures below shows the results of multiplying one fraction by another. Label each of the shaded regions with its dimensions and area . Then write a multiplication equation to match

ex

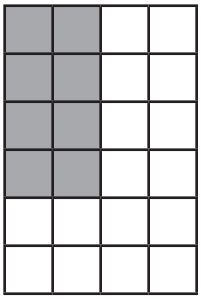


$\frac{2}{3} \times \frac{6}{7} = \frac{12}{21}$

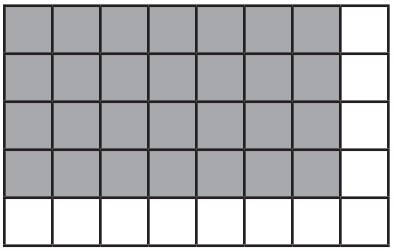
a



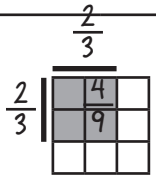
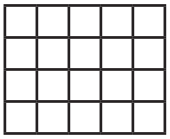
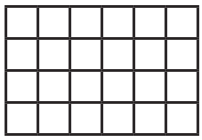
b



c



2 Fill in the chart to solve each of the problems below.

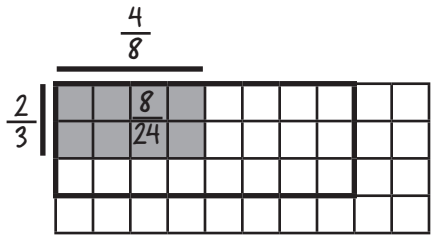
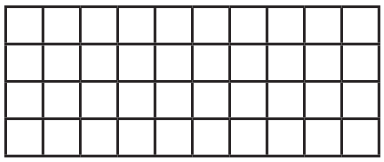
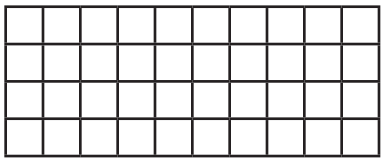
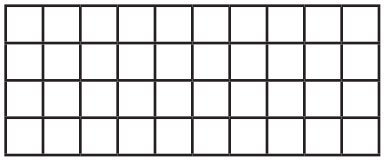
Multiplication Expression	Word to Match	Labeled Sketch	Answer
ex $\frac{2}{3} \times \frac{2}{3} =$	two-thirds of two-thirds		$\frac{4}{9}$
a $\frac{3}{4} \times \frac{3}{5} =$			
b $\frac{2}{4} \times \frac{5}{6} =$			

NAME _____ **DATE** _____

Multiplying Fractions page 2 of 2

3 Solve each of the multiplication problems below. For each:

- outline a rectangle on the grid that will work for both fractions.
- draw and label the dimensions and area, and write the answer.
- write the problem and answer in words.

ex $\frac{2}{3} \times \frac{4}{8} = \frac{8}{24}$		Two-thirds of four-eighths is eight twenty-fourths.
a $\frac{1}{3} \times \frac{3}{4} =$		
b $\frac{2}{4} \times \frac{7}{8} =$		
c $\frac{2}{3} \times \frac{8}{10} =$		

4 Sara says that to multiply two fractions, all you have to do is multiply one numerator by the other, and multiply one denominator by the other. Do you agree? Why or why not?

NAME _____ **DATE** _____

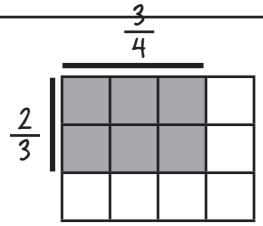
Set A9 ★ Independent Worksheet 1

INDEPENDENT WORKSHEET

Picturing Fraction Multiplication

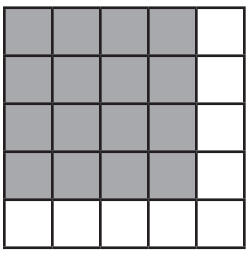
1 Each of the pictures below shows the results of multiplying one fraction by another. Label each of the shaded regions with its dimensions and area . Then write a multiplication equation to match.

ex

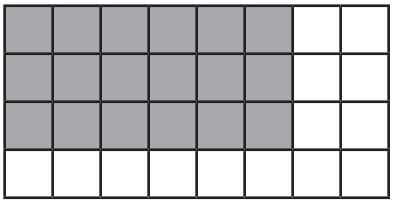


$\frac{2}{3} \times \frac{3}{4} = \frac{6}{12}$

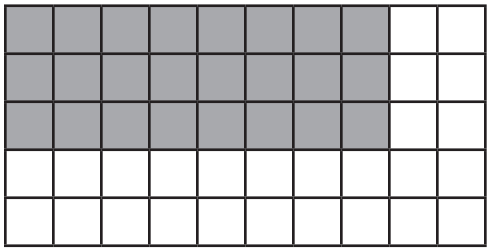
a



b



c



2 Pedro's dog, Oso, got into the kitchen last night. Oso saw three-fourths of a meat loaf still in the pan. He ate half of the meat loaf that was there before Pedro stopped him. What part of the meat loaf was still left? Use numbers, words, and/or pictures to solve the problem. Show your work.

Answer: _____ of the meat loaf was still left.

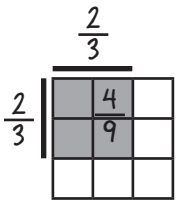
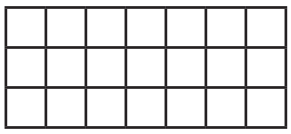
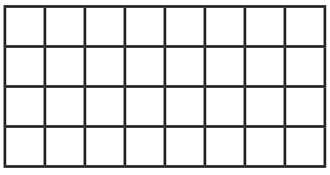
NAME _____ **DATE** _____

Set A9 ★ Independent Worksheet 2

INDEPENDENT WORKSHEET

More Fraction Multiplication

1 Fill in the chart to solve each of the problems below.

Multiplication Expression	Word to Match	Labeled Sketch	Answer
ex $\frac{2}{3} \times \frac{2}{3} =$	two-thirds of two-thirds		$\frac{4}{9}$
a $\frac{2}{3} \times \frac{6}{7} =$			
b $\frac{1}{2} \times \frac{4}{6} =$			
c $\frac{3}{4} \times \frac{4}{8} =$			

2 Multiply the numerators, then multiply the denominators to solve each problem.

$\frac{3}{4} \times \frac{2}{4} =$ $\frac{1}{4} \times \frac{3}{6} =$ $\frac{5}{6} \times \frac{1}{2} =$ $\frac{6}{7} \times \frac{3}{5} =$

$\frac{2}{3} \times \frac{4}{5} =$ $\frac{6}{8} \times \frac{1}{2} =$ $\frac{3}{4} \times \frac{1}{3} =$ $\frac{2}{7} \times \frac{2}{4} =$

NAME _____ **DATE** _____

Set A9 ★ Independent Worksheet 3

INDEPENDENT WORKSHEET

Fraction Stories

1 Jake is making cookies. The recipe says he needs three-fourths of a cup of butter, but Jake wants to cut the recipe in half. What is one-half of three-fourths of a cup of butter? Use numbers, words, and/or pictures to solve the problem. Show your work.

2 Mrs. Smith had $\frac{4}{6}$ of a carton of eggs in her refrigerator. She dropped the carton by accident and a fourth of the eggs in the carton broke. How much of a carton of eggs did she have left after she cleaned up the mess? How many eggs was that? Use numbers, words, and/or pictures to solve the problem. Show your work.

3 Write your own story problem to go with this expression. Then solve it. Use numbers, words, and/or pictures to solve the problem. Show your work.

$\frac{1}{2} \times \frac{2}{3} =$

CHALLENGE

4 Rosa bought a bag of apples. After she baked pies, she had $\frac{2}{3}$ of a bag left. Then she gave her cousin $\frac{3}{4}$ of these, which was 9 apples. How many apples did Rosa have to start?

BRIDGES IN MATHEMATICS 5

GRADE 5 SUPPLEMENT

Set A10 Number & Operations: Integers

Includes

Skills & Concepts

★ read, write, compare, and order integers in mathematical and real world situations

★ locate points defined by ordered pairs of integers

★ write an ordered pair for a point in a coordinate plane with integer coordinates

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P0809

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Set A10 Number & Operations: Integers

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P0809

Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set A10 ★ Activity 1

ACTIVITY

Introducing Integers

Overview

Students discuss the definitions of counting numbers, whole numbers, and integers. Then the class plays a game designed to help students understand integers by relating them to elevation: above sea level, at sea level, and below sea level.

Skills & Concepts

★ read, write, compare, and order integers in mathematical and real world situations

You'll need

★ Three Useful Definitions (page A10.6, run 1 copy on a transparency)

★ Elevation Bingo (page A10.7, run 1 copy on a transparency, see Advance Preparation)

★ Elevation Bingo Board A (page A10.8, run a half class set on colored copy paper)

★ Elevation Bingo Board B (page A10.9, run a half class set on white copy paper)

★ Word Resource Cards (pages A10.10–A10.12, optional, run 1 copy of each sheet on paper or cardstock)

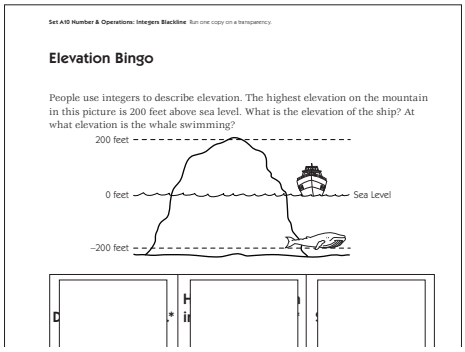
★ 1½" × 2" sticky notes (see Advance Preparation)

★ a piece of paper to mask portions of the overhead

★ red colored pencils (class set)

★ Student Math Journals

Advance Preparation Cover each of the 9 elevations on the Elevation Bingo overhead with 1½" × 2" sticky notes.


Set A10 Number & Operations: Integers Blackline Run one copy on a transparency.

Elevation Bingo

People use integers to describe elevation. The highest elevation on the mountain in this picture is 200 feet above sea level. What is the elevation of the ship? At what elevation is the whale swimming?

200 feet
0 feet
Sea Level
–200 feet

Instructions for Introducing Integers

1. Ask students to get out their math journals and pencils. Explain that you are going to give them three mathematical definitions today, which they will need to record in their journals. Then show just the top portion of the Useful Definitions overhead.

Activity 1 Introducing Integers (cont.)

Set A10 Number & Operations: Integers Blackline Run 1 copy on a transparency.

Three Useful Definitions

Counting Numbers are the set of numbers we use to count from 1 to infinity.

1, 2, 3, 4, 5, 6, 7...

Circle the counting numbers. Cross out the others.

1,000 2 –5 0.75 453 $\frac{1}{2}$ 35,040

2. Read the text with the class, and clarify as needed. Have students copy the definition into their journals. Then ask them to identify the numbers in the bottom line that fit the definition, and record just those numbers in their journals. When most students are finished, ask a volunteer to name one of the numbers he or she recorded. If he or she is correct, circle the number on the overhead.

> ***Teacher*** *Who would like to name one of the numbers from the bottom row they recorded in their journal? Sasha?*
>
> ***Sasha*** *I wrote down 1,000.*
>
> ***Teacher*** *Thumbs up if you agree with Sasha that 1,000 is a counting number. How do you know?*
>
> ***Students*** *Because you land on 1,000 when you're counting.*
> *If you count by 1's, you'll get to 1,000.*
> *It's just a regular number.*

3. Repeat this process until the students have identified, and you have circled, all of the counting numbers: 1000, 2, 453, and 35,040. Ask students to explain why you need to cross out the others in the row. (The counting numbers do not include fractions, decimals, or negative numbers.)

4. Reveal the next section of the overhead and repeat steps 2 and 3. Do the same with the last section. Then give students a few minutes to respond in their journals to the question at the bottom of the overhead.

Whole Numbers are the set of counting numbers AND zero.

0, 1, 2, 3, 4, 5, 6, 7...

Circle the whole numbers. Cross out the others.

47 –36 0 $\frac{1}{2}$ 235 0.25 $\frac{1}{4}$ 1

Integers are the set of whole numbers and their opposites.

...–3, –2, –1, 0, 1, 2, 3...

Circle the integers. Cross out the others.

567 –48 0 0.5 $\frac{1}{4}$ –1 –14,890

One example of integers in daily life is a thermometer that measures temperatures above and below 0. List at least 2 other examples of how people use integers at home, in sports, or on the job.

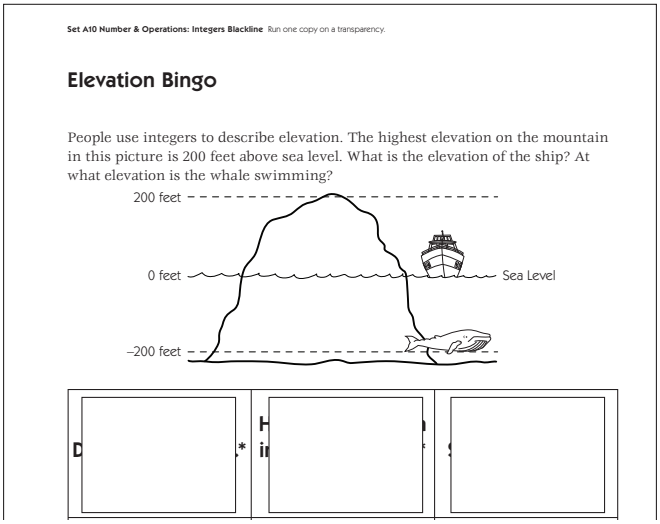
5. Have students pair-share their responses to the question, and then call on volunteers to share their ideas with the class.

Activity 1 Introducing Integers (cont.)

Students *In golf, you can get a score that's below par. If it usually takes 3 strokes to get the ball into the hole, and you do it in 2 strokes, you get a score of minus 1.*
Penalties in football are like negative numbers.
The thermometer at our house goes all the way up to 120° and all the way down to negative 60°.
There are lots of integers in my big sister's math book.
With money, you can have some, like 5 dollars, or you can have none, that's zero. Or if you owe someone money, it's kind of like a negative number.

6. Let the students know that you are going to spend several days investigating integers together. Today, you are going to play a game that involves integers. Divide the class into 2 teams. Give each of the students on Team 1 a copy of Elevation Bingo Board A, and each of the students on Team 2 a copy of Elevation Bingo Board B. Tell them that they will need a red colored pencil to play the game.

7. Place the Elevation Bingo overhead on display. Give students a few moments to examine the display quietly. Then read the text with the class, and ask students to identify the elevation of the ship and the whale in the illustration.



8. Then explain that there is an elevation recorded under each sticky note. You will let teams take turns telling you which sticky notes to remove. If either or both teams have that elevation on their board, they get to circle it and mark the elevation line to show its position. The first team to mark 3 boxes in a vertical, horizontal, or diagonal row wins.

9. Call on a student from one of the teams to tell you which sticky note to remove from the overhead.

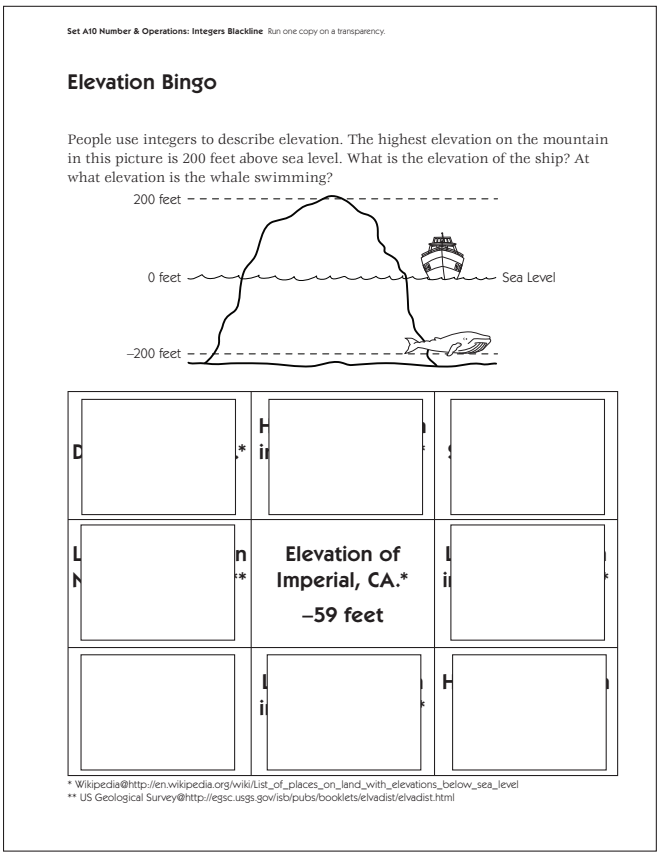
Maya *Please take off the one in the middle of the middle row.*

Students *Okay, the elevation of Imperial, California is 59 feet below sea level.*
How could a place on land be below sea level?
It could be in a valley, or a really low place.

Teacher *If you have 59 feet below sea level on your board, circle it. Then find negative 59 on the elevation line, mark it, and label it.*

Activity 1 Introducing Integers (cont.)

Students *Where's 59 on this line?*
We need to mark negative 59, not positive 59.
It goes 0, negative 100, and negative 200. Each of the marks in between must be 50.
I'm going to make a mark just a little bit below the negative 50 mark.
59 feet below sea level is like negative 59, right?



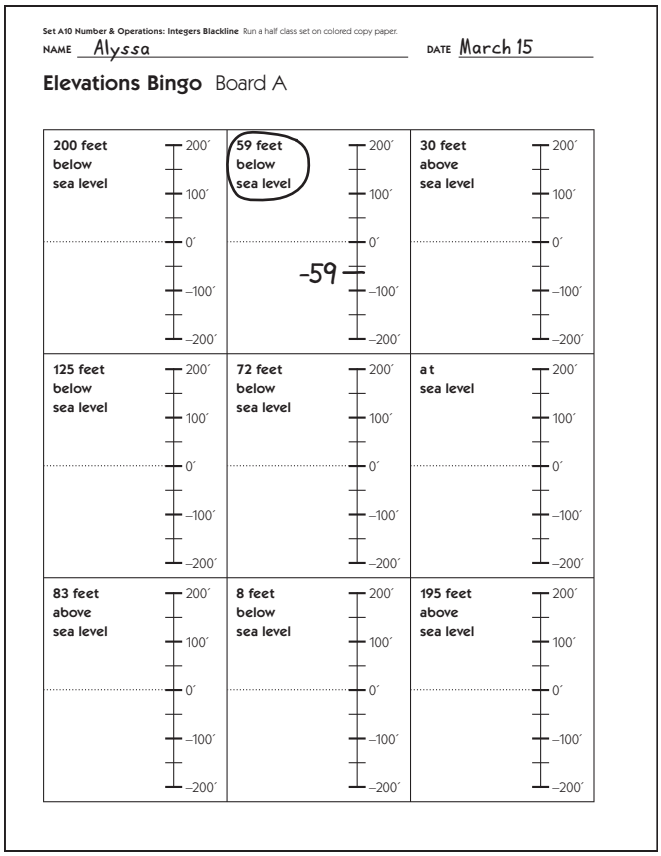
Set A10 Number & Operations: Integers Blackline Run one copy on a transparency.

Elevation Bingo

People use integers to describe elevation. The highest elevation on the mountain in this picture is 200 feet above sea level. What is the elevation of the ship? At what elevation is the whale swimming?

	Elevation of Imperial, CA.* –59 feet	

* Wikipedia@http://en.wikipedia.org/wiki/List_of_places_on_land_with_elevations_below_sea_level
** US Geological Survey@http://egsc.usgs.gov/isb/pubs/booklets/elvadist/elvadist.html



Set A10 Number & Operations: Integers Blackline Run a half class set on colored copy paper.

NAME Alyssa DATE March 15

Elevations Bingo Board A

200 feet below sea level	59 feet below sea level	30 feet above sea level
125 feet below sea level	72 feet below sea level	at sea level
83 feet above sea level	8 feet below sea level	195 feet above sea level

Each cell has a number line: 200′, 100′, 0′, –100′, –200′. In the 59 feet below sea level cell, –59 is marked.

10. Call on a student from the other team to tell you which sticky note to remove, and repeat the process described above. Continue until one of the teams has marked 3 boxes in a horizontal, vertical, or diagonal row.

11. When one of the teams has won, remove all of the sticky notes from the overhead. Discuss the set of elevations with the class. Here are some questions and prompts you might pose:

- Which elevation on the overhead is the lowest? Which is the highest?
- List the elevations in order from lowest to highest in your journal. When you are finished, we will list them together on the board so you can check your work.
- How do you know that 72 feet below sea level is lower than 59 feet below sea level?
- How do you know that 125 feet below sea level is lower than 83 feet above sea level? A second grader might be confused because 125 is greater than 83. How would you explain this to a younger student?)
- What is the difference, in feet, between 8 feet below sea level and 30 feet above sea level? Use one of the elevation lines on your sheet to help determine the answer.
- What is the difference, in feet, between 72 feet below sea level and 83 feet above sea level? Use one of the elevation lines on your sheet to help determine the answer.

Activity 1 Introducing Integers (cont.)

Extensions

- Use pages A10.10–A10.12 to create Word Resource Cards for counting numbers, whole numbers, and integers. Post these cards in a prominent location in the classroom for students' reference.
- The Los Angeles County Office of Education has a web site that introduces integers and operations with integers at http://mathstar.lacoe.edu/lessonlinks/integers/integers_main.html. If you have access to the Internet and the necessary projection equipment, you might consider sharing the first two activities in the Introducing Integers section with your students. Integer Challenge helps students understand integers by linking them to extreme temperatures and elevations around the world. Sets of Numbers reviews the definitions of counting numbers, whole numbers, and integers, and uses effective animations to show how the three sets are related. Students who are especially interested in math and/or science might be interested in exploring these interactive computer activities on their own if you don't have time to pursue them with the class.

Three Useful Definitions

Counting Numbers are the set of numbers we use to count from 1 to infinity.

1, 2, 3, 4, 5, 6, 7...

Circle the counting numbers. Cross out the others.

1,000 2 –5 0.75 453 $\frac{1}{2}$ 35,040

Whole Numbers are the set of counting numbers AND zero.

0, 1, 2, 3, 4, 5, 6, 7...

Circle the whole numbers. Cross out the others.

47 –16 0 $\frac{2}{3}$ 235 0.25 $\frac{5}{10}$ 1

Integers are the set of whole numbers and their opposites.

...–3, –2, –1, 0, 1, 2, 3...

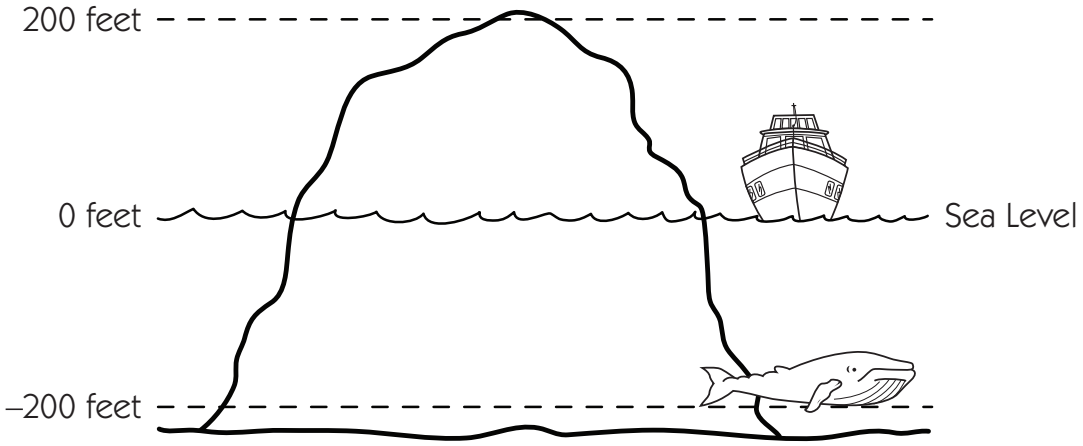
Circle the integers. Cross out the others.

567 –48 0 0.50 $\frac{3}{4}$ –1 –14,890

One example of integers in daily life is a thermometer that measures temperatures above and below 0. List at least 2 other examples of how people use integers at home, in sports, or on the job.

Elevation Bingo

People use integers to describe elevation. The highest elevation on the mountain in this picture is 200 feet above sea level. What is the elevation of the ship? At what elevation is the whale swimming?

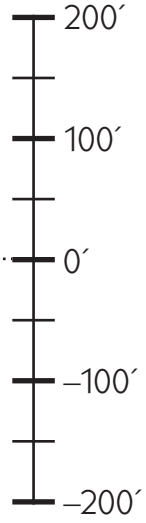
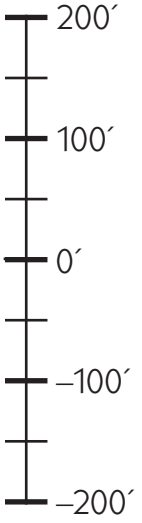
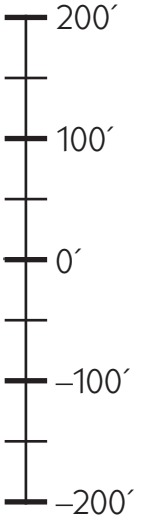
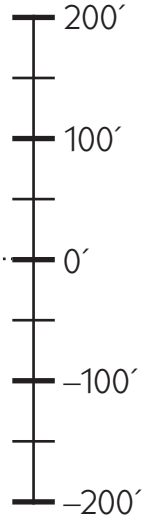
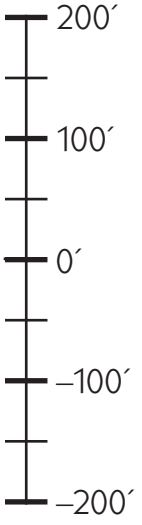
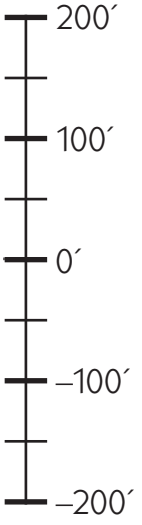
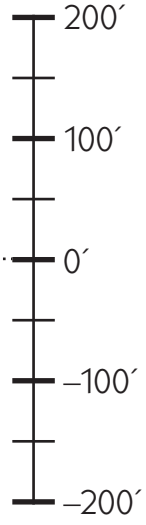
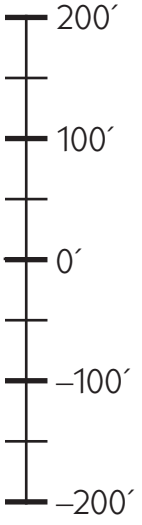
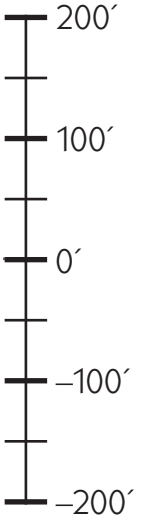


Elevation of Desert Shores, CA.* **–200 feet**	**Highest Elevation in Houston, TX.**** **83 feet**	**Elevation of Salton City, CA.*** **–125 feet**
Lowest Elevation in New Orleans, LA.** **–8 feet**	**Elevation of Imperial, CA.*** **–59 feet**	**Lowest Elevation in Memphis, TN**** **195 feet**
Elevation of Coachella, CA.* **–72 feet**	**Lowest Elevation in Portland, OR**** **Sea Level**	**Highest Elevation in Miami, FL**** **30 feet**

* Wikipedia@http://en.wikipedia.org/wiki/List_of_places_on_land_with_elevations_below_sea_level
** US Geological Survey@http://egsc.usgs.gov/isb/pubs/booklets/elvadist/elvadist.html

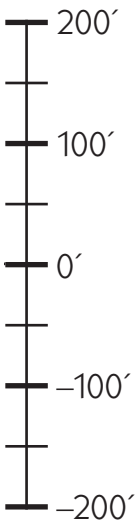
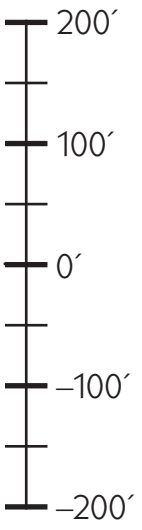
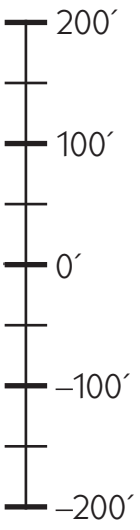
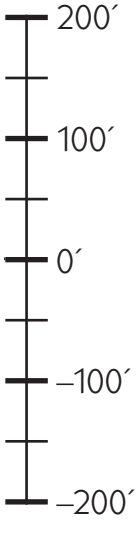
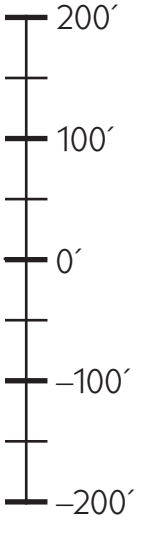
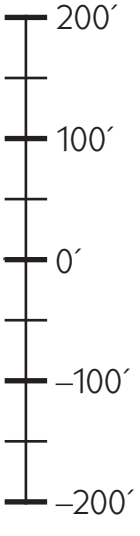
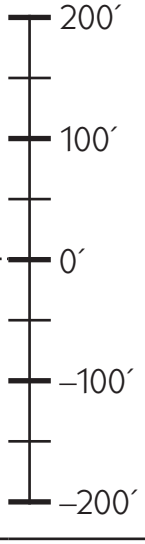
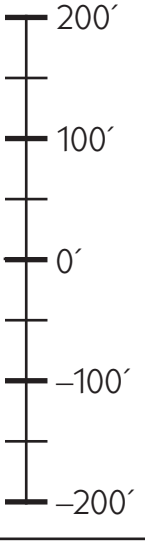
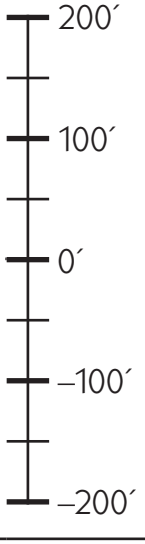
NAME _____ **DATE** _____

Elevations Bingo Board A

200 feet below sea level 	**59 feet below sea level** 	**30 feet above sea level** 
125 feet below sea level 	**72 feet below sea level** 	**At sea level** 
83 feet above sea level 	**8 feet below sea level** 	**195 feet above sea level** 

NAME _____ **DATE** _____

Elevations Bingo Board B

72 feet below sea level 	**At sea level** 	**195 feet above sea level** 
8 feet below sea level 	**83 feet above sea level** 	**125 feet below sea level** 
200 feet below sea level 	**59 feet below sea level** 	**30 feet above sea level** 

Counting Numbers

1, 2, 3, 4, 5, 6...

Counting Numbers:

also called natural numbers, this is the set of numbers used to count from 1 to infinity

Whole Numbers

1, 2, 3, 4, 5, 6...

Whole Numbers:

the set of counting numbers AND zero

Integers

...–3, –2, –1, 0, 1, 2, 3...

Integers:

the set of whole numbers and their opposites

Set A10 ★ Activity 2

ACTIVITY

Integer Tug O' War

Overview

Among the real world situations in which negative numbers appear are games such as Jeopardy and Hearts, where players score both positive and negative points, and football, where teams move in positive and negative directions with respect to their own goal line. Integer Tug O' War is a board game that bears a slight resemblance to football, in that two teams race to be the first to their own goal line, rolling positive and negative numbers to determine their moves. The teacher introduces Integer Tug O' War to the whole class, and then students play the game in pairs.

Skills & Concepts

★ read, write, compare, and order integers in mathematical and real world situations

You'll need

★ Introducing Integer Tug O' War (page A10.18, run 1 copy on a transparency)

★ Integer Tug O' War Team 1 Game Board (page A10.19, half class set on colored copy paper)

★ Integer Tug O' War Team 2 Game Board (page A10.20, half class set on white copy paper)

★ dice numbered 1–6 and 4–9 (1 of each per student pair)

★ positive and negative dice (1 per student pair, see Advance Preparation)

★ black and red linear pieces (4 of each color per student pair)

★ transparent spinner overlays (optional, half class set, see Advance Preparation)

★ Student Math Journals

Advance Preparation If you have blank dice or wood cubes, make a half class set of positive and negative dice by marking 3 sides of each die with a plus sign and 3 sides with a minus sign. Although dice are much better than spinners for this game, you can use page A10.21 to make positive and negative spinners if you don't have access to blank dice or cubes. (If you make spinners instead of dice, each pair of students will need a transparent spinner overlay.)

Note We strongly recommend that you read the rules and play Integer Tug O' War by yourself or with a partner before you teach this lesson. While the rules may seem complex at first glance, the game is simple but rich in strategic possibilities.

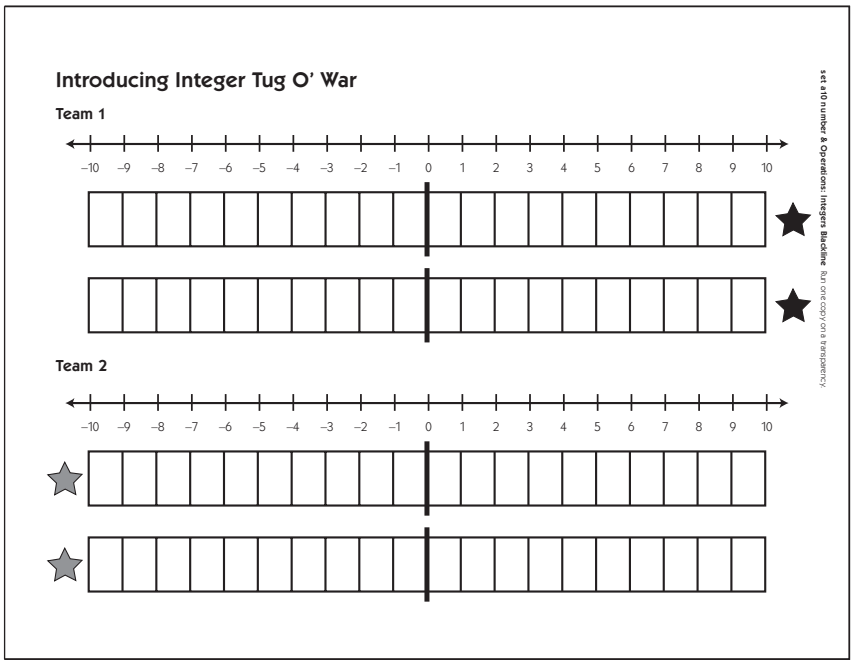
Background for the Teacher: Helping Students Understand Integers *In* Elementary and Middle School Mathematics: Teaching Developmentally, *John Van de Walle writes that the number line is one of the two models most commonly used for teaching integers in middle school. He says that the number line can be confusing, and that games such as football can provide students with an intuitive sense of how the model*

Activity 2 Integer Tug O' War (cont.)

works. He writes, "It is important to remember that signed values are directed distances *and not points on a line." Integer Tug O' War is designed to provide early experiences with this concept. For example, positive and negative 5 can be spotted on the number line in this game, but students also come to understand that integers are actually measured distances from 0. If your marker is sitting on negative 2 and you roll positive 5, you will move 5 spaces to the right, landing on positive 3. If your marker is on positive 3 and you roll negative 6, you will move 6 spaces to the left, landing on negative 3. While not intended to teach operations with integers, Integer Tug O' War helps students develop the understandings they will need to do in middle school.*

Instructions for Integer Tug O' War

1. Place the Introducing Tug O' War overhead on display. Ask students to examine it quietly for a few moments, and then have them pair-share observations. After a minute or so, call on volunteers to share their observations with the class.



Students *It's a board for a game with 2 teams.*
Team 1 has stars on the right side; Team 2 has stars on the left.
There are positive and negative numbers on the lines.
They go up to positive 10 and down to negative 10.
The lines are kind of like the elevation lines from yesterday, but they're sideways instead of up and down.

2. Let students know that this is, a game board. Today, you are going to teach the class a new game called Integer Tug O' War, that will help them learn more about integers and how they work. Review the definition of *integers* (the set of whole numbers and their opposites), and note with students that the members of each number pair (–1 and 1, –2 and 2, –3 and 3, etc.) are the same distance from zero in the opposite direction, while zero is neither positive nor negative.

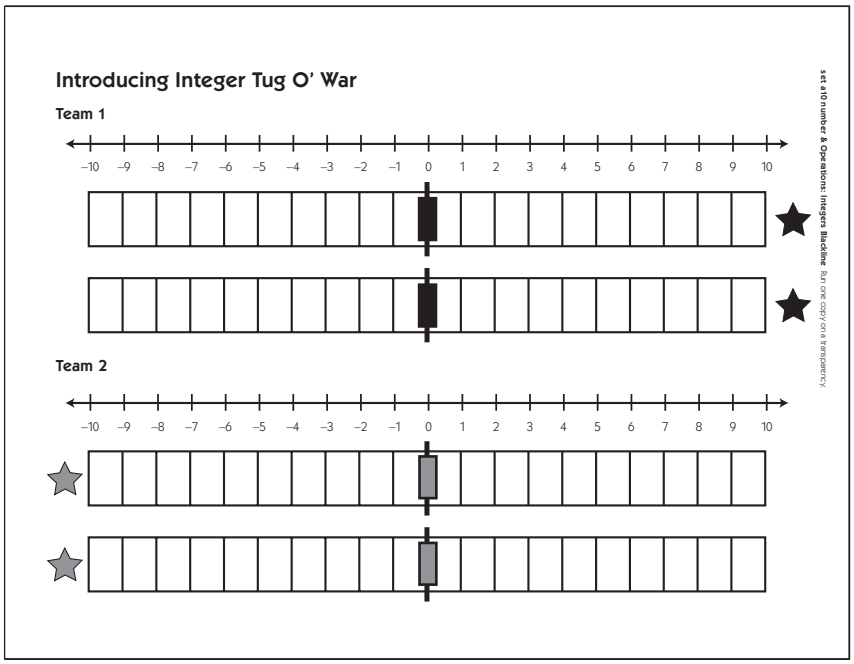
3. Explain that Integer Tug O' War is a little bit like football, in that each team tries to get their markers to their own goal line. Team 1's goal lines are set at positive 10; Team 2's are set at negative 10. At the be-

Activity 2 Integer Tug O' War (cont.)

ginning of the game, each team places their markers at 0. The teams take turns rolling 2 dice and moving the designated number of spaces. One of the dice is numbered; the other is marked with positive and negative signs. A negative roll results in a move to the left; a positive roll results in a move to the right.

4. Ask students to pair up. Number off so that one student in each pair is assigned the number 1, and the other is assigned the number 2. Explain that all the 1's will play for Team 1, and all the 2's will play for Team 2. Then give each pair a Team 1 and a Team 2 game board, while a student helper places a small handful of black and red linear pieces at each table or cluster of desks. Let students know that you are going to play a demonstration game with the whole class that uses only 2 of the tracks for each team. When everyone understands how the game works, they will play with their partners, and use all 4 of the tracks on their boards.

5. Explain that Team 1 will use black linear pieces as game markers, and Team 2 will use red linear pieces. Have students place their markers at zero on the first 2 tracks on their boards while you set up the overhead game board. Then ask a student from each team to roll the 2 dice and report the results. The team with the greater number gets to start first.



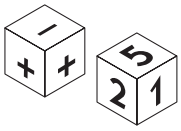
Students *We got a positive 2 and you guys got negative 3. We get to start.*
What do you mean? 3 is higher than 2.
But positive 2 is more than 0, and negative 3 is less than 0. If you count it on the line, 2 is actually 5 more than negative 3!

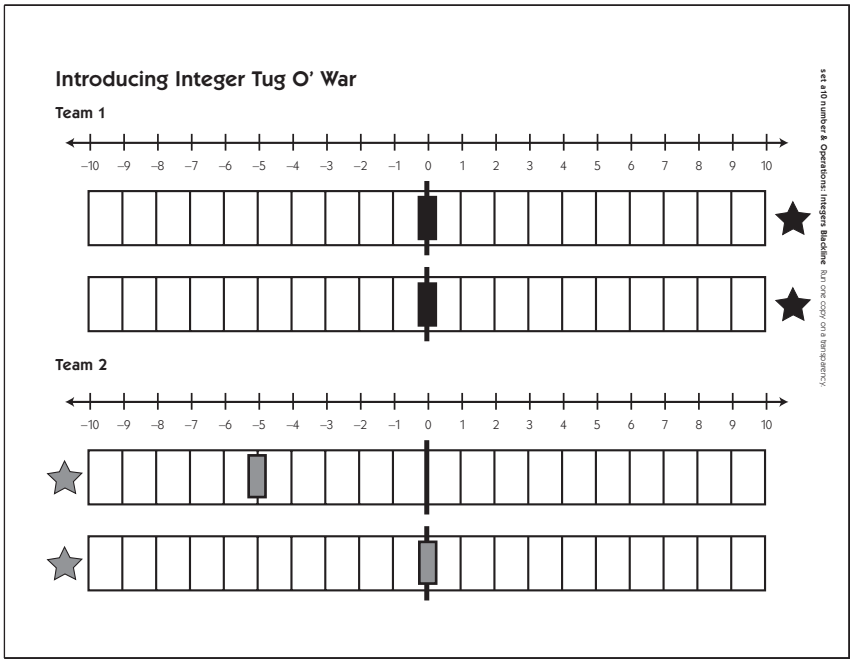
6. Once the starting team has been identified, call a representative up from that team to roll the dice and move one of the markers at the overhead, as the members of that team do the same on their game boards. If there is any confusion about which direction to move, explain that rolling a positive number always results in a move to the right, no matter where you are on the line. Likewise, rolling a negative number always results in a move to the left.

Activity 2 Integer Tug O' War (cont.)

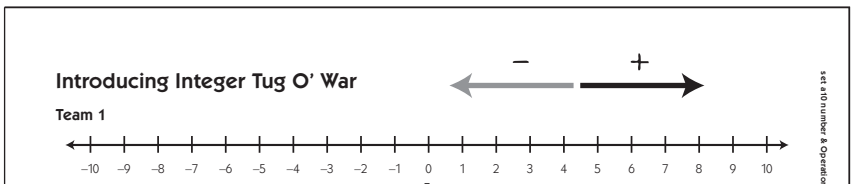
Jasmine *I rolled negative 5. That means we have to move backwards, kind of like taking 5 away?*

Sergio *That's good, though. We want to go that way. Our goal line is down on negative 10. We want to roll negative numbers!*





7. Now have a representative from the other team come up to roll and move a marker at the overhead as members of that team do so on their own game boards. Then have the two teams take turns rolling and moving until one team gets both the markers to their own goal line. If students become confused about which direction to move, draw a black arrow pointing to the right and a red arrow pointing to the left to help them remember that a positive roll always means a move to the right, and a negative roll always means a move to the left.



Here are some additional rules to introduce as the game proceeds:

- A team can split a roll between its 2 markers. If a team rolls positive 5, for instance, it can move one of its markers 3 spaces to the right, and the other marker 2 spaces to the right.
- The student who is rolling for a team and moving the marker(s) at the overhead on any given turn is in charge of that move for the whole team. (This is important because there will be more than one way to handle the roll in many cases. There may be some discussion, but the student at the overhead gets to make the final decision.)
- If one of a team's markers lands on the other team's goal line, the players get to move that marker back to 0. If, for instance, Team 1 has gotten enough negative rolls to have forced one of their markers down to negative 10, they get to move that marker back to 0 before their next turn. (This is the redemption rule, providing a team down on its luck with new hope of winning the game.)

Activity 2 Integer Tug O' War (cont.)

- In order to win, a team has to land on its own goal line exactly. For example, if Team 2 has one of its markers positioned on -9, the players will have to roll a -1 to win. If they roll a -2 or -3, they can split the roll between their two markers. If one of their markers is already at their goal line, they lose a turn and must wait for their next roll.
- Even after a team has gotten one of its markers to its own goal line, that marker is still in play and can still be moved if necessary.
- A team cannot move its markers off the track. If a move is not possible, the players lose that turn and must wait for the next one.

8. Play the game until one team has won. Then ask students to share some thoughts about the game. What are some strategies they might use to win when they play again with their partner?

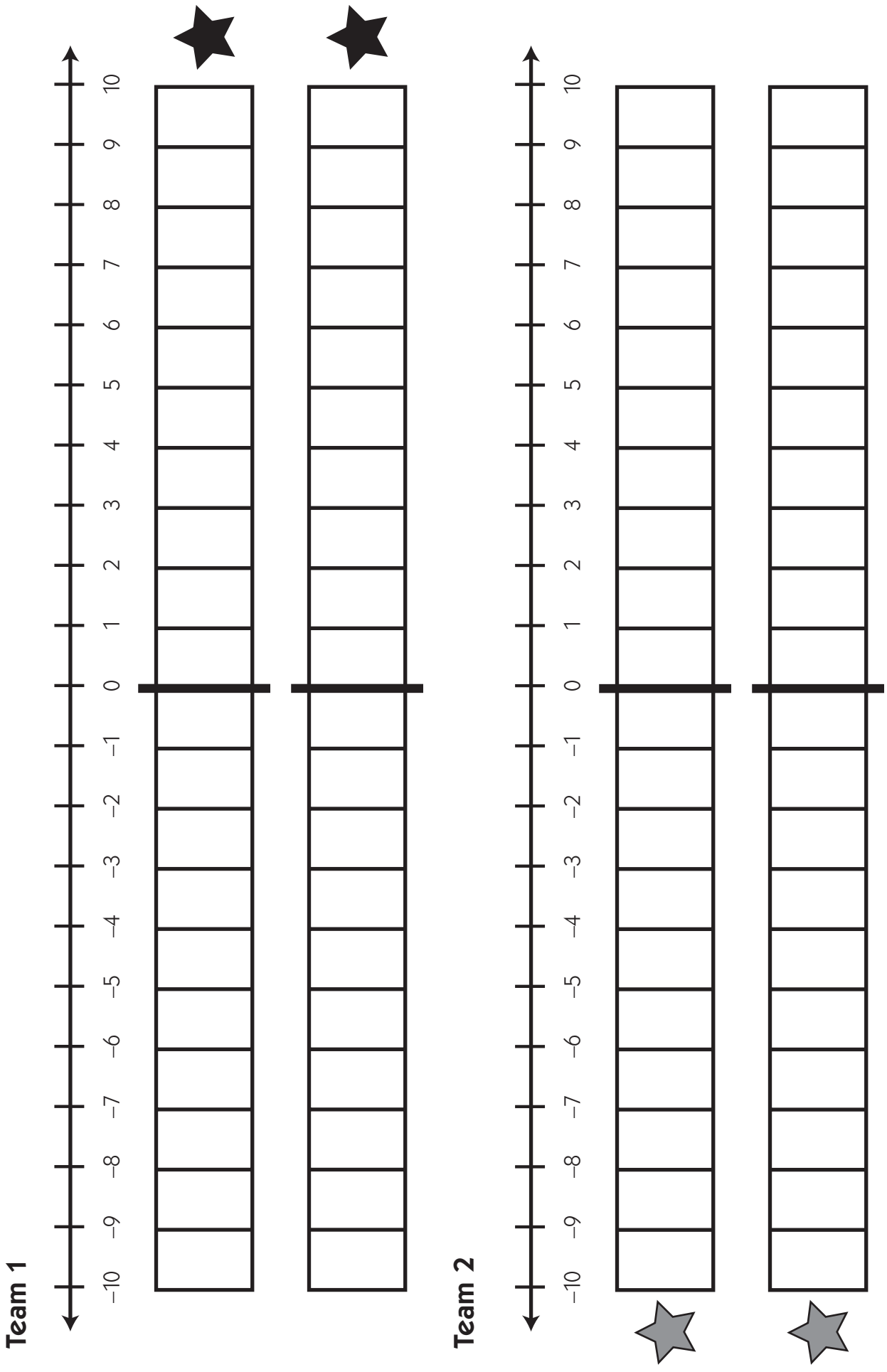
> ***Students*** *Sometimes it's good to split up the roll.*
> *Yeah, like if one of your markers is almost to the goal line, and the other one isn't, you can take part of the roll to get the first marker to the line, and then use the rest for the other marker.*
> *If you're getting a lot of bad rolls, it's good to just let one of your markers land on the other team's goal line. Then you can move it back to 0.*
> *Yeah, the 0 rule is good. It makes you feel like you still have a chance to win.*

9. Then give each student pair a signed die and numbered die, and allow them to use the rest of the instructional period to play the game in pairs. Let them know that they can use 2, 3, or even all 4 of the tracks on their board. Put the 4–9 dice in a place that is easily accessible to all the students, and let them know that they can use a 4–9 die in place of the 1–6 die if they want. Furthermore, they can switch back and forth between the 1–6 and 4–9 dice whenever they want during the game, but they cannot use both at once. Circulate to observe and give assistance as needed. Depending on the needs of your students, you may want to pull a small group together to play the game with you. If more than a few of your students run into difficulties, reconvene the group to work through the problem(s) together using the overhead board. Encourage students to play the game more than once if time allows. If they only used 2 tracks the first time, challenge them to use 3 or 4 the next. The more tracks they use, the more options they will have when it comes to dealing with problematic rolls.

Extensions

- Allow students to revisit the game during free time. The more they play Integer Tug O' War, the more they will be able to refine their strategies. Playing the game multiple times also strengthens students' understandings of signed numbers as directed distances, providing the foundation they need to add and subtract integers in middle school.
- Ask students to write about their experiences playing Integer Tug O' War. Some prompts might include:
  - Do you think this is a fair game? Why or why not?
  - Does it make any difference whether you are on the positive or the negative team?
  - Here's what I like about this game.
  - Here's what frustrates me about this game.
  - Here's what I would do to make this a better game.

Introducing Integer Tug O' War



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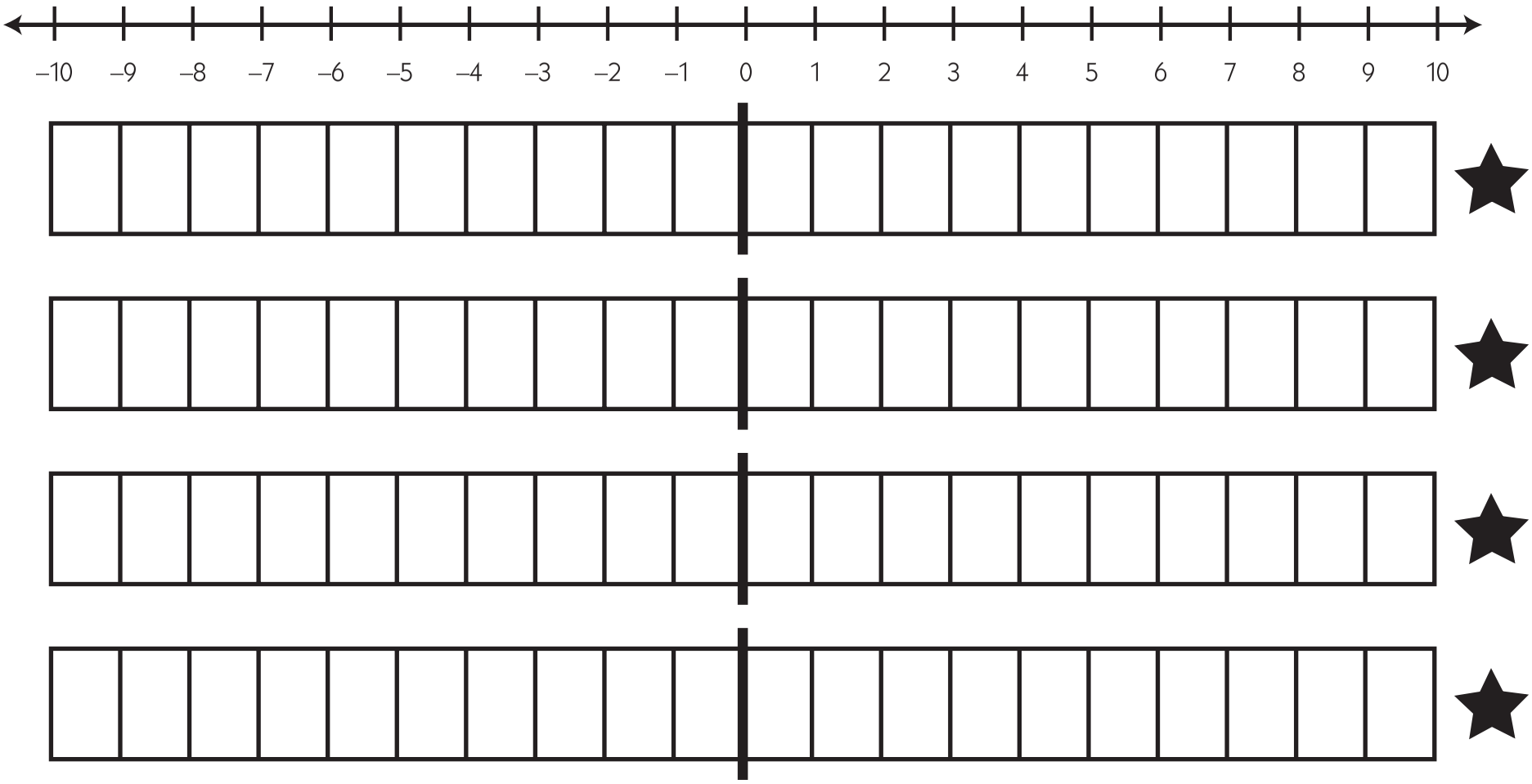
Integer Tug O' War Team 1 Game Board



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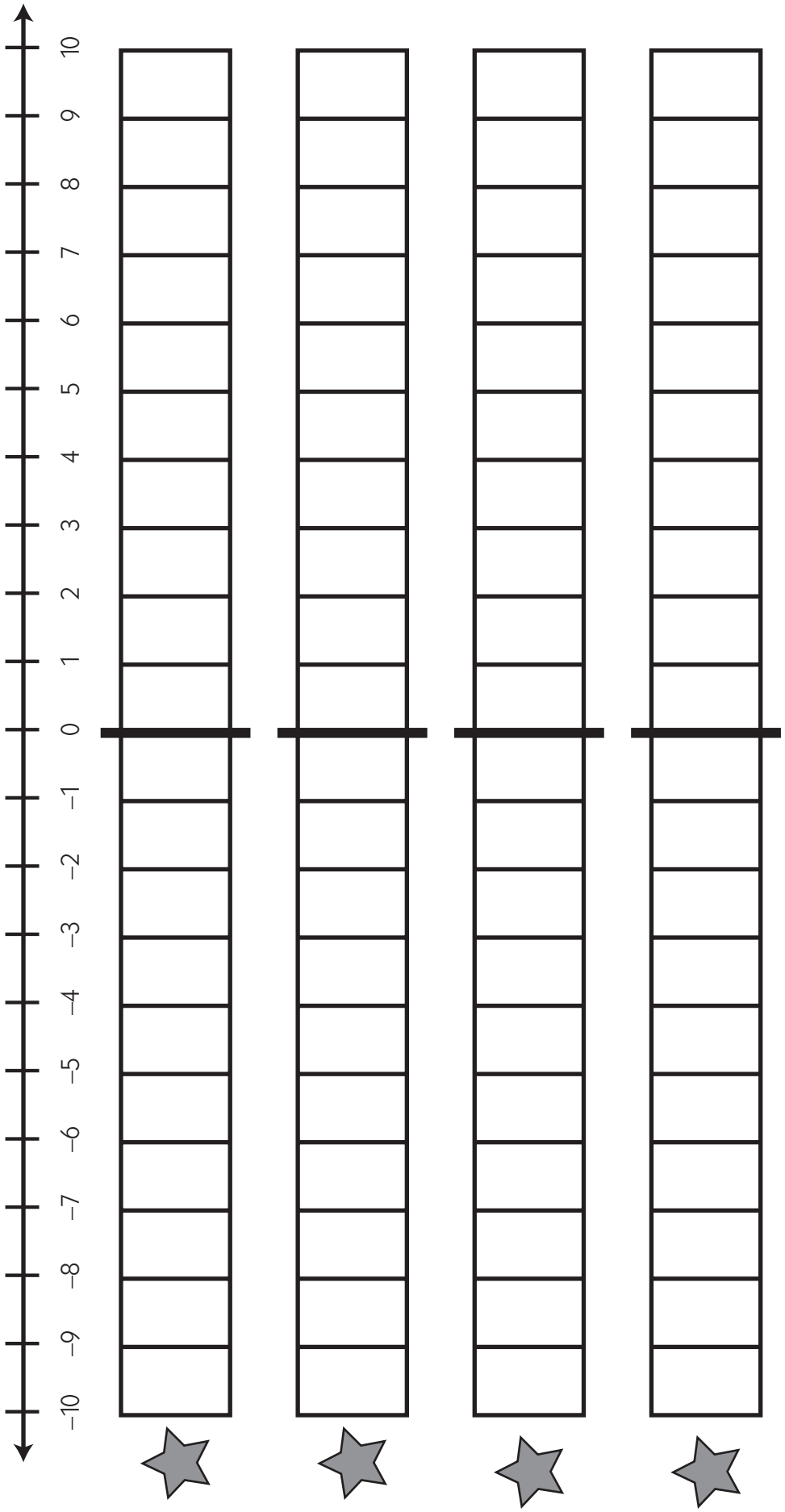
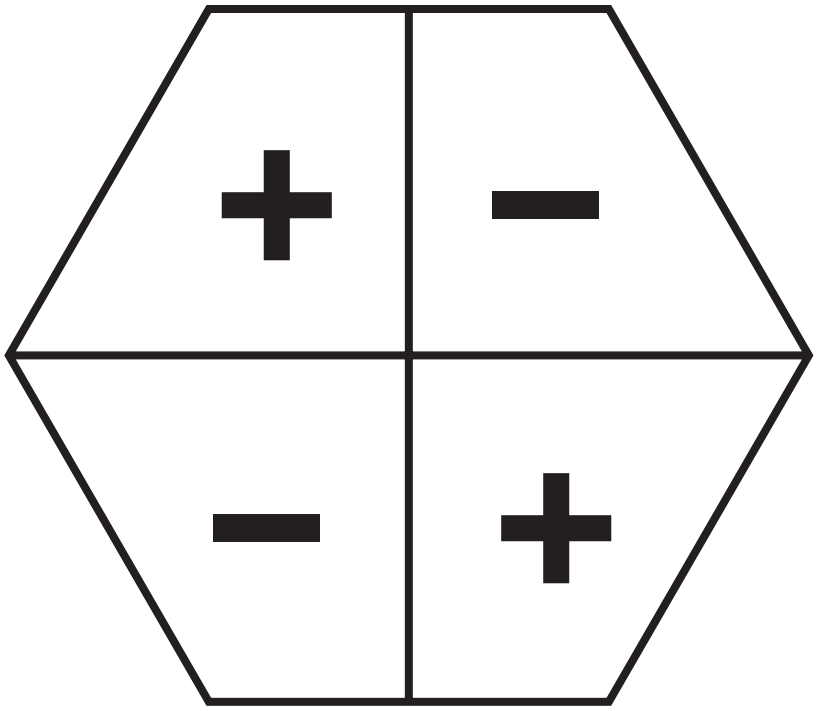
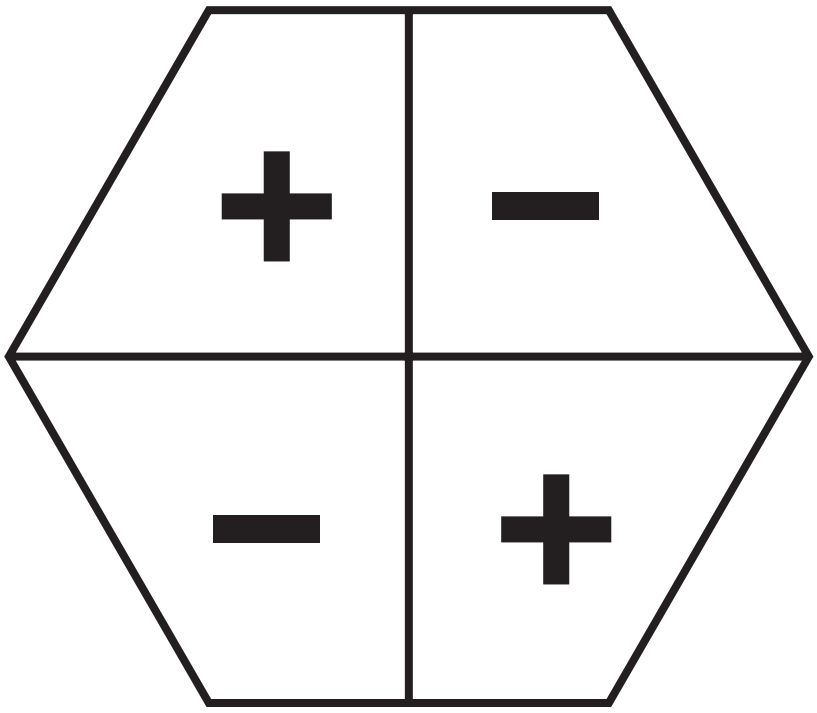
Integer Tug O' War Team 2 Game Board



Positive/Negative Spinner



Positive/Negative Spinner



Set A10 ★ Activity 3

ACTIVITY

4-Quadrant Battleship

Overview

This activity provides students with opportunities to read and write ordered pairs of integers as they appear on a 4-quadrant coordinate grid. After they practice locating and recording ordered pairs, the teacher challenges the class to a modified version of Battleship.

Skills & Concepts

★ read, write, compare, and order integers in mathematical and real world situations

★ locate points defined by ordered pairs of integers

★ write an ordered pair for a point in a coordinate plane with integer coordinates

You'll need

★ 4-Quadrant Battleship game board (page A10.28, run a double-sided class set and 1 copy on a transparency)

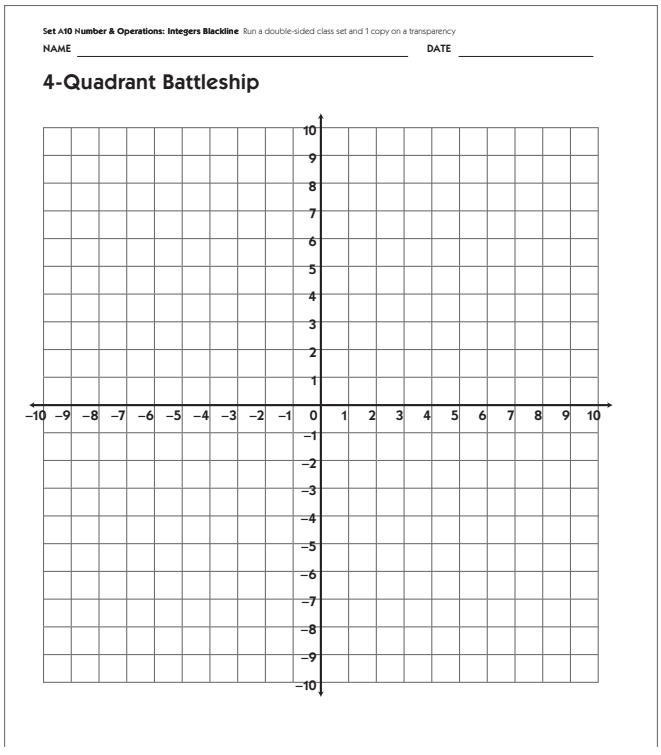
★ 7 blue game markers

★ overhead pens in red and black

★ red and blue colored pencils (class set)

Instructions for 4-Quadrant Battleship

1. Place the 4-Quadrant Battleship game board overhead on display. Ask students to examine it quietly for a few moments, and then have them pair-share observations. After a minute or so, call on volunteers to share their observations with the class.


Set A10 Number & Operations: Integers Blackline Run a double-sided class set and 1 copy on a transparency

NAME _____ DATE _____

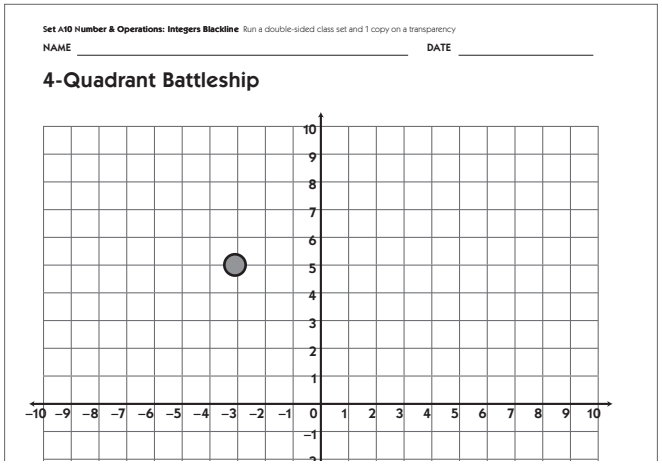
4-Quadrant Battleship

Activity 3 4-Quadrant Battleship (cont.)

Students *It's a grid for Battleship. I've played that game before!*
It has positive and negative numbers on it.
Those are integers!
It's kind of like a combination of a number line and a thermometer or an elevation line.
It's like you have a regular number line, and then one that goes up and down instead of sideways.
We've used grids like this before, but they only had positive numbers on them.

2. Tell students that this is a 4-quadrant coordinate grid, and you will use it to play a modified version of Battleship with them later. First, however, you're going to ask them to practice finding and naming coordinates on the grid. Give students each a copy of the game board.

3. Draw a large red dot at (–3, 5) on the grid. Ask students to identify the location of the dot as precisely as possible.



Students *It's on the left-hand side of the number line that's going up and down.*
It's up 5 and then you have to go over 3 the negative way.
If it was on the other side, it would be at (3, 5) so maybe it's at (5, –3).

4. Remind students that the horizontal number line is called the *x*-axis and the vertical number line is called the *y*-axis, and. Label the axes on the overhead, and write the ordered pair that describes the location of the red dot:

(–3, 5)

Review the fact that any point on the grid can be named with two numbers or *coordinates*. The first number is the *x*-coordinate. It tells the distance from the point where the two lines intersect (the origin) along the *x*-axis. The second number tells the distance from the origin along the *y*-axis. Because these two numbers are always written in order (first *x*, then *y*), they are called an *ordered pair*. Some students may remember the order by reminding themselves to go over and then up when they identify the location of a point. That still works on a 4-quadrant grid, but if the *x*-coordinate is negative, one goes over to the left instead of the right, and if the *y*-coordinate is negative, one goes down instead of up.

5. Erase the red dot, and draw another at (3, 5). Ask students to pair-share the coordinates for this point, and call it out as a group when you give them the signal by raising your hand. Record the ordered pair on the board to confirm their response.

Activity 3 4-Quadrant Battleship (cont.)

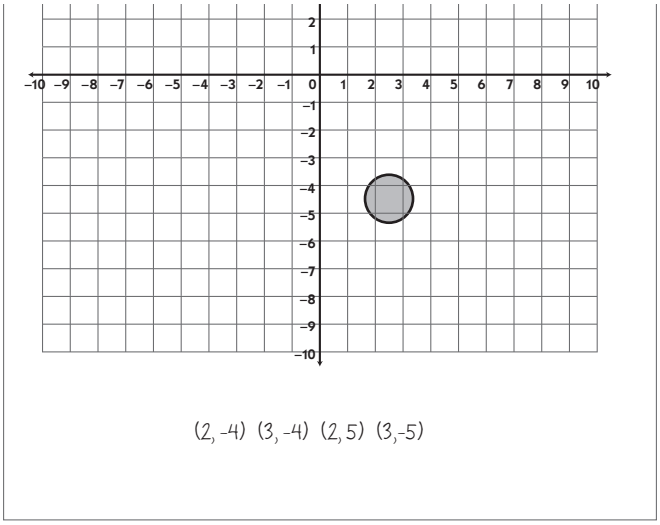
6. Repeat step 5 with several other points on the grid, including (3, –5) and (–3, –5). Then erase the overhead and tell students you are going to write an ordered pair on the board for them to locate on their grids. Write (2, –4) on the board, and ask them to mark that point on their grids with a red pencil. After a moment, invite a volunteer to the overhead to mark the point, and explain how he or she knew where to place it.

> ***Marta*** *I just went over 2, and then down 4 because it's a negative 4, and that's where I made my red dot.*

7. Repeat step 6 with several other ordered pairs:

(–4, –9) (–8, 6) (6, –10) (8, 0) (0, –7)

8. Now explain that you are going to play a modified version of the game Battleship with the class. First, you will turn off the projector and place 7 game markers on your grid. These will be your ships. You will turn the projector on for just a few seconds to give students a quick peek. Then the students will try to sink your ships by identifying their locations correctly. Show students what you mean by placing a blue game marker on the board. If you place it directly over one of the squares on the grid, it will touch 4 points. Ask students to identify the coordinates for each of the 4 points as you write them on the overhead. Explain that when you play the game, they will only have to name one of the 4 coordinates to sink your ship.



9. Erase the overhead and turn off the projector, as students turn their sheets over and get out their red and blue pencils. Place 7 blue game markers at various locations on the board. Position each so that it covers exactly 4 points, and place at least one marker in each quadrant. Turn on the projector for about 10 seconds, just long enough for students to get some sense of how you have positioned the markers, and then turn it off again.

10. Call on a volunteer to guess where one of your ships is by writing an ordered pair on the board that might identify one of the points the ship is touching. Ask the rest of the students to write the ordered pair below the grid on their paper. If one of your ships is touching the point named by the volunteer, tell the students they have made a hit, and have them mark the point on their own grid in red. If none of

Activity 3 4-Quadrant Battleship (cont.)

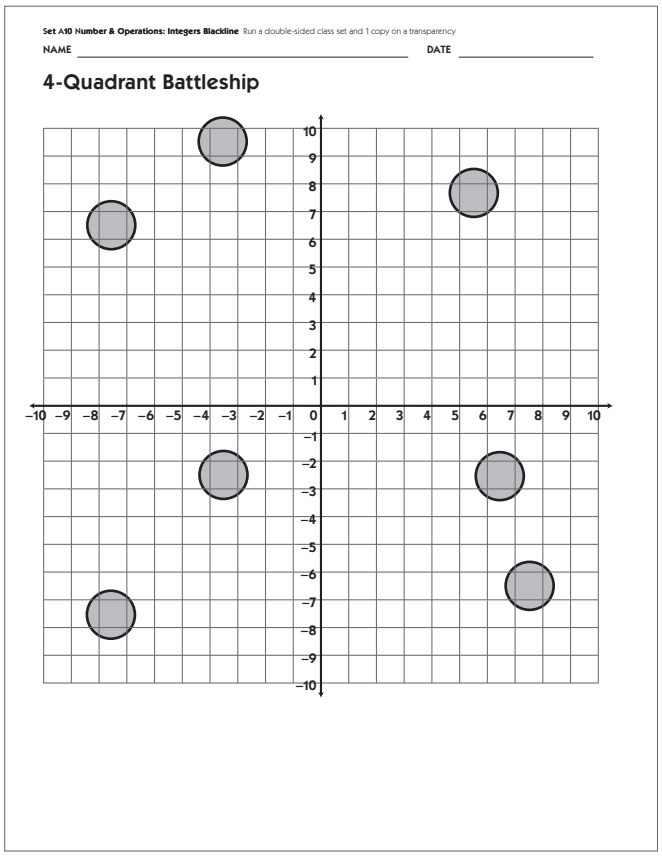
your ships is touching the point named by the volunteer, tell the students they have missed, and have them mark the point on their own grid in blue.

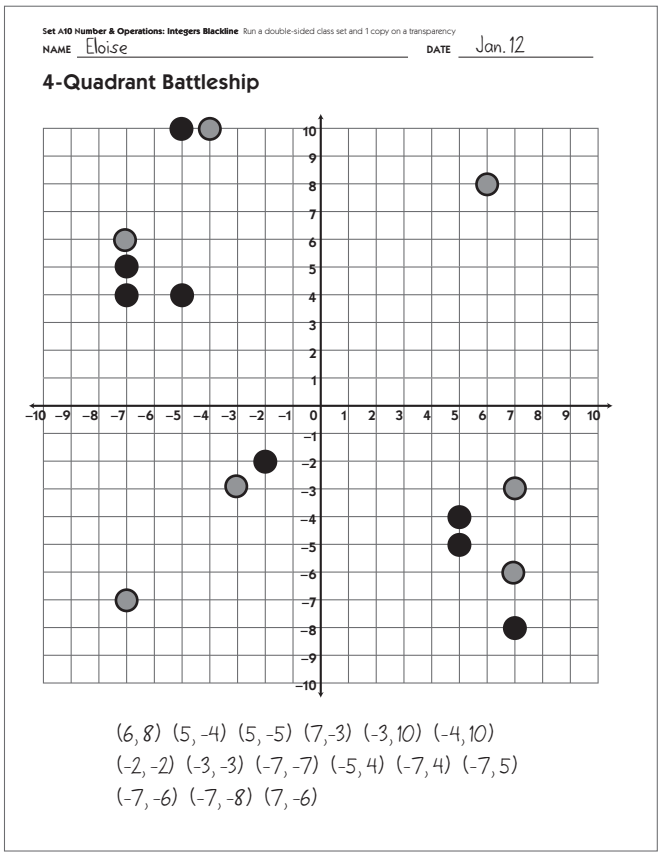
> ***Teacher*** *Who would like to take the first shot at sinking one of my ships. Charlie?*
>
> ***Charlie*** *Okay, I think you have a ship at (6, 8).*
>
> ***Teacher*** *Please write those coordinates on the board so the rest of the class can see. Boys and girls, please copy that ordered pair on your own sheet below the grid. Okay, I'm going to tell you that's a hit. How are you going to show that on your grid?*
>
> ***Students*** *We get to put a red dot at (6, 8) on our grids!*
> *It's red for the explosion that sunk your ship!*

11. Repeat step 10 as many times as necessary. In order to prevent the game from becoming tedious, give the students hints when they name a point that is near one of your ships.

> ***Teacher*** *(5, –4) is a miss, but you are getting very warm. Try going up 1 and over 2 from there and see what happens.*

When students have hit all 7 of your ships, turn on the projector so they can see exactly where you positioned the ships.





Activity 3 4-Quadrant Battleship (cont.)

Extensions

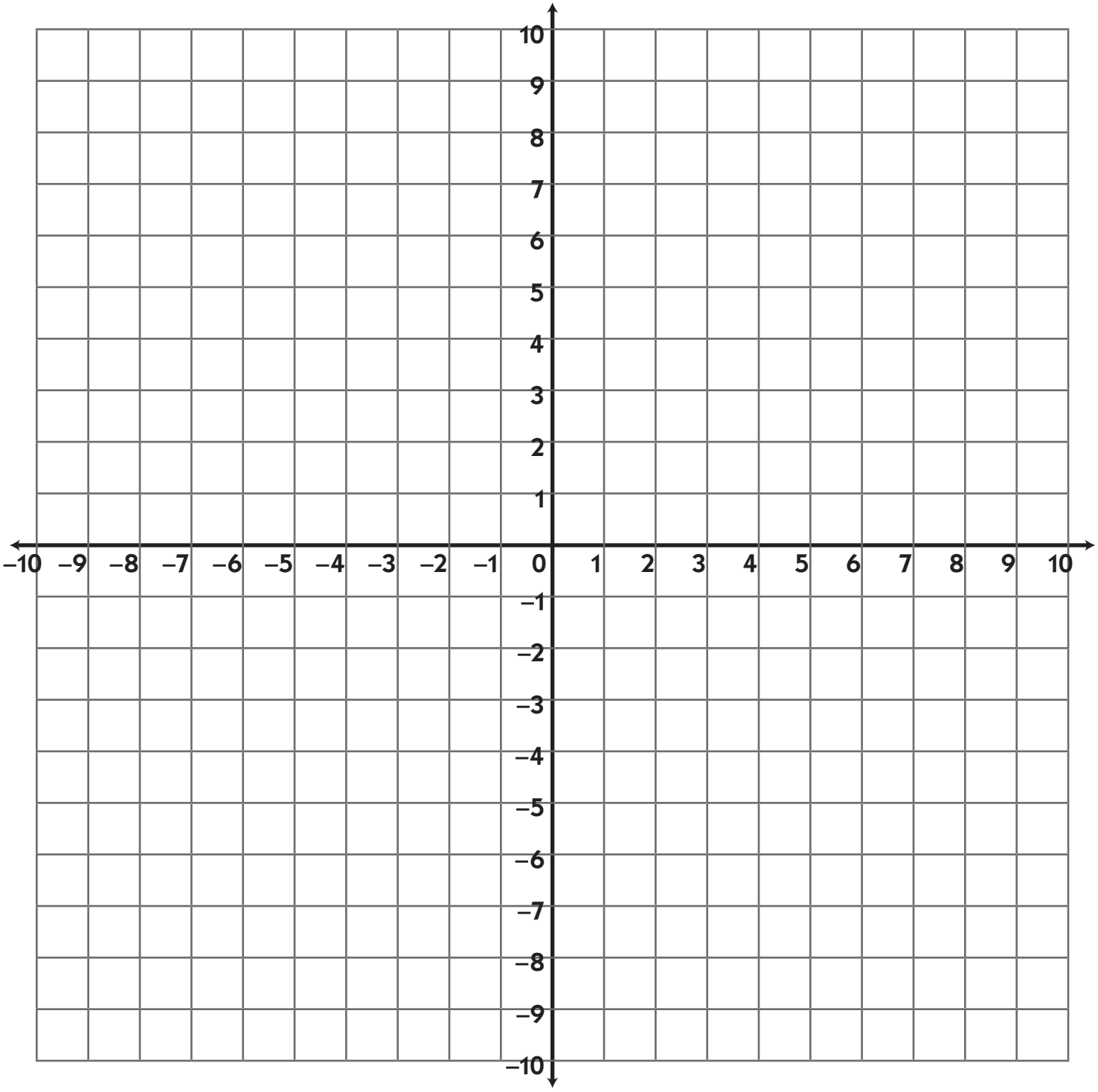
- Reposition your markers and play the game again. Challenge students to sink your ships with fewer guesses this time.
- Invite a student to act as the leader in the game.
- A search for Battleship on the Internet will turn up a variety of results. Some web sites, including Math is Fun at http://www.mathsisfun.com/games/battleship.html allow students to play the game with the computer as a partner. While the version on the Math is Fun web site of the game doesn't involve a coordinate grid, it does promote spatial reasoning.

INDEPENDENT WORKSHEET

Use Set A10 Independent Worksheets 1–3 (pages A10.29–A10.34) to provide students with more practice reading, writing, and comparing negative numbers in real world and mathematical contexts.

NAME _____ **DATE** _____

4-Quadrant Battleship



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Set A10 ★ Independent Worksheet 1

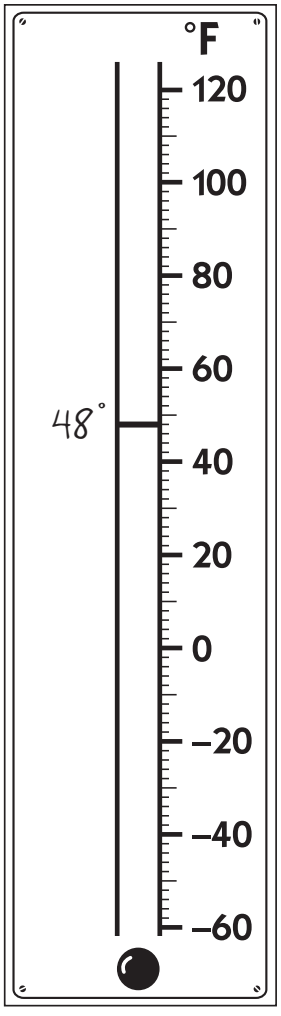
INDEPENDENT WORKSHEET

Negative & Positive Temperature

Water freezes at 32 degrees Fahrenheit, but temperatures on Earth can get much colder than that. Some places even report temperatures below 0 in the winter time.

1 This chart shows the average low temperatures for January in several different cities. Mark each one on the thermometer at right. The first one has been marked for you.

City or Town	Average Low, January*
Orlando, FL.	48° F
Tok, AK.	–27° F
Memphis, TN	30° F
Nome, AK	0° F
Little Falls, MN	–2° F
Honolulu, HI	65° F
Hoyt Lakes, MN	–11° F



2 Write less than (<) or greater than (>) in each circle to show how some of the temperatures from the chart compare. Use the thermometer to help.

a 48° F ◯ 65° F

b –2° F ◯ –11° F

c 0° F ◯ – 27° F

d –27° F ◯ – 11° F

3 Write the temperatures in order from lowest to highest on the lines below.

_____ _____ _____ _____ _____ _____ _____

lowest highest

* Temperatures listed above are found on the US Weather website@ http://countrystudies.us/united-states/weather/

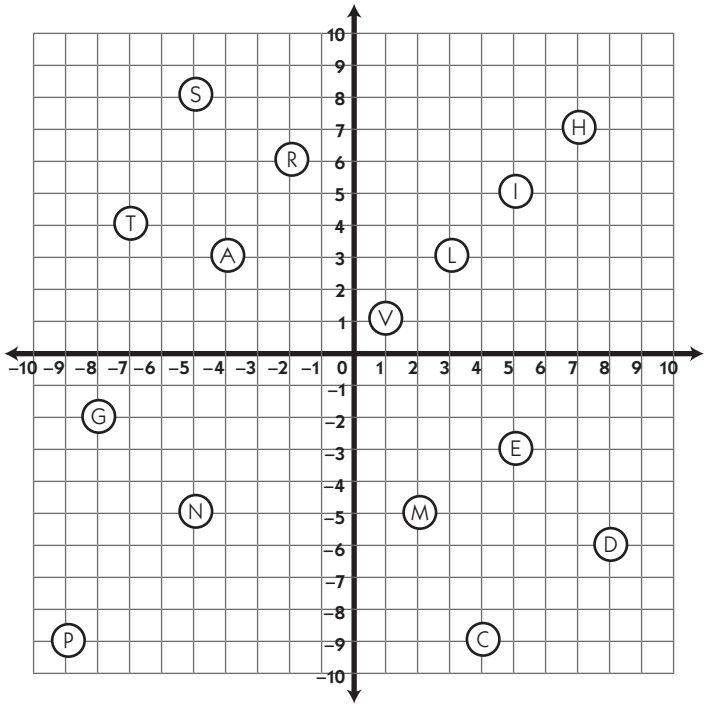
NAME _____ **DATE** _____

Set A10 ★ Independent Worksheet 2

INDEPENDENT WORKSHEET

Temperature & Elevation Riddles

The number pairs under each line below tell you the x and y coordinates of the letters that will answer these riddles about temperatures and elevations around the world. The first two letters are filled in for you in the first riddle.



1 At 29,035 feet, this mountain has the highest elevation in the world.

M	T								
(2, –5)	(2, –5)	(5, –3)	(1, 1)	(5, –3)	(–2, 6)	(5, –3)	(–5, 8)	(–7, 4)	

2 The deepest part of the ocean is 35,838 feet below sea level. It is called the

(4, –9)	(7, 7)	(–4, 3)	(3, 3)	(3, 3)	(5, –3)	(–5, –5)	(–8, –2)	(5, –3)	(–2, 6)

(8, –6)	(5, –3)	(5, –3)	(–9, –9)

3 The coldest temperature on earth (–129° F) was recorded in

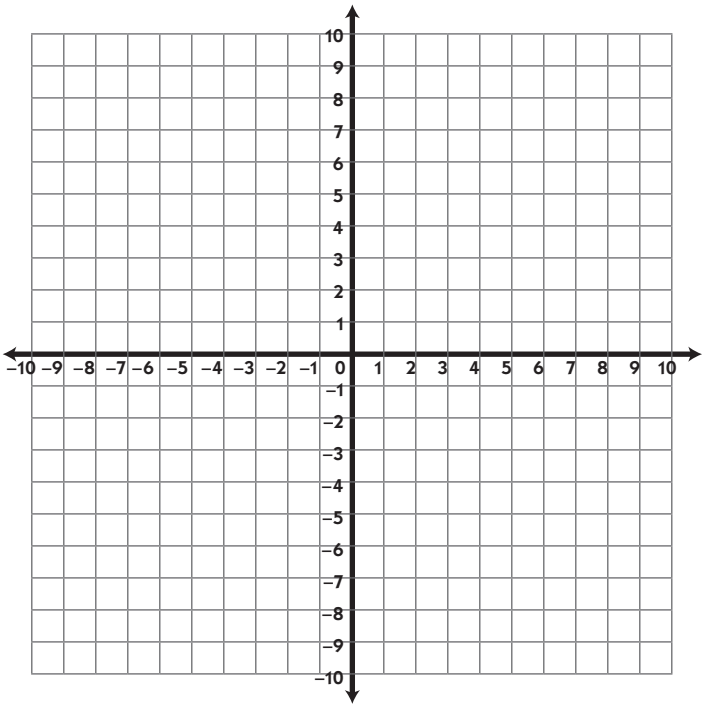
(–4, 3)	(–5, –5)	(–7, 4)	(–4, 3)	(–2, 6)	(4, –9)	(–7, 4)	(5, 5)	(4, –9)	(–4, 3)

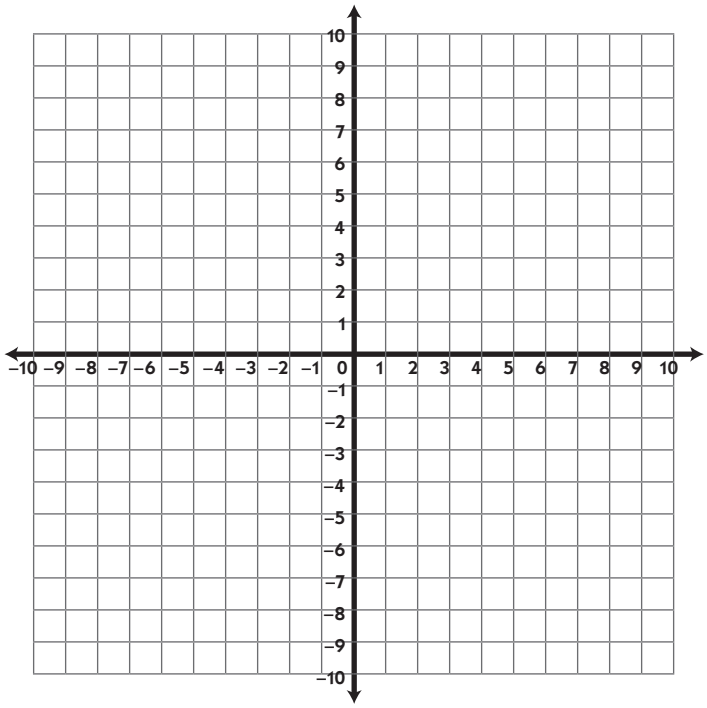
NAME _____ **DATE** _____

Set A10 ★ Independent Worksheet 3

INDEPENDENT WORKSHEET

Shapes on a 4-Quadrant Grid





1a Plot the following points on the coordinate grid above.

① (–5, 2)
② (–3, 5)
③ (3, 5)
④ (5, 2)
⑤ (5, –2)
⑥ (3, –5)
⑦ (–3, –5)
⑧ (–5, –2)

b Connect the dots in order. Then connect the last dot to the first dot. What is the name of this shape?

2a If you plot the points listed below on the coordinate grid above and connect the dots, what shape will you get?

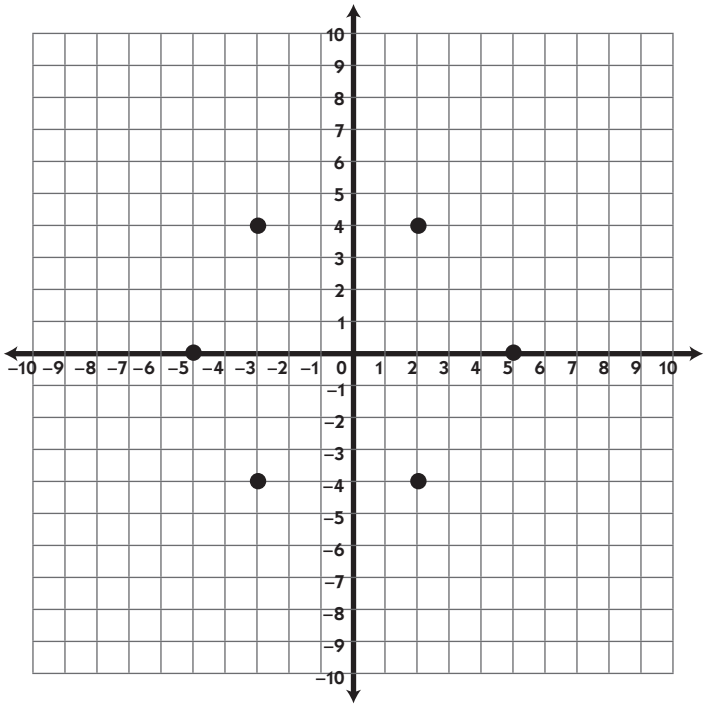
Points: (–4, 7) (3, 4) (–6, –4)

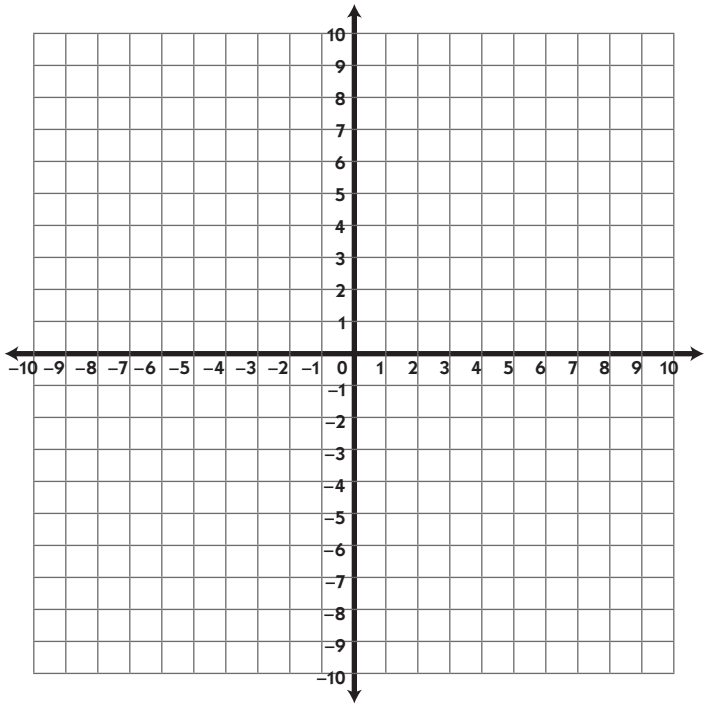
b How do you know for sure?

c Plot the points and connect the dots to find out if you are correct.

(continued on back)

Independent Worksheet 3 Shapes on a 4-Quadrant Grid (cont.)





3a Six points have been marked on the coordinate grid above. List the coordinates for each point below. The first one has been done for you.

(-5, 0)

(____, ____)

(____, ____)

(____, ____)

(____, ____)

(____, ____)

b Connect the dots. Then connect the last dot to the first dot. What is the name of this shape?

4 Ramani wants to program her robot to walk in a square on this grid. She wants to include all 4 quadrants in the path. List the coordinates for 4 points that would work. Then plot them on the grid above and connect them to check.

(____, ____)

(____, ____)

(____, ____)

(____, ____)

BRIDGES IN MATHEMATICS 5

GRADE 5 SUPPLEMENT

Set A11 Number & Operations: Multiplying Decimals

Includes

Skills & Concepts

- ★ find 0.1 more than a number and 0.1 less than a number
- ★ find 0.01 more than a number and 0.01 less than a number
- ★ find 0.001 more than a number and 0.001 less than a number
- ★ round numbers to the nearest 0.1, 0.01, and 0.001
- ★ multiply and divide by powers of 10, including 0.01, 0.1, 1, 10, 100, and 1,000
- ★ multiply whole numbers and decimal numbers by decimal numbers to the hundredths place
- ★ describe the effect of place value when multiplying whole numbers and decimals by 0.01, 0.1, 1, 10, 100, and 1,000
- ★ multiply decimal numbers to the hundredths place in a variety of ways, including using models
- ★ estimate solutions to arithmetic problems in order to assess reasonableness of results

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P0310b

Bridges in Mathematics Grade 5 Supplement
Set A11 Number & Operations: Multiplying Decimals

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P0310b

Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set A11 ★ Activity 1

ACTIVITY

Multiplying by Powers of 10

Overview

Students complete a string of calculations with fractions and decimals and then discuss the relationships among those calculations to build greater computational fluency and a stronger number sense with decimals. Then they explore what happens, and why, when they multiply by powers of 10 (0.01, 0.1, 1, 10, etc.).

Skills & Concepts

- ★ multiply by powers of 10, including 0.01, 0.1, 1, 10, 100, and 1,000
- ★ describe the effect of place value when multiplying whole numbers and decimals by 0.01, 0.1, 1, 10, 100, and 1,000
- ★ apply fraction and decimal equivalencies to solve problems

You'll need

- ★ base ten pieces for each pair of students, plus a set for the projector
- ★ Patterns in Multiplying by Powers of 10 (pages A11.4 and A11.5, 1 copy for display, plus a class set)
- ★ Multiplying by Powers of 10 Practice (page A11.6, 1 copy for display, plus a class set)
- ★ Great Wall of Base Ten saved from Unit Six

Advance Preparation Try to find some copies of Bridges Student Book pages 160 and 161, Fraction & Decimal Equivalents, which students completed in Unit Six, Session 10. You might also fill in Display Master 6.10, Fraction & Decimal Equivalencies, which you used in Session 12. Both of these resources may jog students' memory of the fraction equivalents of common decimals in steps 1 and 3 below.

Instructions for Multiplying by Powers of 10

1. Explain to students that they're going to be multiplying decimal numbers in the next few days and that they'll begin with powers of 10, like 0.1, 10, and 100. Write the following problems one at a time where students can see them (answers included in parentheses for your reference). Ask students to work in pairs for a minute or two to solve one problem at a time, and then have students share their answers and strategies as a whole group.

- ½ × 10 (5)
- 0.5 × 10 (5)
- ¼ × 10 (2.5)
- 0.25 × 10 (2.5)
- 0.75 × 10 (7.5)

2. When they have solved all five problems, ask students to discuss the relationships they noticed among the problems. Students are likely to note equivalencies between ½ and 0.5, and between ¼ and 0.25. They may also have noticed that they could halve half of 10 to find one-fourth of 10, and that three-fourths (0.75) is three times one-fourth. They might also notice that when multiplying a decimal number by 10, you move the decimal point one place to the right (e.g., 0.25 × 10 = 2.5).

Actvity 1 Multiplying by Powers of 10 (cont.)

Describing the relationships among the problems should help students begin to develop efficient strategies for computing with decimal numbers. Students will solve similar sets of problems at the beginning of each activity in this set.

3. Place Patterns in Multiplying by Powers of 10 on display and give each student a copy. Review the sheet with the class. Discuss the sample equations in each table and have students connect the elements of each equation to the problem situation. Also be sure students remember how to write each decimal (0.01 and 0.1) as a fraction. Invite them to refer to Bridges Student Book pages 160 and 161, Fraction & Decimal Equivalents, or a filled in copy of Display Master 6.10, Fraction & Decimal Equivalencies, if you were able to retrieve these resources from Unit Six.

Set A11 Number & Operations: Multiplying Decimals Blackline Run 1 copy for display, plus a class set.

NAME _____ DATE _____

Patterns in Multiplying by Powers of 10, page 1 of 2

1a The post office sells one-cent stamps. Fill out the table below to show how much it would cost to buy different quantities of one-cent stamps.

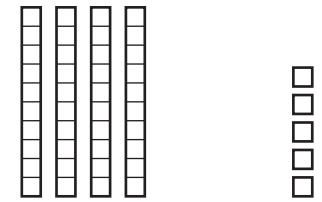
Number of Stamps	Decimal Equation	Fraction Equation	Total Cost
1 stamp	$1 \times 0.01 = 0.01$	$1 \times {}^{1}/_{100} = {}^{1}/_{100}$	$0.01
2 stamps	$2 \times 0.01 = 0.02$	$2 \times {}^{2}/_{100} = {}^{2}/_{100}$	$0.02
10 stamps			
20 stamps			
45 stamps			
321 stamps			
404 stamps			

b What do you notice about multiplying by 0.01?

4. Give students time to complete the sheet in pairs. Then reconvene the class as a whole group and open the discussion by asking what they noticed about multiplying by 0.01, 0.1, and 10. Discuss each multiplier one at a time, and encourage students to explain why the patterns they see (e.g., "When you multiply by 0.01, the decimal point moves two places to the left") make sense. Encourage students to refer to the Great Wall of Base Ten and to use the base ten pieces to explain the patterns they see. Remember that when modeling decimals, the mat represents 1, the strip 0.10, and the unit 0.01.

> ***Student*** *I saw when you multiply a number by 0.01, like in the first problem, you can just move the decimal point two places to the left like this. It works every time.*
>
> $45 \times 0.01 = 0.45$
>
> 45
>
> ***Teacher*** *Why does it work? Can you use the Great Wall of Base Ten or these base ten pieces to explain?*
>
> ***Student*** *Well, 45 times one-hundredth is 45 hundredths. 40 hundredths is the same as four-tenths. That's the .4 part of the answer. And 5 hundredths is just 5 hundredths. So it's like each part of the first number gets a hundred times smaller: 40 becomes four-tenths and 5 becomes five-hundredths. Or you could just think 45 hundredths, really. That's a hundred times smaller than 45.*

Actvity 1 Multiplying by Powers of 10 (cont.)



40 hundredths is 4 tenths

5 hundredths is just 5 hundredths

5. After students have discussed the patterns that emerged when multiplying by 0.01, 0.1, and 10, give each student a copy of Multiplying by Powers of 10 Practice. Explain that they'll complete it independently, and then select a couple of problems from the sheet to do together before asking students to work on their own.

Extensions

- If students finish early, ask them to turn their papers over and write problems for each other in this form:

  $45 \times \_\_\_\_\_ = 0.045$ $45 \times \_\_\_\_\_ = 4{,}500$ $45 \times \_\_\_\_\_ = 4.5$

  Then they can trade papers and fill in the missing powers of 10 in each equation.
- Clarify the term "power of ten" using the Great Wall of Base Ten, and introduce exponent notation. A power of ten is a number resulting from multiplying 10 by itself any number of times. We use exponents to show how many times a number, in this case 10, is multiplied by itself. A negative exponent indicates a number less than 1 (a fraction or a decimal).

  $1000 = 10^3$ $100 = 10^2$ $10 = 10^1$ $1 = 10^0$ $0.1 = 10^{-1}$ $0.01 = 10^{-2}$

NAME _____ **DATE** _____

Patterns in Multiplying by Powers of 10, page 1 of 2

1a The post office sells one-cent stamps. Fill out the table below to show how much it would cost to buy different quantities of one-cent stamps.

Number of Stamps	Decimal Equation	Fraction Equation	Total Cost
1 stamp	$1 \times 0.01 = 0.01$	$1 \times {}^{1}/_{100} = {}^{1}/_{100}$	\$0.01
2 stamps	$2 \times 0.01 = 0.02$	$2 \times {}^{2}/_{100} = {}^{2}/_{100}$	\$0.02
10 stamps			
20 stamps			
45 stamps			
321 stamps			
404 stamps			

b What do you notice about multiplying by 0.01?

2a Amelia feeds her pet lizard crickets. The pet store sells crickets for ten cents each. Fill out the table below to show how much it would cost to buy different quantities of crickets.

Number of Crickets	Decimal Equation	Fraction Equation	Total Cost
1 cricket	$1 \times 0.10 = 0.10$	$1 \times {}^{1}/_{10} = {}^{1}/_{10}$	\$0.10
2 crickets	$2 \times 0.10 = 0.20$	$2 \times {}^{1}/_{10} = {}^{2}/_{10}$	\$0.20
10 crickets			
20 crickets			

(Continued on next page.)

Patterns in Multiplying by Powers of 10, page 2 of 2 (cont.)

2a (cont.)

Number of Crickets	Decimal Equation	Fraction Equation	Total Cost
45 crickets			
321 crickets			
404 crickets			

b What do you notice about multiplying by 0.10?

3a Alfonso's company sells T-shirts to soccer teams. Each T-shirt costs ten dollars. Fill out the table below to show how much it would cost to buy different quantities of T-shirts.

Number of Shirts	Equation	Total Cost
1 shirt	$1 \times 10 = 10$	$10
2 shirts	$2 \times 10 = 20$	$20
10 shirts		
20 shirts		
45 shirts		
321 shirts		
404 shirts		

b What do you notice about multiplying by 10?

NAME _____ **DATE** _____

Multiplying by Powers of 10 Practice

Complete the following equations.

106 × 0.01 = _____ 47 × 0.01 = _____ 3 × 0.01 = _____

0.6 × 0.01 = _____ 0.32 × 0.01 = _____ 0.1 × 0.01 = _____

10 × 0.01 = _____

452 × 0.1 = _____ 302 × 0.1 = _____ 64 × 0.1 = _____

0.9 × 0.1 = _____ 0.57 × 0.1 = _____ 0.04 × 0.1 = _____

0.1 × 0.1 = _____

360 × 10 = _____ 23 × 10 = _____ 4 × 10 = _____

0.7 × 10 = _____ 0.54 × 10 = _____ 0.01 × 10 = _____

0.32 × 100 = _____ 4.3 × 100 = _____ 4 × 100 = _____

45 × 100 = _____ 309 × 100 = _____ 0.1 × 100 = _____

0.17 × 1,000 = _____ 0.34 × 1,000 = _____ 9.6 × 1,000 = _____

603 × 1,000 = _____ 0.01 × 1,000 = _____

Set A11 ★ Activity 2

ACTIVITY

Dividing by Powers of 10

Overview

Students complete a string of calculations with fractions and decimals and then discuss the relationships among those calculations to build greater computational fluency and a stronger number sense with decimals. Then they explore what happens, and why, when they divide by powers of 10 (0.01, 0.1, 1, 10, etc.).

Skills & Concepts

- ★ divide by powers of 10, including 0.01, 0.1, 1, 10, 100, and 1,000
- ★ describe the effect of place value when dividing whole numbers and decimals by 0.01, 0.1, 1, 10, 100, and 1,000
- ★ apply fraction and decimal equivalencies to solve problems

You'll need

- ★ base ten pieces for each pair of students, plus a set for the projector
- ★ Patterns in Dividing by Powers of 10 (pages A11.10–A11.12, 1 copy for display, plus a class set)
- ★ Dividing by Powers of 10 Practice (page A11.13, 1 copy for display, plus a class set)
- ★ Great Wall of Base Ten saved from Unit Six

Instructions for Dividing by Powers of 10

1. Write the following problems one at a time where students can see them (answers included in parentheses for your reference). Ask students to work in pairs for a minute or two to solve one problem at a time, and then have students share their answers and strategies as a whole group.

- 10×0.1 (1)
- 10×0.6 (6)
- 600×0.01 (6)
- 600×0.04 (24)
- 40×0.8 (32)

2. When they have solved all five problems, ask students to discuss the relationships they noticed among the problems. Students are likely to note that multiplying by 0.1 is like dividing by 10, just as multiplying by 0.01 is like dividing by 100. With this in mind, they can solve 600 x 0.04, for example, in the following way: $600 \div 100 = 6$ and $6 \times 4 = 24$.

3. Now explain to students that today they're going to be dividing by powers of 10, like 0.1, 10, and 100. Place Patterns in Dividing by Powers of 10 on display and give each student a copy. Review the sheet with the class. Discuss the sample equations in each table and have students connect the elements of each equation to the problem situation. Also be sure students remember how to write each decimal as a fraction.

Activity 2 Dividing by Powers of 10 (cont.)

Set A11 Number & Operations: Multiplying Decimals Blackline Run 1 copy for display, plus a class set.

NAME _____ DATE _____

Patterns in Dividing by Powers of 10

1a Alfonso's company sells T-shirts to soccer teams. Each T-shirt costs ten dollars. If you spent $1030, how many shirts could you buy?

b Fill out the table below to show how many T-shirts you could buy with different amounts of money.

Total Cost	Equation	Number of Shirts
$10	10 ÷ 10 = 1	1
$20	20 ÷ 10 = 2	2
$100		
$200		
$450		
$3210		
$1020		

c What do you notice about dividing by 10?

2a Amelia feeds her pet lizard crickets. The pet store sells crickets for ten cents each. If Amelia spent $1.30 on crickets last week, how many crickets did she buy?

(cont. on next page)

Set A11 Number & Operations: Multiplying Decimals

Patterns in Dividing by Powers of 10 (cont.)

2b Fill out the table below to show how much it would cost to buy different quantities of crickets.

Total Cost	Decimal Equation	Fraction Equation	Number of Crickets
$0.10	0.10 ÷ 0.10 = 1	$^1/_{10} \div {}^1/_{10} = 1$	1 cricket
$0.20	0.20 ÷ 0.10 = 2	$^2/_{10} \div {}^1/_{10} = 2$	2 crickets
$1.00			
$2.00			
$3.30			
$5.20			

c What do you notice about dividing by 0.10?

3a The post office sells one-cent stamps. If you spent $2.08, how many one-cent stamps could you buy?

b Fill out the table below to show how many stamps you could buy with different amounts of money.

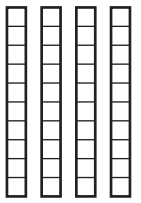
Total Cost	Decimal Equation	Fraction Equation	Number of Stamps
$0.01	0.01 ÷ 0.01 = 1	$^1/_{100} \div {}^1/_{100} = 1$	1 stamp
$0.02	0.02 ÷ 0.01 = 2	$^2/_{100} \div {}^1/_{100} = 2$	2 stamps
$0.10			
$0.40			

As you review the sheet, discuss how to write the numbers that are greater than 1 as a fraction. In this case, students will probably find it most useful to write them as improper fractions. For example, they would write 2.47 as $^{247}/_{100}$ in the first table. This will probably make dividing by $^1/_{100}$ more sensible to them.

4. Now ask students to complete the sheet in pairs. Encourage them to use the base ten pieces to think about the problems if that helps. Then reconvene the class as a whole group and open the discussion by asking what they noticed about dividing by 0.01, 0.1, and 10. Discuss each divisor one at a time, and encourage students to explain why the patterns they see make sense. (e.g., "When you divide by 0.01, the decimal point moves two places to the right. That's what happens when you multiply by 100 too!") Invite students to refer to the Great Wall of Base Ten and to use the base ten pieces to explain the patterns they see. Remember that when modeling decimals, the mat represents 1, the strip 0.10, and the unit 0.01.

> ***Student*** *When you divide by a decimal number, it's like multiplying by the reverse whole number, so you move the decimal point that many places to the right.*
>
> ***Teacher*** *Please use the base ten pieces to show us what you mean and why this is true.*
>
> ***Student*** *Well, think about these strips. They show 40. So if you divide by 0.1, it's like asking, how many tenths in 40? There are 10 tenths in each little unit and 40 units altogether, so you go 10 × 40 = 400. So 40 ÷ 0.1 = 400. 400 is like 40 with the decimal one place to the right.*

Activity 2 Dividing by Powers of 10 (cont.)



Students' verbal explanations will vary considerably in their clarity, so encourage them to show their thinking with base ten pieces and equations. This will allow you to get a clearer sense of what they understand and will make their explanations more comprehensible to other students.

5. After students have discussed the patterns that emerged when dividing by 0.01, 0.1, and 10, give each student a copy of Dividing by Powers of 10 Practice. Explain that they'll complete it independently, and then select a couple of problems from the sheet to do together before asking students to work on their own.

Extensions

- If students finish early, ask them to turn their papers over and write problems for each other in this form:

  45 ÷ _____ = 0.045 45 ÷ _____ = 450 45 ÷ _____ = 4.5

  Then they can trade papers and fill in the missing powers of 10 in each equation.
- You might also consider asking them to write their problems in this form:

  45 ÷ 10 = 45 × _____ 45 ÷ 0.10 = 45 × _____ 45 ÷ 0.01 = 45 × _____

- Help students understand powers of 10 in a graphic way. The Molecular Expressions web site (see URL below) features a photographic display called Secret Worlds: The Universe Within that illustrates powers of 10 starting with the Milky Way, 10 million light years (10^{20} meters) from Earth. A series of photos move closer and closer to Earth, decreasing in distance by a power of 10 each time, until you reach a tall oak tree seen at a distance of 1 meter (10^{0} meter). The photos don't stop there, however. The powers of 10 go negative as the series moves in the microscopic world of an oak leaf, and finally into a subatomic universe of electrons and protons.
  http://micro.magnet.fsu.edu/primer/java/scienceopticsu/powersof10/

INDEPENDENT WORKSHEET

Use Set A11 Independent Worksheets 1–3 to provide students with more practice multiplying and dividing by powers of ten, as well as rounding and doing calculations with decimals.

NAME _____ **DATE** _____

Patterns in Dividing by Powers of 10, page 1 of 3

1a Alfonso's company sells T-shirts to soccer teams. Each T-shirt costs ten dollars. If you spent $1030, how many shirts could you buy?

b Fill out the table below to show how many T-shirts you could buy with different amounts of money.

Total Cost	Equation	Number of Shirts
$10	10 ÷ 10 = 1	1
$20	20 ÷ 10 = 2	2
$100		
$200		
$450		
$3210		
$1020		

c What do you notice about dividing by 10?

2a Amelia feeds her pet lizard crickets. The pet store sells crickets for ten cents each. If Amelia spent $1.30 on crickets last week, how many crickets did she buy?

(Continued on next page.)

Patterns in Dividing by Powers of 10, page 2 of 3 (cont.)

2b Fill out the table below to show how much it would cost to buy different quantities of crickets.

Total Cost	Decimal Equation	Fraction Equation	Number of Crickets
\$0.10	0.10 ÷ 0.10 = 1	$^1/_{10} \div {}^1/_{10} = 1$	1 cricket
\$0.20	0.20 ÷ 0.10 = 2	$^2/_{10} \div {}^1/_{10} = 2$	2 crickets
\$1.00			
\$2.00			
\$3.30			
\$5.20			

c What do you notice about dividing by 0.10?

3a The post office sells one-cent stamps. If you spent \$2.08, how many one-cent stamps could you buy?

b Fill out the table below to show how many stamps you could buy with different amounts of money.

Total Cost	Decimal Equation	Fraction Equation	Number of Stamps
\$0.01	0.01 ÷ 0.01 = 1	$^1/_{100} \div {}^1/_{100} = 1$	1 stamp
\$0.02	0.02 ÷ 0.01 = 2	$^2/_{100} \div {}^1/_{100} = 2$	2 stamps
\$0.10			
\$0.40			

(Continued on next page.)

NAME _____ **DATE** _____

Patterns in Dividing by Powers of 10, page 3 of 3 (cont.)

3b Cont.

Total Cost	Decimal Equation	Fraction Equation	Number of Stamps
$0.86			
$2.47			
$3.05			

C What do you notice about dividing by 0.01?

NAME _____ **DATE** _____

Dividing by Powers of 10 Practice

Complete the following equations.

3000 ÷ 1000 = _____

2504 ÷ 1000 = _____

372 ÷ 1000 = _____

0.6 ÷ 1000 = _____

0.03 ÷ 1000 = _____

900 ÷ 100 = _____

406 ÷ 100 = _____

7 ÷ 100 = _____

3.2 ÷ 100 = _____

0.08 ÷ 100 = _____

405 ÷ 10 = _____

0.63 ÷ 10 = _____

87 ÷ 0.1 = _____

6 ÷ 0.1 = _____

0.5 ÷ 0.1 = _____

0.48 – 0.1 = _____

3 ÷ 0.01 = _____

6.9 ÷ 0.01 = _____

0.8 ÷ 0.01 = _____

409 ÷ 0.01 = _____

Set A11 ★ Activity 3

ACTIVITY

Using Decimals to Calculate Sale Prices

Overview

As a whole group, students review how to find a sale price, as well as fraction, decimal, and percent equivalences. Then students work in pairs to complete a set of related problems. At the end of the activity, students share their strategies for solving some of the more difficult problems.

Skills & Concepts

★ multiply whole numbers and decimal numbers by decimal numbers to the hundredths place

★ apply fraction, decimal, and percent equivalencies to solve problems

You'll need

★ The Game Sale (pages A11.18 and A11.19, 1 copy for display, plus a class set)

★ Fraction, Decimal & Percent Number Line from Unit Six, Session 16 (See Advance Preparation.)

Advance Preparation Find the Fraction, Decimal & Percent Number Line, which you created with the class in Unit Six, Session 16. If you no longer have it, make an enlarged photocopy of the picture on page 881, Bridges Teacher's Guide, Vol. 3. You might also consider playing the Number Line Game from Unit Six, Session 16 if you think students will need a refresher on equivalent fractions, decimals, and percents.

Instructions for using Decimals to Calculate Sale Prices

1. Write the following problems one at a time where students can see them (answers included in parentheses for your reference). Ask students to work in pairs for a minute or two to solve one problem at a time, and then have students share their answers and strategies as a whole group.

- ½ × 28 (14)
- 0.50 × 28 (14)
- ¼ × 28 (7)
- 0.25 × 28 (7)
- 0.50 × 0.08 (0.04)
- 0.25 × 0.08 (0.02)

2. When they have solved all six problems, ask students to discuss the relationships they noticed among the problems. Students are likely to note that ½ is equal to 0.50 and that ¼ is equal to 0.25. They may also have solved 0.50 × 0.08 by reasoning that half of eight-hundredths is four-hundredths (0.04) and then halved again to solve 0.25 × 0.08. Such strategies show a good understanding of the relationship between fractions, decimals, and division.

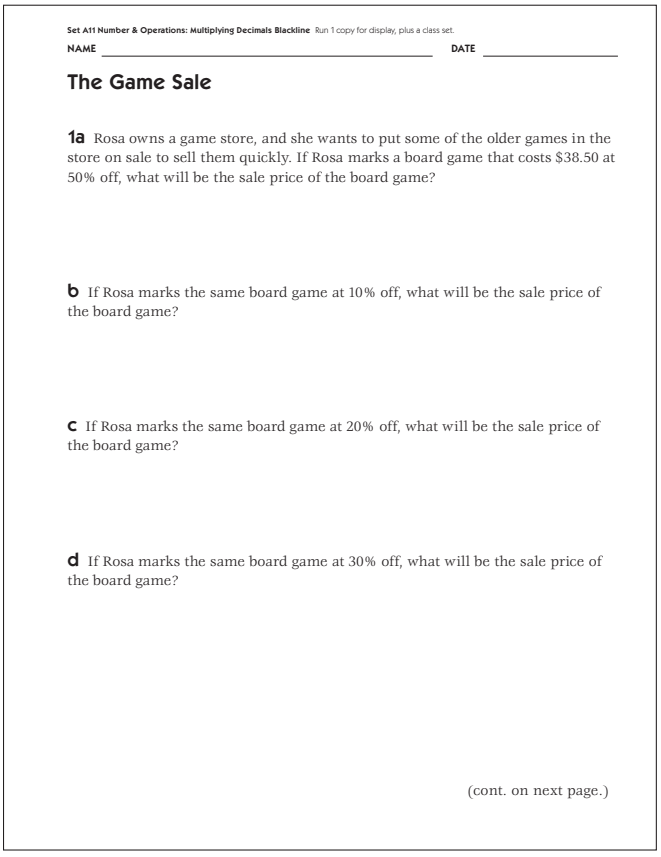
3. Explain that today's activity involves finding the sale prices of different items. Invite students to share some examples of things they have purchased on sale. How much did the item cost originally? How was the sale expressed: in terms of a new price or a certain amount off?

4. After students have shared some examples, ask them to imagine that a bike that originally cost $120 is on sale for 10% off. How could fractions and decimals help them think about the new price for the

bike? (Write the scenario on the board.) Ask students to think about it quietly and then talk to a partner about their ideas. After a few moments, invite partners to share their thoughts with the whole group. Be sure students are clear that they need to calculate the discount (the percent taken off) and then subtract it from the original price to find the sale price, unless, of course, they calculate 120 × 0.90 to find the sale price.

After they have shared some ideas, which will likely involve thinking about fractions and division, refer students to the Fraction, Decimal & Percent Number Line from Unit Six, Session 16. Explain that they can use this number line to refresh their memories of fractions, decimals, and percents that are equivalent during today's activity.

5. Place The Game Sale on display and give each student a copy. Review the sheet with the class. In particular, you'll need to discuss the idea of recording a decimal equation for each row. Students are likely to use what they know about fractions and division to solve each problem, but writing an equation with the discount expressed as a decimal will prompt them to connect their work to multiplication with decimal numbers.



Set A11 Number & Operations: Multiplying Decimals Blackline Run 1 copy for display, plus a class set.

NAME _____ DATE _____

The Game Sale

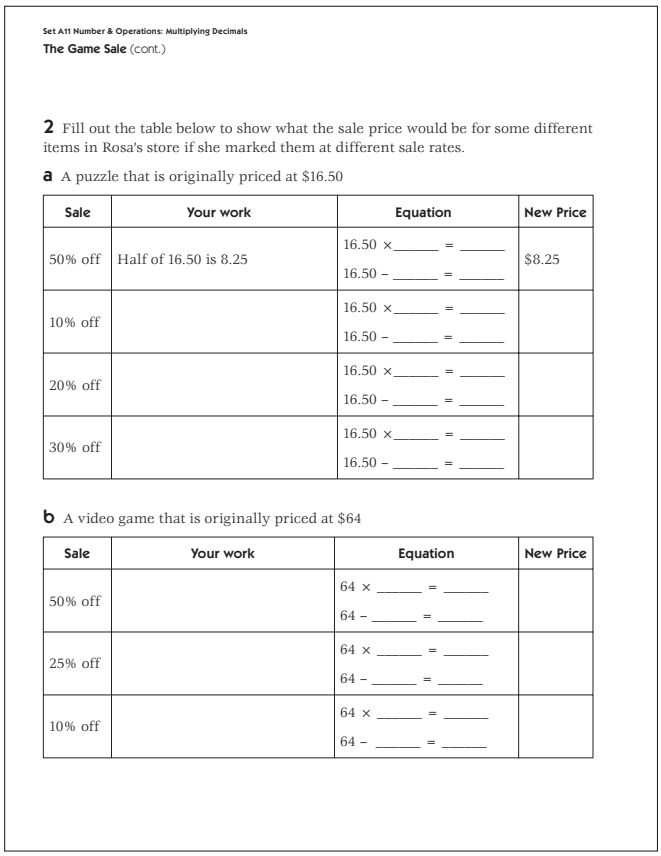
1a Rosa owns a game store, and she wants to put some of the older games in the store on sale to sell them quickly. If Rosa marks a board game that costs $38.50 at 50% off, what will be the sale price of the board game?

b If Rosa marks the same board game at 10% off, what will be the sale price of the board game?

c If Rosa marks the same board game at 20% off, what will be the sale price of the board game?

d If Rosa marks the same board game at 30% off, what will be the sale price of the board game?

(cont. on next page.)



Set A11 Number & Operations: Multiplying Decimals

The Game Sale (cont.)

2 Fill out the table below to show what the sale price would be for some different items in Rosa's store if she marked them at different sale rates.

a A puzzle that is originally priced at $16.50

Sale	Your work	Equation	New Price
50% off	Half of 16.50 is 8.25	16.50 ×_____ = _____ 16.50 – _____ = _____	$8.25
10% off		16.50 ×_____ = _____ 16.50 – _____ = _____	
20% off		16.50 ×_____ = _____ 16.50 – _____ = _____	
30% off		16.50 ×_____ = _____ 16.50 – _____ = _____	

b A video game that is originally priced at $64

Sale	Your work	Equation	New Price
50% off		64 × _____ = _____ 64 – _____ = _____	
25% off		64 × _____ = _____ 64 – _____ = _____	
10% off		64 × _____ = _____ 64 – _____ = _____	

6. Circulate around the room while students work on the sheets in pairs. Take time to provide support, and reconvene the class as a group to discuss some of the problems if more than a few children are confused. Watch how students are working, and think about which problems you'd like to discuss as a whole group.

7. When you have about 15 minutes left in the session, reconvene the class as a whole group to discuss students' strategies for solving a few select problems from the sheets. If you saw students using a valuable or noteworthy strategy, invite them to share their work with the class.

Activity 3 Using Decimals to Calculate Sale Prices (cont.)

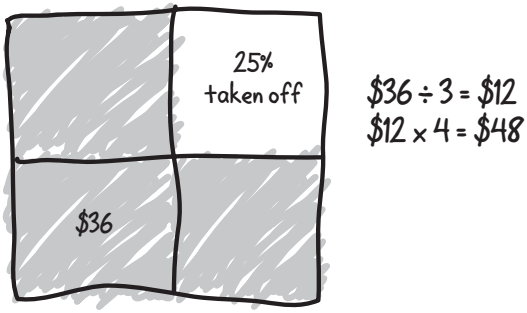
Extension

Invite students to work on some more challenging sale problems. For example:

- A cell phone was 10% off. The sale price was $90. What was the original price?
- A digital camera was 10% off. The sale price was $225. What was the original price?
- A jacket was 25% off. The sale price was $36. What was the original price?

Students will come up with a variety of ways to solve these problems. Here is an example of how a fifth grader might solve the last problem.

This big square is the original price of the jacket. 25 percent is one-fourth of the total. The rest of it is $36. That's the sale price. It's made up of three-fourths of the original price. So I divided $36 by 3 to see how much each part was worth. $12 is one-fourth of the total original price, so that makes the original price $48.



NAME _____ **DATE** _____

The Game Sale

1a Rosa owns a game store, and she wants to put some of the older games in the store on sale to sell them quickly. If Rosa marks a board game that costs $38.50 at 50% off, what will be the sale price of the board game?

b If Rosa marks the same board game at 10% off, what will be the sale price of the board game?

c If Rosa marks the same board game at 20% off, what will be the sale price of the board game?

d If Rosa marks the same board game at 30% off, what will be the sale price of the board game?

(Continued on next page.)

The Game Sale (cont.)

2 Fill out the table below to show what the sale price would be for some different items in Rosa's store if she marked them at different sale rates.

a A puzzle that is originally priced at $16.50

Sale	Your work	Equation	New Price
50% off	Half of 16.50 is 8.25	16.50 × 0.50 = 8.25 16.50 – 8.25 = 8.25	$8.25
10% off		16.50 × _____ = _____ 16.50 – _____ = _____	
20% off		16.50 × _____ = _____ 16.50 – _____ = _____	
30% off		16.50 × _____ = _____ 16.50 – _____ = _____	

b A video game that is originally priced at $64

Sale	Your work	Equation	New Price
50% off		64 × _____ = _____ 64 – _____ = _____	
25% off		64 × _____ = _____ 64 – _____ = _____	
10% off		64 × _____ = _____ 64 – _____ = _____	
40% off		64 × _____ = _____ 64 – _____ = _____	

Set A11 ★ Activity 4

ACTIVITY

Multiplying Decimals

Overview

Students complete a string of related decimal calculations and then discuss the relationships among those calculations. Then they find the area of a computer chip to think about multiplying two decimal numbers. Finally, students solve two more story problems that require them to multiply decimal numbers, as well as a few straight calculations in which they multiply two decimal numbers using an algorithm, an array, or both.

Skills & Concepts

★ multiply decimal numbers to the hundredths place in a variety of ways, including using models

★ estimate solutions to arithmetic problems in order to assess reasonableness of results

You'll need

★ Decimal Grid (page A11.26, 2 copies for display, plus a class set run double-sided, plus extra)

★ Area of a Computer Chip (page A11.27, 1 copy for display)

★ Using the Area Model to Multiply Decimal Numbers (page A11.28, 1 copy for display, plus a class set)

Instructions for Multiplying Decimals

1. Write the following problems one at a time where students can see them (answers included in parentheses for your reference). Ask students to work in pairs for a minute or two to solve one problem at a time, and then have students share their answers and strategies as a whole group.

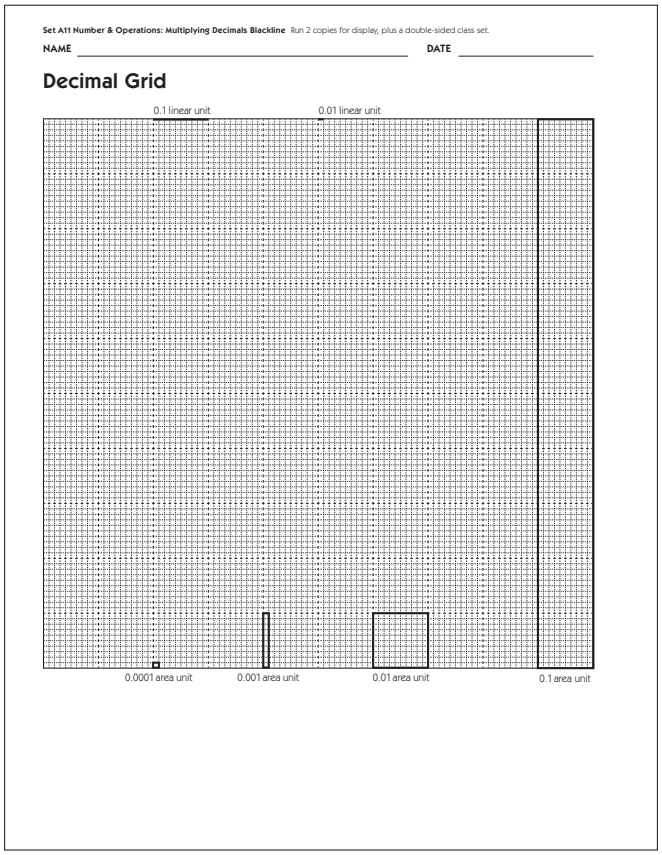
- 0.10×43 (4.3)
- 0.20×43 (8.6)
- 0.10×4.3 (0.43)
- 0.30×4.3 (1.29)

2. When they have solved all four problems, ask students to discuss the relationships they noticed among the problems. Students are likely to note that they can use one-tenth of a number (0.10) to determine any number of tenths (e.g., 0.20 and 0.30 in this case) of that same number.

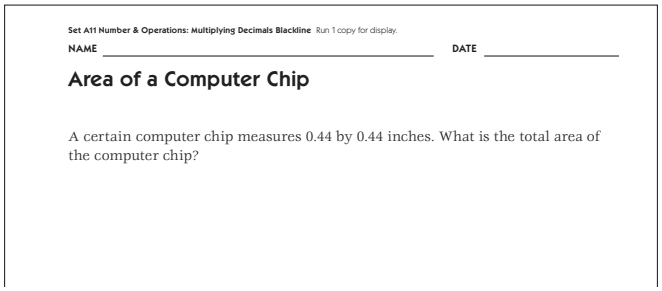
3. Now explain that mental calculations like the ones they've been doing for the past few days aren't as helpful when multiplying certain combinations of decimal numbers. Today they'll be using the area model to help multiply some less friendly decimal numbers.

4. Display a copy of the Decimal Grid on the projector and give each student a double-sided copy of the grid. Ask students what the dimensions of the square must be if the total area is 1. After students have identified each dimension as 1 linear unit, ask them to identify what length each division on the grid indicates. (The heavier lines show tenths of a linear unit, and the finest grid lines show hundredths of a linear unit.) Label your grid to show these lengths, and have students do the same.

5. Then have them identify the fraction of the total area represented by the larger and smaller squares (hundredths and ten thousandths, respectively). Then ask students to identify what portion of the grid represents one-tenth and one-thousandth of the total area (a strip of 10 large squares and a strip of 10 small squares, respectively). Label these areas on your grid, and ask students to do the same.



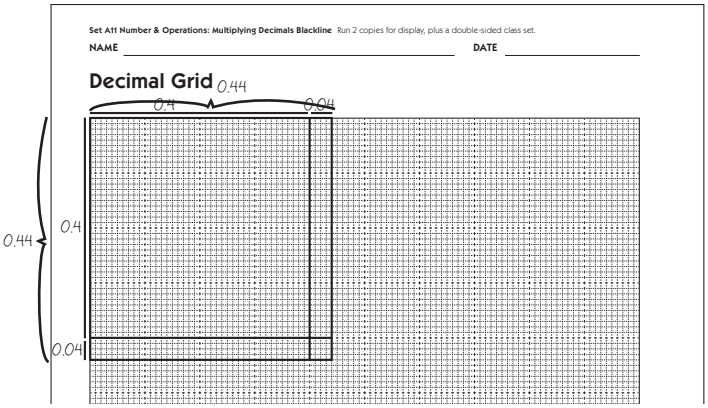
6. Post the Area of a Computer Chip problem on the projector, and ask students to turn their papers over and draw an array on their second Decimal Grid to represent the problem.



Before students continue, ask them to check their work with a partner and then make an estimate of the total area of their array with their partner. Tell them to refer to their labeled Decimal Grids or the one you have displayed at the overhead as needed.

7. Now ask a volunteer to help you label the dimensions of the array on another projected copy of the Decimal Grid. When the dimensions have been correctly labeled, outline the array and make lines to show the partial products within the array.

Activity 4 Multiplying Decimals (cont.)

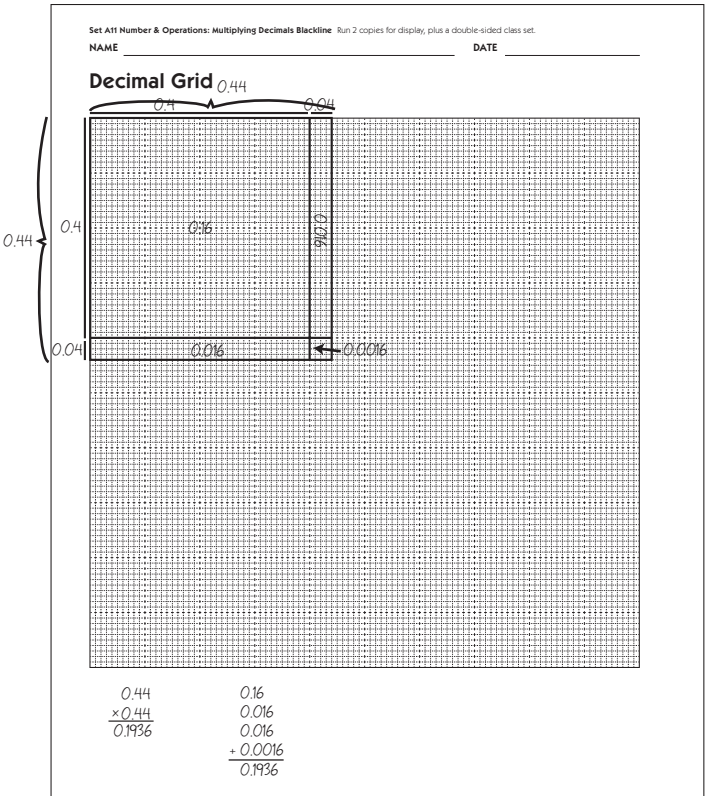


8. Before continuing, ask students to share their estimates of the total area of the array. When they do, encourage them to justify their thinking, and help them write each estimate in the form of an inequality. (You may need to invite them to refer to their labeled grids to remind them how big each piece of the grid is.)

$0.44 \times 0.44 < 0.25$ $\quad$ $0.44 \times 0.44 > 0.16$

9. Now ask students to divide their arrays into partial products as you have on the projected Decimal Grid. Then give them time to work in pairs to find the total area of the computer chip. Circulate while they work to listen in on their conversations. Reconvene the class to clarify any confusion that may arise. Otherwise, let them work, and reconvene the group when most have finished.

10. Invite volunteers to help you label the partial products on the array, and then ask them how they found the total area.



Activity 4 Multiplying Decimals (cont.)

11. After they have shared their strategies, ask what they notice about the process or result of this calculation. Students may be surprised or interested to find that the total area is considerably smaller in relation to the area of the unit than the dimensions are in relation to the linear unit. Encourage them to use the Decimal Grid to explore why this is so. (The linear unit has been divided just once for each dimension, but the area unit has been divided twice, once at each linear dimension.)

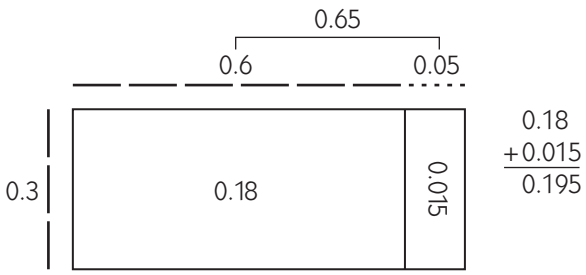
You might also ask them to investigate why the product goes to four decimal places when the dimensions each go to just two decimal places. You might also want to wait until students have completed a few more problems before investigating this phenomenon. If they can discern and explain some patterns related to where the decimal point goes in the product, they will be able to use the standard algorithm to multiply decimal numbers. Prompting them to estimate a reasonable answer before they calculate will also help students be able to place the decimal point in the products based on what makes sense for the numbers they are multiplying.

12. Now give each student a copy of Using the Area Model to Multiply Decimal Numbers and ask them to complete the problems in pairs. These problems require students to sketch an array for each problem, rather than use a Decimal Grid. If students seem to be having trouble with their sketches, gather everyone together as a group to make the sketches together before having them continue solving the problems in pairs. (If necessary, allow students who need extra support to make their sketches on Decimal Grid paper and attach them to the worksheet.) A sketch of each problem is shown below for your convenience.

Without the entire Decimal Grid, students may have difficulty determining the area of each partial product, struggling to recall whether each unit of area in a given region is one hundredth or one thousandth of the total, for example. Encourage them to break the numbers apart to apply the associative property and use what they know about multiplying by powers of 10. For example, students might calculate the area of the larger partial product in the first example below in one of the following ways:

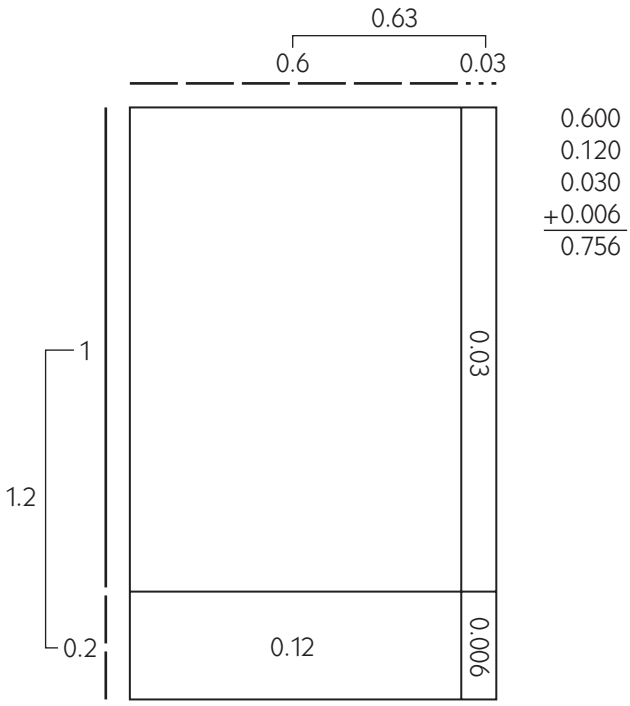
$0.3 \times 0.6 = 3 \times 0.1 \times 0.6$
$3 \times 0.1 \times 0.6 = 3 \times 0.06$
$3 \times 0.06 = 0.18$

$0.3 \times 0.6 = 3 \times 0.1 \times 6 \times 0.1$
$3 \times 0.1 \times 6 \times 0.1 = 3 \times 6 \times 0.1 \times 0.1$
$3 \times 6 \times 0.1 \times 0.1 = 18 \times 0.01$
$18 \times 0.01 = 0.18$



$0.3 \text{ m} \times 0.65 \text{ m} = 0.195 \text{ m}^2$

Activity 4 Multiplying Decimals (cont.)



1.2 km by 0.63 km = 0.756 km^2

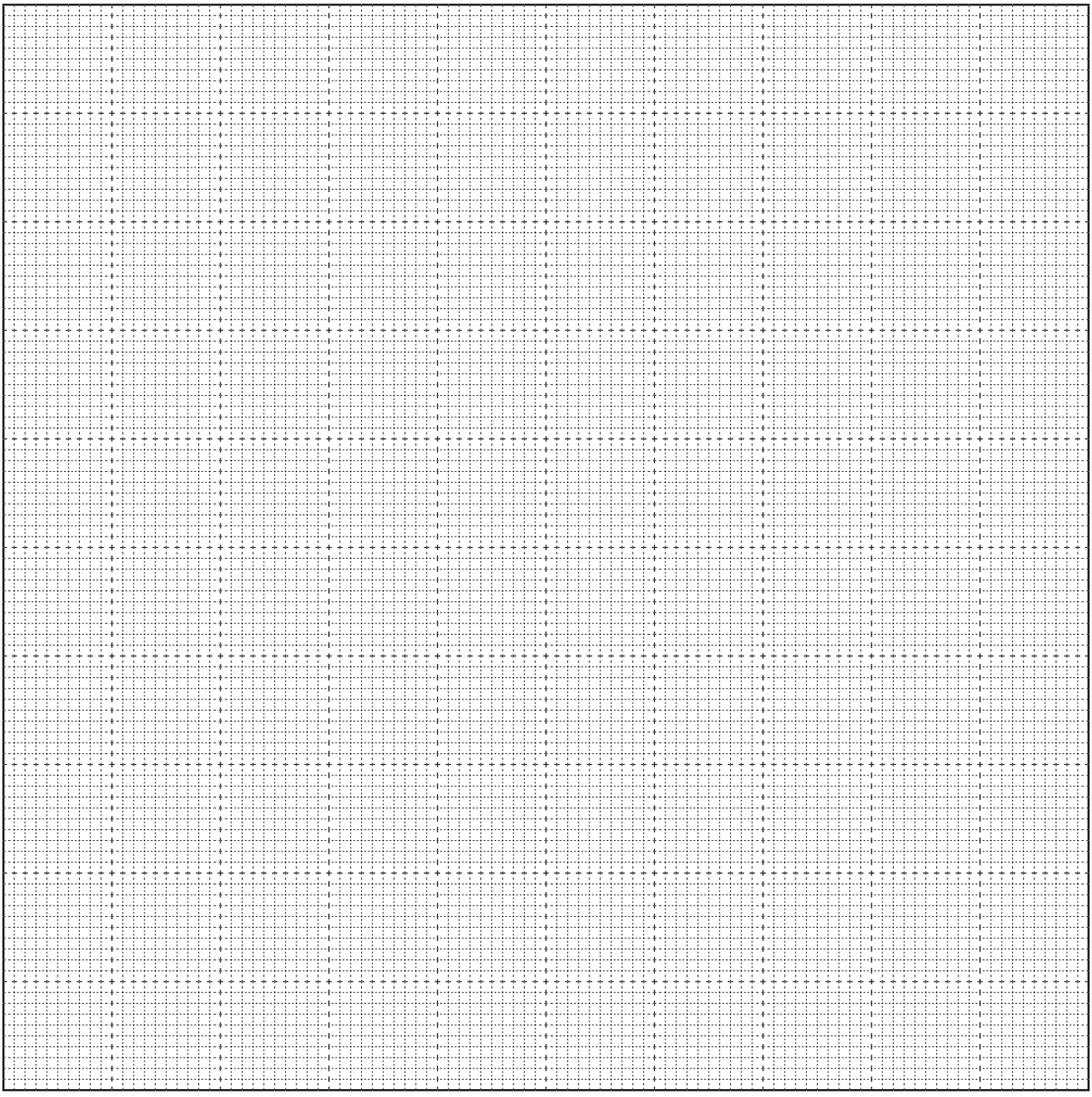
13. Extend students' work into a second day if needed. After watching them work, consider opening the second day's lesson with a mini-lesson focusing on whatever elements of these calculations were most challenging for them the first day.

INDEPENDENT WORKSHEET

Use Set A11 Independent Worksheets 4 and 5 to provide students with more practice multiplying decimals.

NAME _____ **DATE** _____

Decimal Grid



NAME _____ **DATE** _____

Area of a Computer Chip

A certain computer chip measures 0.44 by 0.44 inches. What is the total area of the computer chip?

NAME _____ **DATE** _____

Using the Area Model to Multiply Decimal Numbers

1a A piece of paper measures 0.3 m by 0.65 m. Estimate the total area of the piece of paper.

b Make a labeled sketch of the piece of paper and use it to calculate an exact answer.

2a The city park measures 1.2 km by 0.63 km. Estimate the total area of the park.

b Make a labeled sketch of the park and use it to calculate an exact answer.

3 Use an algorithm or sketch arrays on another piece of paper to find the products below.

1.6	1.5	4.5	2.43
× 0.7	× 0.2	× 2.3	× 1.8

NAME _____ **DATE** _____

Set A11 ★ Independent Worksheet 1

INDEPENDENT WORKSHEET

Thinking about Tenths, Hundredths & Thousandths

1 Write two fractions that are equal to each decimal number.

0.1 = _____ and _____ 0.01 = _____ and _____

0.001 = _____ and _____ 0.05 = _____ and _____

2 Complete the chart below.

Number	0.1 less	0.1 greater	0.01 less	0.01 greater	0.001 less	0.001 greater
1.2	1.1	1.3	1.19	1.21	1.199	1.201
8.73						
4.06						
6.9						
2.896						
6						

3 Round each number to the place shown to complete the chart below.

Number	Nearest tenth (0.1) Look at the 0.01 place.	Nearest hundredth (0.01) Look at the 0.001 place.	Nearest thousandth (0.001) Look at the 0.0001 place.
0.1629	0.2	0.16	0.163
0.9608			
0.0274			
6.0085			

NAME _____ **DATE** _____

Set A11 ★ Independent Worksheet 2

INDEPENDENT WORKSHEET

Very Large & Very Small Numbers in Context

1 A micrometer is one-millionth of a meter (0.000001 m): ten thousand times shorter than a centimeter (0.01 m). How many micrometers long is one edge of a centimeter cube?

2a The football team for the University of Tennessee, the Tennessee Volunteers, plays its home games in the Neyland Stadium in Knoxville, Tennessee. The stadium holds about 100,000 people. (Do an image search on the internet to see what this many people looks like.) How many stadiums would it take to hold one million people (a bit less than the number of people living in Dallas, Texas)?

b According to United Nations estimates, there are over 300 million people living in the United States. How many Neyland Stadiums would it take to hold 300 million people?

3 The table below shows the estimated population of different countries as of 2009. Round each number to complete the table.

Country	Population	Nearest 1,000,000	Nearest 100,000	Nearest 10,000
Philippines	92,226,600	92,000,000	92,200,000	92,230,000
Iran	74,196,000			
France	65,447,400			
South Korea	49,773,100			
Argentina	40,134,400			
Sudan	39,154,500			

NAME _____ **DATE** _____

Set A11 ★ Independent Worksheet 3

INDEPENDENT WORKSHEET

Multiplying & Dividing by Powers of Ten

1 Solve the multiplication problems below.

34 × 0.01 = _____ 34 × 0.10 = _____ 34 × 1 = _____

34 × 10 = _____ 34 × 100 = _____ 34 × 1,000 = _____

2 Solve the division problems below.

34 × 0.01 = _____ 34 ÷ 0.10 = _____ 34 × 1 = _____

34 ÷ 10 = _____ 34 ÷ 100 = _____ 34 ÷ 1,000 = _____

3 What patterns do you notice in the equations you completed above?

4 Solve the multiplication and division problems below.

62 ÷ 100 = _____ 3.4 × 1000 = _____ 7.89 ÷ 0.10 = _____

0.43 × 100 = _____ 0.08 × 0.01 = _____ 123.05 ÷ 100 = _____

5 Ramon bought erasers shaped like animals to give away at Family Night at his school. Each eraser costs $0.10. If he spent $25.60, how many erasers did he buy?

a Write a division equation to represent this situation.

b Solve the problem using a strategy that makes sense to you. Show all your work.

NAME _____ **DATE** _____

Set A11 ★ Independent Worksheet 4

INDEPENDENT WORKSHEET

Using Landmark Fractions & Percents to Multiply by Decimals

1a At morning assembly, the principal said that the number of students at the school would be increasing by 10% next year. If there are 260 students at the school this year, how many more students are coming to the school next year?

b How many students will be at the school altogether next year?

c If the number of students increased by 30% over the next three years, how many more students would be coming to the school?

d If the number of students increased by 25% over the next three years, how many more students would be coming to the school?

2 Look at your work above. Use it to complete the equations below.

260 × 0.10 = _____ 260 × 0.30 = _____ 260 × 0.25 = _____

3 Complete the following equations.

430 × 0.10 = _____ 430 × 0.20 = _____ 430 × 0.50 = _____

84 × 0.01 = _____ 84 × 0.02 = _____ 84 × 0.06 = _____

72 × 0.50 = _____ 72 × 0.25 = _____ 72 × 0.75 = _____

0.12 × 0.50 = _____ 0.12 × 0.25 = _____ 0.12 × 0.10 = _____

NAME _____ **DATE** _____

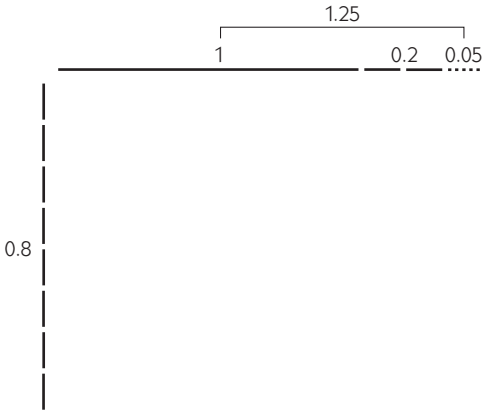
Set A11 ★ Independent Worksheet 5

INDEPENDENT WORKSHEET

Multiplying Two Decimal Numbers

1a The memory card for Steve's camera measures 0.82 inches by 1.25 inches. What do you estimate the total area of the memory card is?

b Find the exact area of the memory card. Show all your work. Fill in the array below if it helps you.



c What is the place value of the smallest unit of area in the array above?

2 Fill in an estimate and the exact answer for the problems below.

a Estimate:

$$\begin{array}{r} 0.40 \\ \times\ 0.56 \\ \hline \end{array}$$

Exact Answer:

b Estimate:

$$\begin{array}{r} 2.06 \\ \times\ 1.42 \\ \hline \end{array}$$

Exact Answer:

c Estimate:

$$\begin{array}{r} 3.7 \\ \times\ 0.28 \\ \hline \end{array}$$

Exact Answer:

BRIDGES IN MATHEMATICS 5

GRADE 5 SUPPLEMENT

Set B1 Algebra: Diagrams & Equations

Includes

Skills & Concepts

★ represent an unknown quantity using a letter or a symbol

★ express mathematical relationships using equations

★ use diagrams and equations to draw conclusions about problem situations

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P0509

Bridges in Mathematics Grade 5 Supplement
Set B1 Algebra: Diagrams & Equations

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Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

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Set B1 ★ Activity 1

ACTIVITY

The Carnival

Overview

Students practice writing equations and drawing diagrams to go with a variety of problem situations. Then they select equations and diagrams that best represent a problem situation.

Skills & Concepts

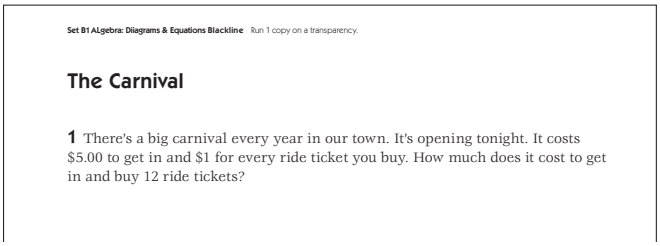
- ★ represent an unknown quantity using a letter or a symbol
- ★ express mathematical relationships using equations
- ★ use diagrams and equations to draw conclusions about problem situations

You'll need

- ★ The Carnival (page B1.3, run 1 copy on a transparency)
- ★ More Carnival Problems (pages B1.4–B1.6, run 1 copy on a transparency, plus a class set)
- ★ overhead pens
- ★ piece of paper to mask parts of the overhead
- ★ Student Math Journals or 1 piece of lined or grid paper per student

Instructions for The Carnival

1. Place the top portion of The Carnival overhead on display, keeping the other 3 problems covered for now. Read the problem with the class, and ask students to give the thumbs-up sign when they have the answer. Invite a couple of volunteers to share and explain their solutions.



Set B1 ALgebra: Diiagrams & Equations Blackline Run 1 copy on a transparency.

The Carnival

1 There's a big carnival every year in our town. It's opening tonight. It costs $5.00 to get in and $1 for every ride ticket you buy. How much does it cost to get in and buy 12 ride tickets?

Gabe *It's $17.00 because you have to pay $5.00 to get in and $1.00 for each ticket. If you get 12 tickets, that's $12.00. Five more dollars makes 17 in all.*

Alyssa *I said the same thing. I just went 12 + 5 because I knew it was a dollar for every ride ticket.*

2. Have students get out their math journals. Ask them to write an equation to show the amount of money it would take to get in and buy 12 ride tickets. Have them pair-share their responses and then call on volunteers to read theirs to the class. Record the suggested equations at the overhead.

3. Explain that sometimes people use a lettrt, such as x, to represent the quantity to be determined. How would you write the equation if you used x to stand for the total amount of money in this problem? Discuss this with the class and record their ideas at the overhead.

Activity 1 The Carnival (cont.)

Set B1 Algebra: Diagrams & Equations Blackline Run 1 copy on a transparency.

The Carnival

1 There's a big carnival every year in our town. It's opening tonight. It costs $5.00 to get in and $1 for every ride ticket you buy. How much does it cost to get in and buy 12 ride tickets?

$5.00 + $12.00 = $17.00
$5.00 + $12.00 = ×

$5.00 + (12 × $1.00) = $17.00
× = $5.00 + (12 × $1.00)

4. Reveal each of the other 3 problems one by one. In each case, have students respond in their journals and pair-share their responses before asking volunteers to share their thinking with the class. Press students to explain how they made their selections in problems 2 and 4, and why some of the other choices don't work. (The answers have been marked on the copy below for your reference. Some of your students may have other valid responses to problem 3.)

2 Miguel is going with his friend, Corey. Miguel is planning to buy 16 ride tickets. Which equation could be used to find x, the amount of money he'll need to get in and buy ride tickets?

(a) $x = \$5.00 + (16 \times \$1.00)$
b $x = \$5.00 \times (16 \times \$1.00)$
c $x = \$16.00 - \$5.00$
d $x = (16 \times \$1.00) \div \$5.00$

3 Corey has $27.00 to spend on admission and tickets. How many tickets will he be able to buy? Write an equation in your journal to show. Use the letter x to stand for the number of tickets Corey will be able to buy.

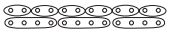
× = $27.00 - $5.00

4 Miguel's favorite ride is the Teacup. Some of the cups hold 2 people. Others hold 4 people. There are 9 cups in all, and when the ride is full, it holds 24 people. Which diagram best represents this problem? Why?

a

b

(c)



d

5. Ask students to use the information in problem 4, including diagram c to solve the following problem: How many of the teacups seat 2 people, and how many seat 4 people?

6. Give students each a copy of More Carnival Problems. Review the sheets with the class. When students understand what to do, have them go to work. Encourage them to share and compare strategies and solutions as they work.

7. Reconvene the class as time allows to discuss solutions and strategies for some or all of the problems.

INDEPENDENT WORKSHEET

See Set B1 Independent Worksheets 1 and 2 for more practice selecting equations and diagrams to represent meaningful problem situations.

The Carnival

1 There's a big carnival every year in our town. It's opening tonight. It costs $5.00 to get in and $1 for every ride ticket you buy. How much does it cost to get in and buy 12 ride tickets?

2 Miguel is going with his friend, Corey. Miguel is planning to buy 16 ride tickets. Which equation could be used to find x, the amount of money he'll need to get in and buy ride tickets?

○ $x = \$5.00 + (16 \times \$1.00)$

○ $x = \$5.00 \times (16 \times \$1.00)$

○ $x = \$16.00 - \$5.00$

○ $x = (16 \times \$1.00) \div \$5.00$

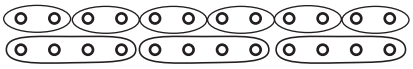
3 Corey has $27.00 to spend on admission and tickets. How many tickets will he be able to buy? Write an equation in your journal to show. Use the letter x to stand for the number of tickets Corey will be able to buy.

4 Miguel's favorite ride is the Teacup. Some of the cups hold 2 people. Others hold 4 people. There are 9 cups in all, and when the ride is full, it holds 24 people. Which diagram best represents this problem? Why?

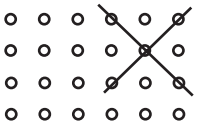
○

○

○



○



NAME _____ **DATE** _____

More Carnival Problems page 1 of 3

1 Each of the seats on the giant ferris wheel holds 3 people. There are 26 seats in all. Which equation could be used to find x, the number of people riding when the ferris wheel is full?

$3 \div 26 = x$ ○

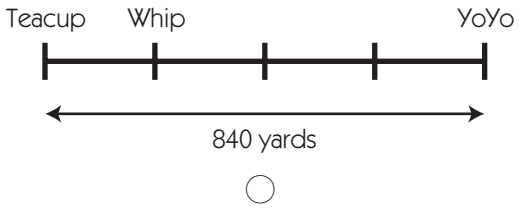
$x + 26 = 3$ ○

$3 \times 26 = x$ ○

$x - 3 = 26$ ○

2 After they rode on the Teacup, Miguel and Corey wanted to go on the Yoyo. In order to get there, they had to walk past the Whip. It is three times as far from the Teacup to the Whip as it is from the Whip to the Yoyo. It is 840 yards from the Teacup to the Yoyo. How far is it from the Teacup to the Whip?

a Which diagram below best shows this problem?



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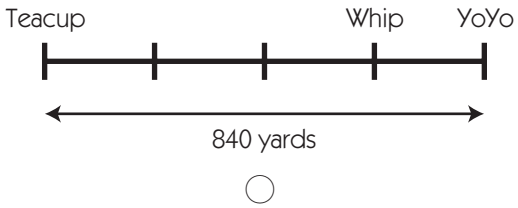

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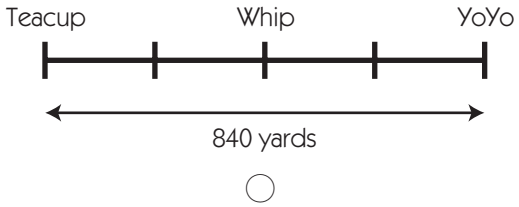

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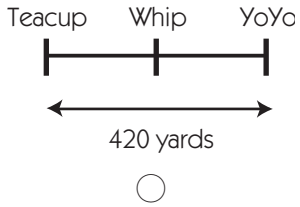


○

b Use the diagram you picked to help solve the problem. Show all of your work.

More Carnival Problems page 2 of 3

3 Some of the rides take 2 tickets and some of them take 3 tickets.

a If Marisa had 17 tickets and used all of them, how many 2-ticket and 3-ticket rides did she take?

○ 5 two-ticket rides and 4 three-ticket rides

○ 10 two-ticket rides and 7 three-ticket rides

○ 3 two-ticket rides and 3 three-ticket rides

○ 4 two-ticket rides and 3 three-ticket rides

b Use numbers, words, and/or labeled sketches to explain your answer to part a.

4 Darius has 9 rides tickets. His sister Deja has 3 more ride tickets than Darius. Their friend Camila has twice as many ride tickets as Deja.

a Which equation could be used to find x, the number of tickets Camila has?

$(9 + 3) \times 2 = x$ ○ $9 \times 3 = x$ ○ $(9 + 3) \div 2 = x$ ○ $9 \times 3 \div 2 = x$ ○

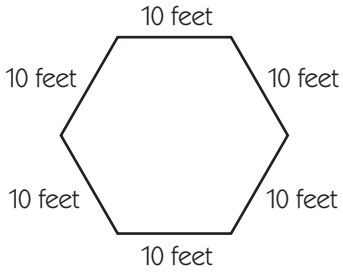
b Use numbers, words, and/or labeled sketches to explain your answer to part a.

NAME _____ **DATE** _____

More Carnival Problems page 3 of 3

5 There is a bumper-car ride for little kids next to the hotdog stand. The fence around the ride is a hexagon with 2 long sides that are equal and 4 short sides that are equal.

a Which diagram below best shows the fence around the bumper car ride?



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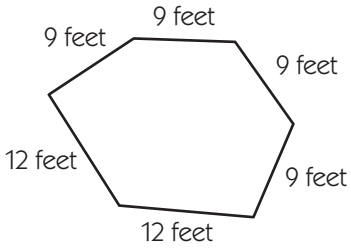

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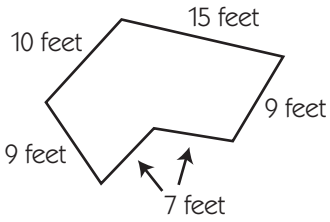


○

b Use the diagram you picked to write and solve an equation for the perimeter of the fence.

NAME _____ **DATE** _____

Set B1 ★ Independent Worksheet 1

INDEPENDENT WORKSHEET

Padre's Pizza

1 It costs $9.50 for a large pizza with cheese at Padre's Pizza. Each extra topping is $1.00.

a Which equation could be used to find y, the amount of money it would cost for a large pizza with 4 extra toppings?

$y = \$9.50 - \$4.00$ ○

$y = \$9.50 \times (4 \times \$1.00)$ ○

$y = \$9.50 + (4 \times \$1.00)$ ○

$y = (4 \times \$1.00) \div \$9.50$ ○

b Explain your answer to part a. Why did you choose this equation instead of the others?

2 It's Ty's birthday. For his party, his mom bought 4 large pizzas with a total of 9 extra toppings.

a Which equation could be used to find y, the amount of money she had to pay?

$y = \$9.50 + (9 \times \$1.00)$ ○

$y = (4 \times \$9.50) + (4 \times \$1.00)$ ○

$y = \$9.50 - (9 \times \$1.00)$ ○

$y = (4 \times \$9.50) + (9 \times \$1.00)$ ○

b Explain your answer to part a. Why did you choose this equation instead of the others?

(Continued on back.)

Independent Worksheet 1 Padre's Pizza (cont.)

3 The marching band went to Padre's after the Friday night football game They ordered 7 large pizzas with 3 extra toppings each and 4 large pizzas with 4 extra toppings each.

a Which equation could be used to find t, the total number of extra toppings?

$t = (7 \times 3) + (4 \times 4)$ ○

$t = 7 \times 3 \times 4 \times 4$ ○

$t = (7 + 3) \times (4 + 4)$ ○

$t = 7 + 3 + 4 + 4$ ○

b Use the equation you picked to solve the problem. How many extra toppings did they order in all? Show your work.

c How much did they have to pay for all the pizzas they ordered? Show all your work.

4 The cook at Padre's Pizza has 12 pizzas lined up for a special order. She put cheese and sausage on all of them. She added pineapple to every second pizza and olives to every third pizza.

a Which pizzas in the line will have all 4 toppings (cheese, sausage, pineapple, and olives)? Mark the row you could use to solve this problem.

○ P | PC | PO | PC T | P | PC O | P | PC T | PO | PC | P | PC OT

○ C | CS | CP | CS O | C | CS P | C | CS O | CP | CS | C | CS PO

○ CS | CS P | CS O | CS P | CS | CS PO | CS | CS P | CS O | CS P | CS | CS PO

(Continued on next page.)

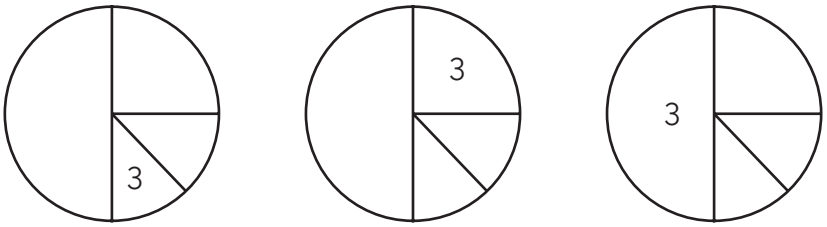
NAME _____ **DATE** _____

Independent Worksheet 1 Padre's Pizza (cont.)

4b Which of the 12 pizzas got all 4 toppings?

5 The boy's basketball team came into Padre's on Wednesday night after practice. Half the boys on this team also play soccer, $\frac{1}{4}$ play baseball, and $\frac{1}{8}$ are in the school band. The remaining 3 boys aren't in any other activities. No one is in more than 2 activities.

a How many boys are there on the basketball team? Circle the diagram that will give you the most help solving this problem.



b Use the diagram you picked to help solve the problem. Show all of your work.

NAME _____ **DATE** _____

Set B1 ★ Independent Worksheet 2

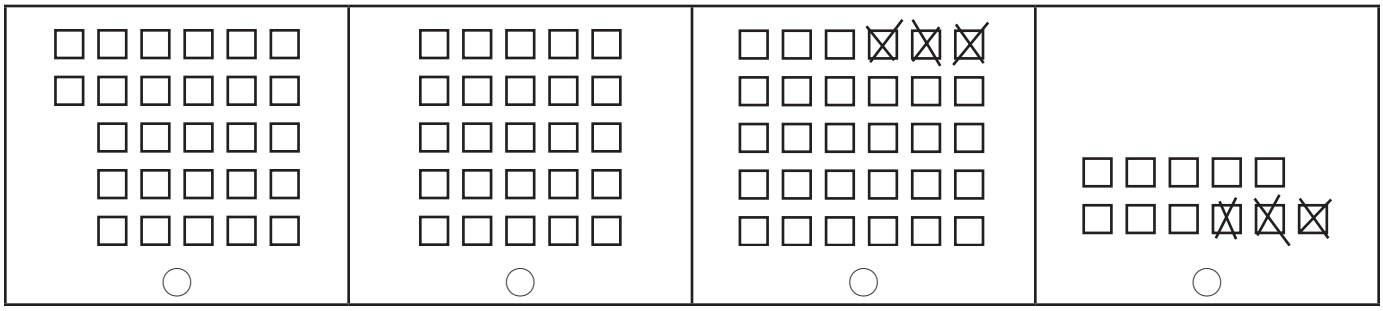
INDEPENDENT WORKSHEET

Choosing Equations & Diagrams

Select the diagram and equation that best represent each problem situation below.

1 There are 5 rows of 6 desks in the classroom. Today, 3 of the desks are empty. How many students are in class today?

a Which diagram below best shows this problem?



b If x represents the number of students in class, which equation could be used to solve the problem?

$5 + 3 + 6 = x$ ○	$(5 \times 6) - 3 = x$ ○	$(5 \times 3) + 6 = x$ ○	$(5 \times 6) + 3 = x$ ○

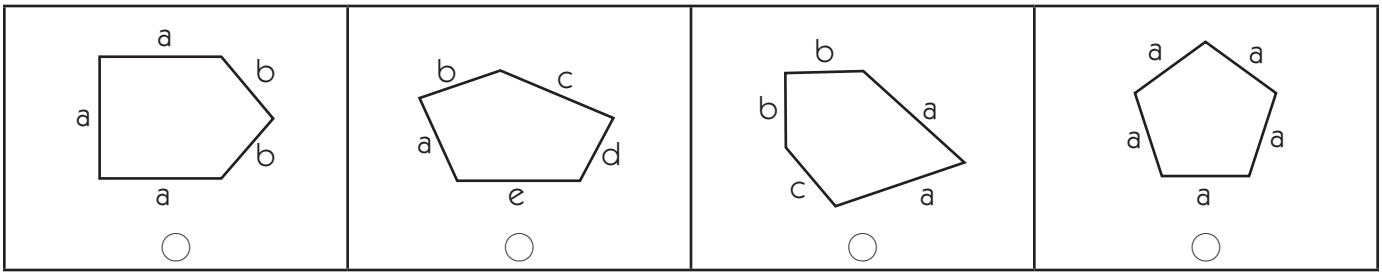
c Explain your answer to part b. Why did you choose this equation instead of the others?

(Continued on back.)

Independent Worksheet 2 Choosing Equations & Diagrams (cont.)

2 A pentagon has three longer sides that are all the same length and two shorter sides that are both the same length.

a Which diagram shows the pentagon described above?

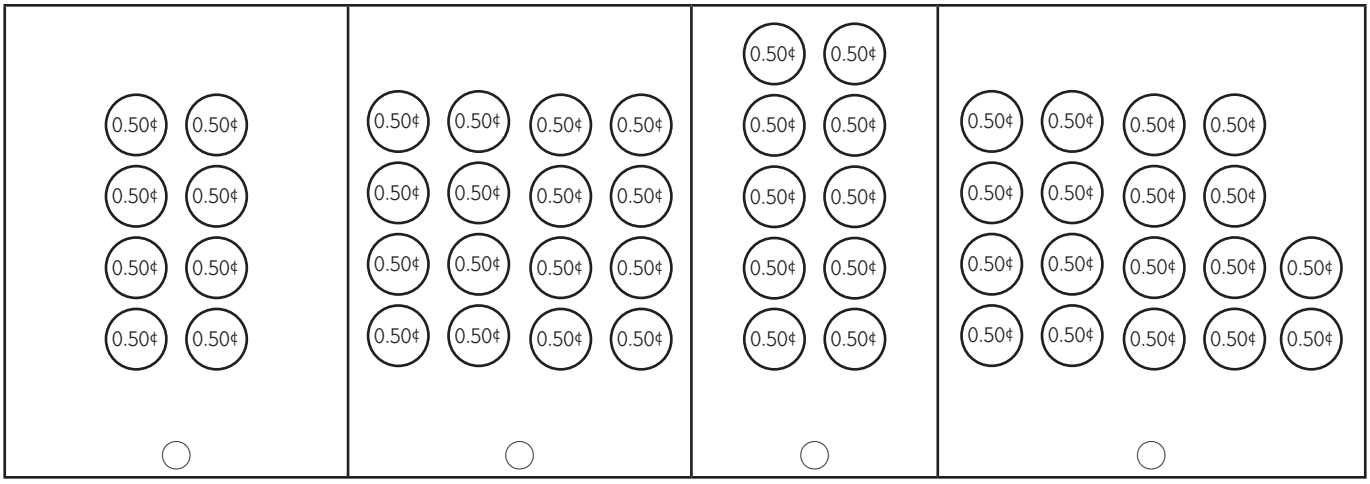


b Which equation could be used to find the perimeter of the pentagon?

$P = 5 \times a$ ○	$P = 3 + a + 2 + b$ ○	$P = (2 \times a) + (2 \times b)$ ○	$P = (3 \times a) + (2 \times b)$ ○

3 Destiny is having a party. She wants to get two cookies for each of the 8 people, including herself, who will be at the party. If each cookie costs 50¢, how much money will she spend on cookies?

a Which diagram below best shows this problem?



b Explain your answer to part a. Why did you choose this diagram instead of the others?

(Continued on next page.)

NAME _____ **DATE** _____

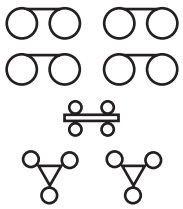
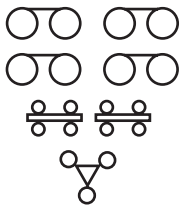
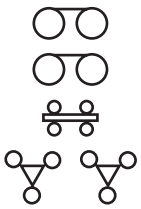
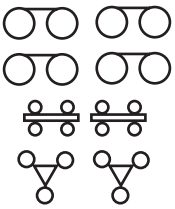
Independent Worksheet 2 Choosing Equations & Diagrams (cont.)

c If x represents the amount of money Destiny is going to spend, which equation could be used to solve the problem?

$(2 + 8) \times 0.50 = x$ ○	$(2 \times 8) \times 1.00 = x$ ○	$(2 \times 8) - 0.50 = x$ ○	$(2 \times 8) \times 0.50 = x$ ○

4 There are 4 bikes, 2 skateboards, and a tricycle in Milo's garage How many wheels are there altogether?

a Which diagram below best shows this problem?

 ○	 ○	 ○	 ○

b If x represents the number of wheels in Milo's garage, which equation could be used to solve the problem?

$2 \times (4 + 2 + 1) = x$ ○	$(2 + 4 + 3) \times 2 = x$ ○	$2 \times 4 \times 3 = x$ ○	$(4 \times 2) + (2 \times 4) + 3 = x$ ○

c Explain your answer to part b. Why did you choose this equation instead of the others?

5 There are some bikes and trikes on the playground. There are 36 wheels in all, and 15 bikes and trikes. How many bikes are there? How many trikes are there? Make a labeled diagram to solve the problem. Show your work. Use the back of the page if you need more room.

BRIDGES IN MATHEMATICS 5

GRADE 5 SUPPLEMENT

Set C1 Geometry: Triangles & Quadrilaterals

Includes

Skills & Concepts

- ★ classify quadrilaterals
- ★ identify, describe, and classify triangles by angle measure and number of congruent sides
- ★ determine the formula for the area of a parallelogram by relating it to the area of a rectangle
- ★ determine the formula for the area of a triangle by relating it to the area of a parallelogram
- ★ use formulas to determine the perimeters and areas of rectangles and parallelograms
- ★ draw quadrilaterals and triangles from given information about sides and angles
- ★ solve single- and multi-step word problems about the perimeters and areas of quadrilaterals and triangles, and verify the solutions

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P0509

Bridges in Mathematics Grade 5 Supplement
Set C1 Geometry: Triangles & Quadrilaterals

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P0509

Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set C1 ★ Activity 1

ACTIVITY

Classifying Triangles

Overview

Students build and record four different triangles on their geoboards. Then they classify their triangles, first by angle size and then by side length.

Skills & Concepts

★ classify triangles by the length of their sides as either scalene, isosceles, or equilateral

★ classify triangles by the size of their angles as either acute, obtuse, or right

★ classify angles as either right, acute, or obtuse

You'll need

★ Triangles Record Sheet (page C1.5, run a class set plus a few extra and one copy on a transparency)

★ Types of Triangles (page C1.6, run one copy on a transparency)

★ overhead geoboard

★ class set of geoboards and rubber bands

★ class set of rulers

★ a piece of paper to mask parts of the overhead

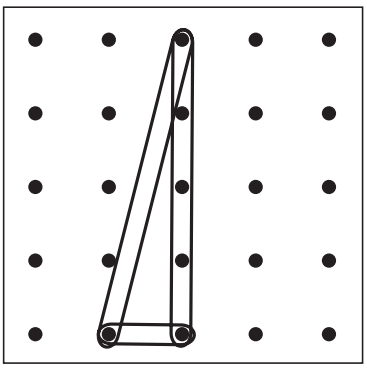
★ access to protractors

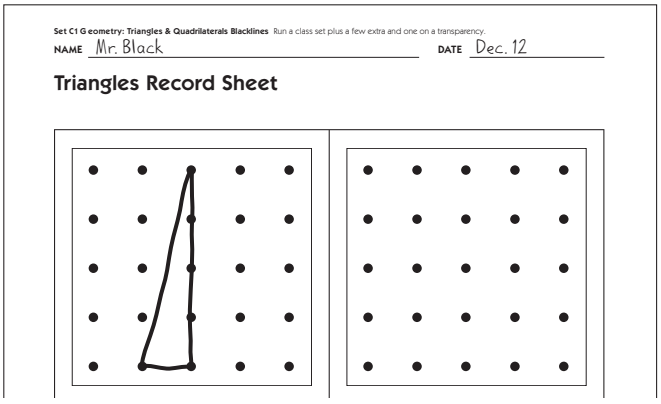
★ Word Resource Cards: acute angle, obtuse angle, right angle (pages D6.7–D6.12, run 1 copy back to back on cardstock, cut out each card. See Advance Preparation)

Advance Preparation Post the Word Resource Cards where all the students can see them clearly before you conduct this activity.

Instructions for Classifying Triangles

1. Ask students to get out their rulers and pencils. Then give them each a geoboard and a copy of the Triangles Record Sheet. Explain that they are going to make and record 4 different types of triangles today. Demonstrate by making a triangle on a geoboard at the overhead. If necessary, review any guidelines you have established with the class for handling the rubber bands carefully. Then copy your triangle onto the Triangles Record Sheet transparency. Solicit advice from students about how to do this carefully and accurately as you are working.

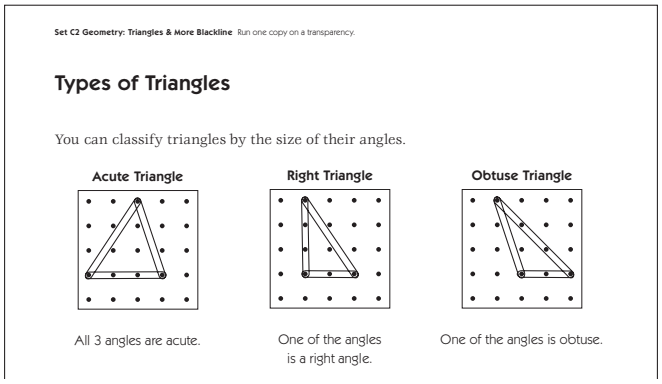




Activity 1 Classifying Triangles (cont.)

2. When students understand what to do, pass out the rubber bands and let them get started. Remind them to make 4 different triangles. Encourage them to make triangles that are different than the one you made, and different from the ones their neighbors are making. Circulate as they are working to talk with them about their triangles. What kinds of angles do they notice as they create their triangles? Can they point out acute, obtuse, and/or right angles in their work?

3. When most students have finished, reconvene the class. Explain that they are going to classify by type, and record, the triangles they have just created. Show just the top portion of Types of Triangles at the overhead.



Set C2 Geometry: Triangles & More Blackline Run one copy on a transparency.

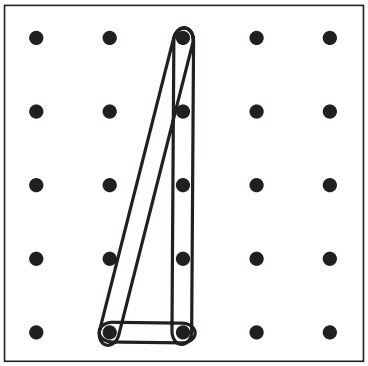
Types of Triangles

You can classify triangles by the size of their angles.

Acute Triangle	Right Triangle	Obtuse Triangle
All 3 angles are acute.	One of the angles is a right angle.	One of the angles is obtuse.

4. Read and discuss the information with the class. Ask volunteers to work with the support of the pictures on the Word Resource Cards to describe each type of angle and label an example of each on the overhead. Then have the students help you classify the triangle you made on your geoboard.

> ***Teacher*** *What kind of triangle did I make when I introduced this activity? I'll hold up my geoboard so you can see it while you look at the different types of triangles on the overhead. Pair-share with the person next to you, and raise your hand when you have an idea.*



> ***Students*** *I think it's an acute triangle because it's so skinny.*
> *It's none of those because it doesn't look like any of the triangles on the overhead.*
> *I'm almost sure the angle at the bottom is a right angle. I think it's a right triangle.*
> *Can we test it out? Let's see if a square pattern block will fit in that corner.*

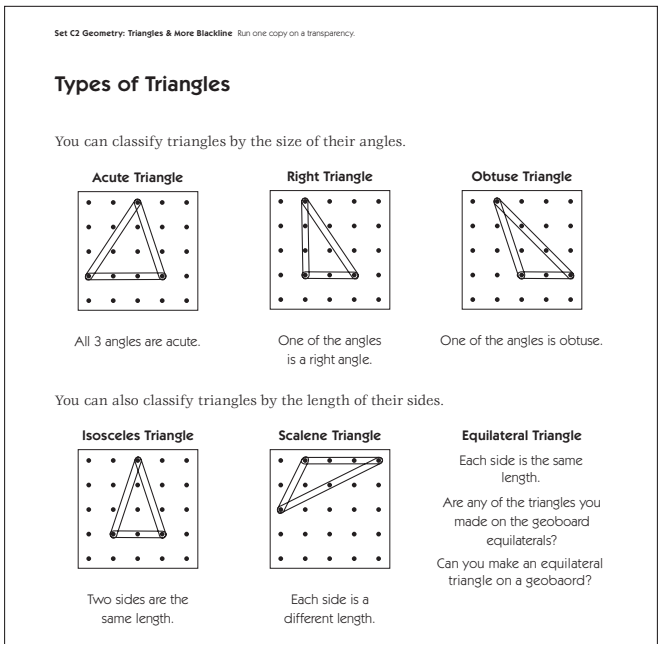
You may have to help students understand that a triangle doesn't have to look exactly like the ones on the overhead to fit into one of the three categories. If necessary, build several more triangles on your board and have the students work together to classify them.

Activity 1 Classifying Triangles (cont.)

5. When students understand what to do, have them work in pairs to classify the triangles on their record sheets by angle size. Ask them to record the classification on the first line in the box below each triangle.

6. As students finish their work, have them confer with others nearby. If there are disagreements, encourage students to work together to resolve them. How can they be certain an angle is acute, right, or obtuse?

7. When most students have finished, reconvene the class and display the other half of the Triangle Types overhead. Read and discuss the information with students.



Set C2 Geometry: Triangles & More Blackline Run one copy on a transparency.

Types of Triangles

You can classify triangles by the size of their angles.

Acute Triangle

All 3 angles are acute.

Right Triangle

One of the angles is a right angle.

Obtuse Triangle

One of the angles is obtuse.

You can also classify triangles by the length of their sides.

Isosceles Triangle

Two sides are the same length.

Scalene Triangle

Each side is a different length.

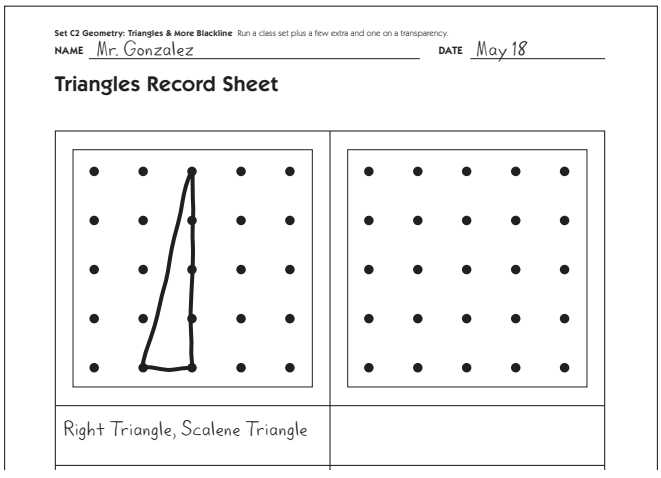
Equilateral Triangle

Each side is the same length.

Are any of the triangles you made on the geoboard equilaterals?

Can you make an equilateral triangle on a geobaord?

8. Ask students to help you classify the triangle you made on your geoboard by the lengths of its sides. Remind them that a triangle doesn't have to look exactly like one of the examples on the overhead to fit one of the categories. When they have come to agreement, record the information on your record sheet.



Set C2 Geometry: Triangles & More Blackline Run a class set plus a few extra and one on a transparency.

NAME Mr. Gonzalez DATE May 18

Triangles Record Sheet

Right Triangle, Scalene Triangle

9. Have students work in pairs to classify their own triangles by side length and record the information on their sheets. Keep the Types of Triangle overhead posted for their reference.

Activity 1 Classifying Triangles (cont.)

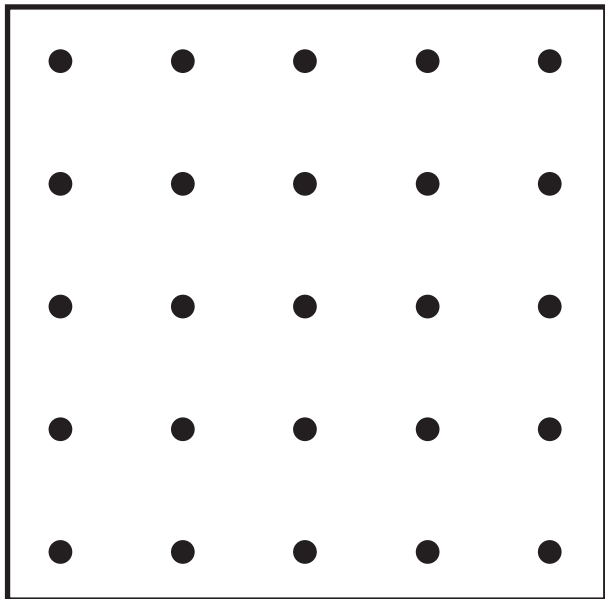
10. A time allows, ask students to share and compare some of the triangles they made. Let them know that it is, in fact, impossible to create an equilateral triangle on this geoboard. If any of the students believe they have created an equilateral triangle, have them share it with the class, and work together to measure the sides very carefully. While the side lengths may be very close, they will not be equal.

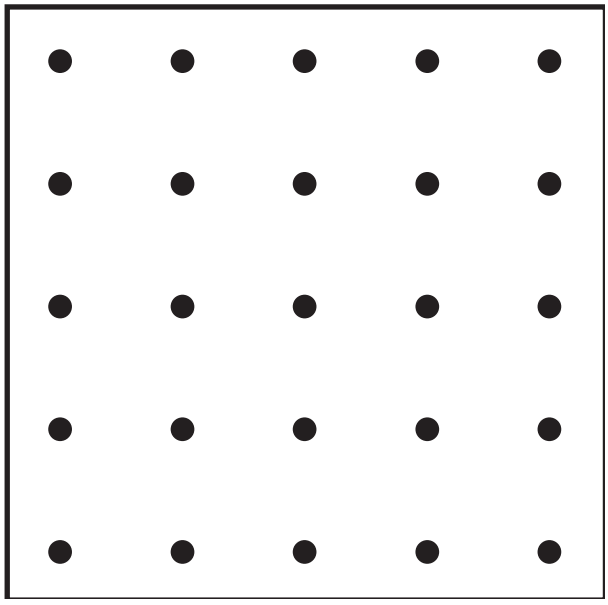
INDEPENDENT WORKSHEET

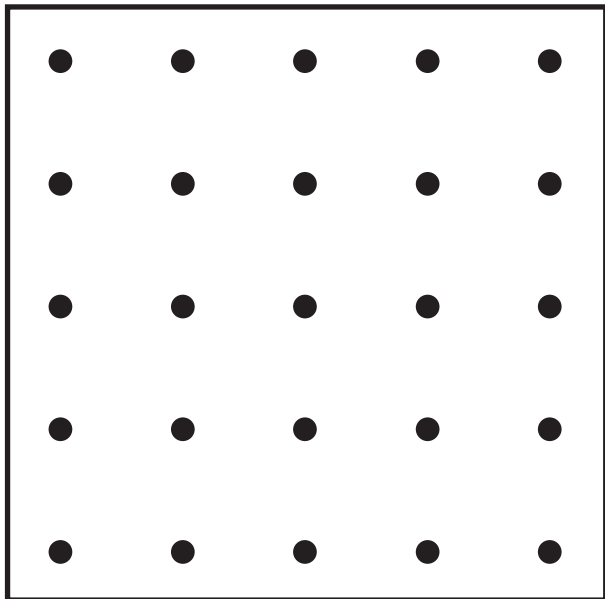
Use Set C1 Independent Worksheets 1 and 2 to provide students with more practice identifying, describing, and classifying triangles by angle size and side length. These sheets also ask students to draw triangles from given information about sides and angles.

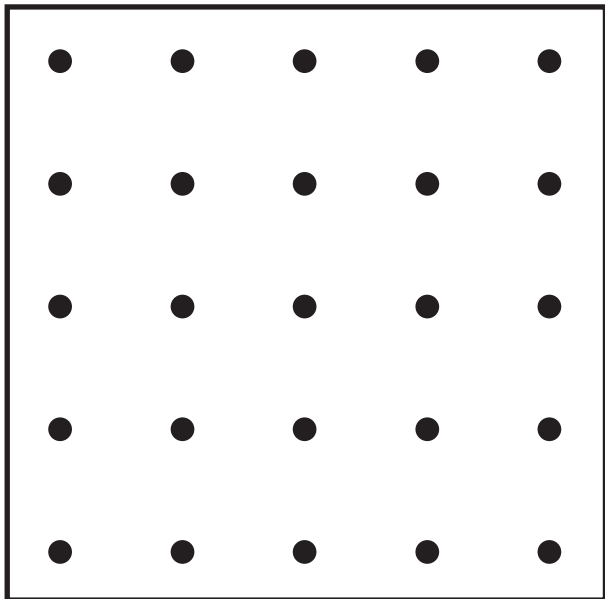
NAME _____ **DATE** _____

Triangles Record Sheet



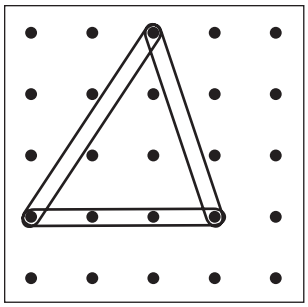
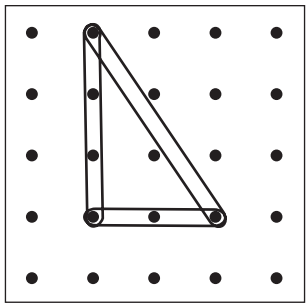
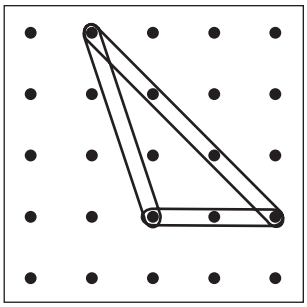




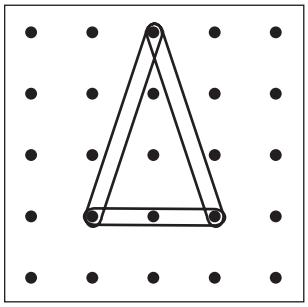
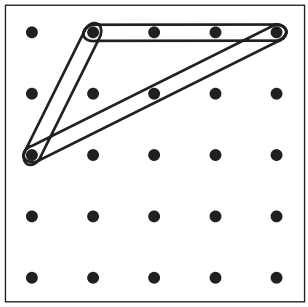


Types of Triangles

1 You can classify triangles by the size of their angles.

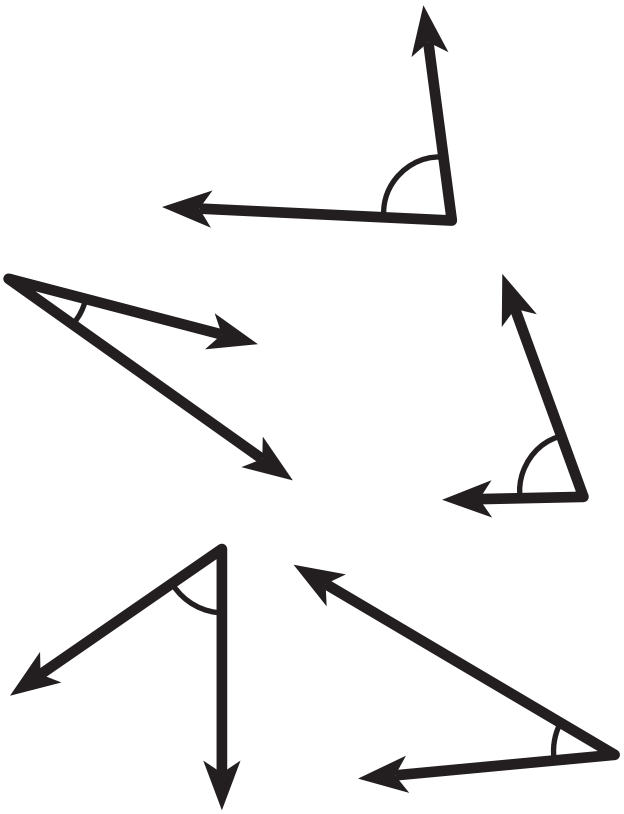
		
Acute Triangle All 3 angles are acute.	**Right Triangle** One of the angles is a right angle	**Obtuse Triangle** One of the angles is obtuse.

2 You can also classify triangles by the length of their sides.

		**Equilateral Triangle** Each side is the same length. Are any of the triangles you made on the geoboard equilaterals? Can you make an equilateral triangle on a geoboard?
Isosceles Triangle Two sides are the same length.	**Scalene Triangle** Each side is a different length.	

acute angle

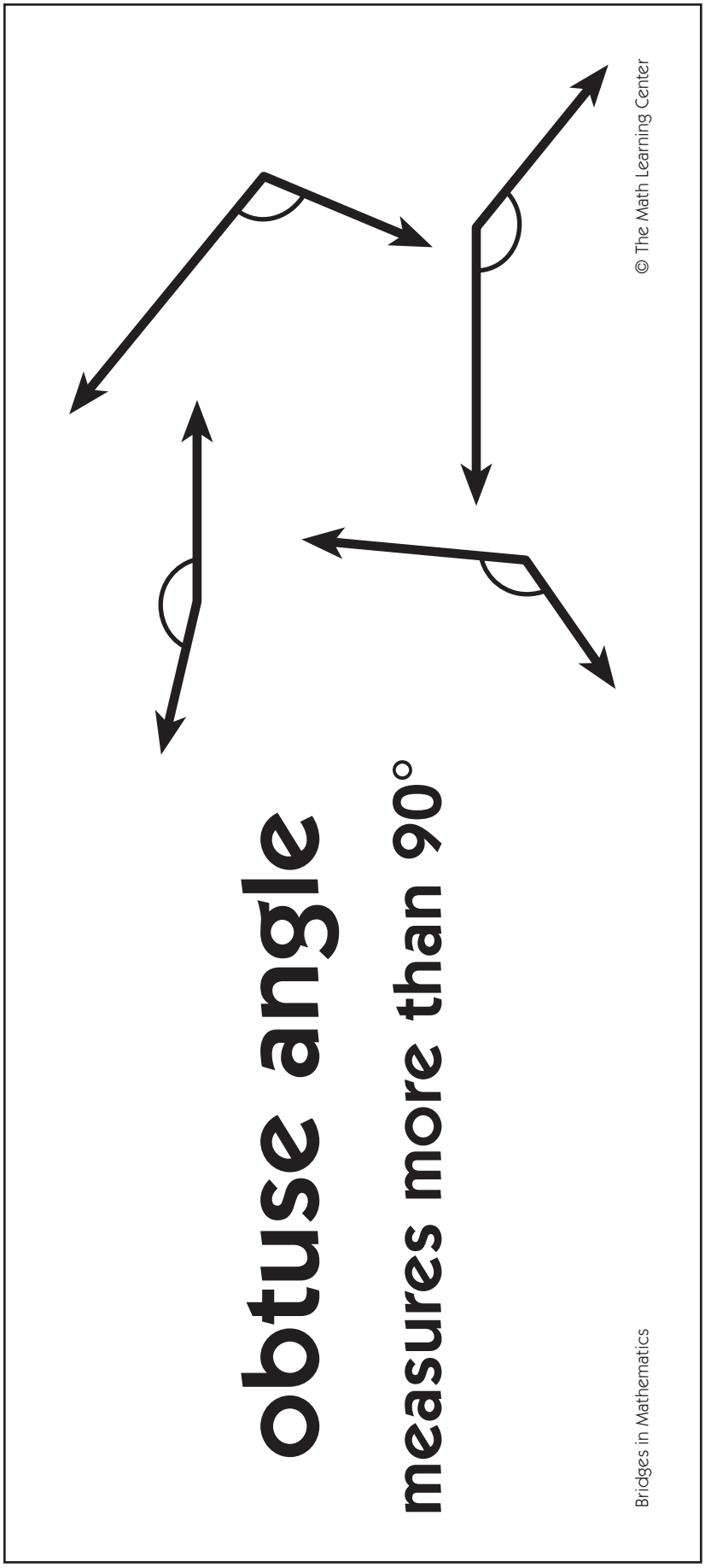
measures less than 90°



Bridges in Mathematics

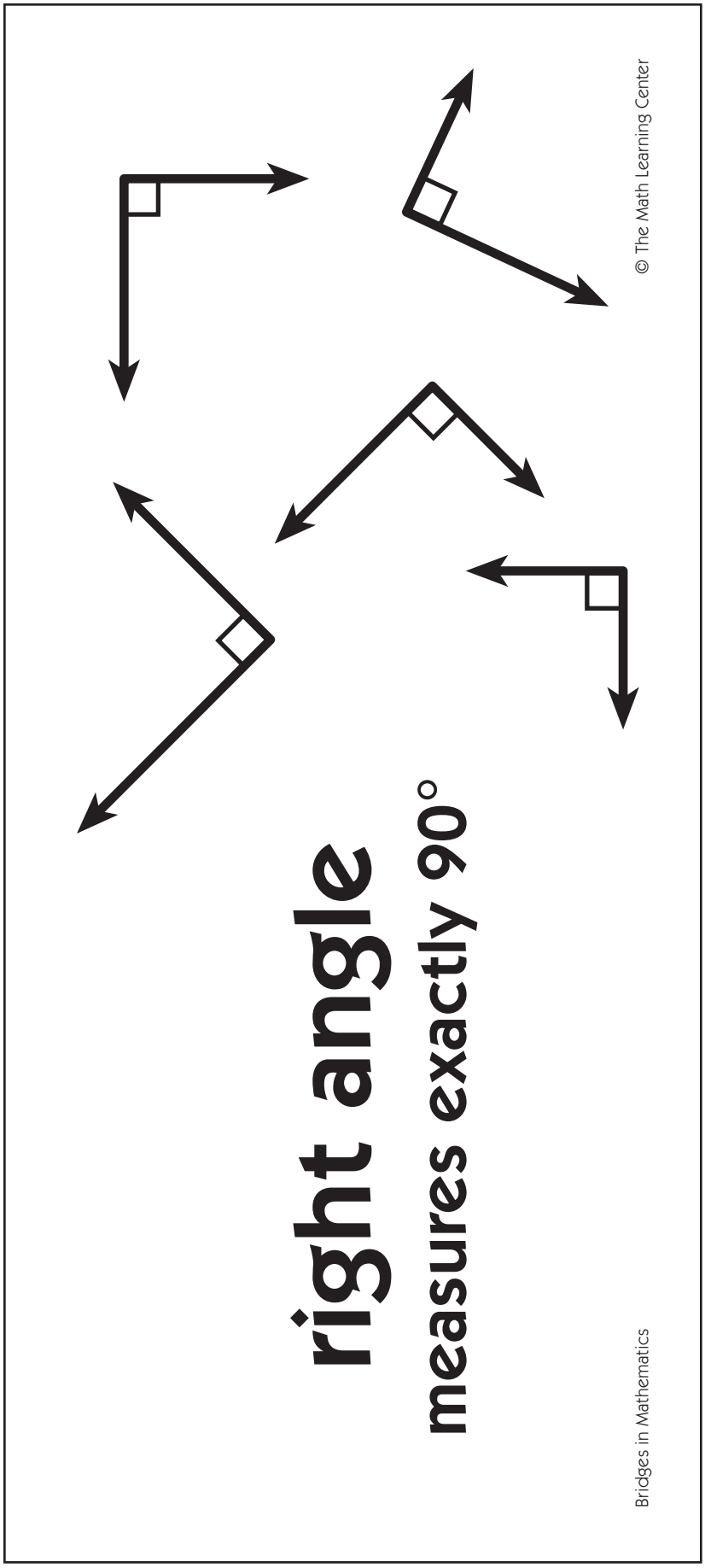
Working Definition

acute angle: an angle that has a measure less than 90°


obtuse angle
measures more than 90°
Bridges in Mathematics
© The Math Learning Center

Working Definition

obtuse angle: an angle that has a measure more than 90° and less than 180°


right angle
measures exactly 90°
Bridges in Mathematics
© The Math Learning Center

Working Definition

right angle: an angle that has a 90° measure

Set C1 ★ Activity 2

ACTIVITY

Sorting & Classifying Quadrilaterals

Overview

Students review what they have learned about quadrilaterals, and use the information to sort and classify quadrilaterals in a variety of ways.

Skills & Concepts

★ classify quadrilaterals

★ measure length with accuracy

You'll need

★ Different Kinds of Quadrilaterals (page C1.19, run a copy on a transparency)

★ Sorting Quadrilaterals (page C1.20, run a copy on a transparency)

★ Paper Quadrilaterals (page C1.21, run a half-class set plus a few extra)

★ Venn Diagram Mat (page C1.22, run a half-class set)

★ The Logic of Quadrilaterals (page A1.23, optional, run a class set)

★ paper to mask parts of the overhead and overhead pens

★ class sets of scissors, rulers and protractors

Instructions for Sorting & Classifying Quadrilaterals

1. Write the word *quadrilateral* on the board or overhead. Ask students to pair-share what they know about this term right now. Then invite a few volunteers to share their ideas with the class. If it doesn't emerge from the group, solicit agreement that a quadrilateral is a 4-sided polygon. Then work with student input to list several examples of different quadrilaterals.

2. Explain that the class is going to do some more work with quadrilaterals today. Display the top portion of Different Kinds of Quadrilaterals on the overhead. Read and discuss the name and description of each shape with students. Here are some questions you might pose as you review the terms with the class. Encourage students to use the information on the overhead as they formulate their answers.

- What is the difference between a rhombus and a square?
- Why do people say that a square is a special kind of rectangle?
- Would it be fair to say that a square is a special kind of rhombus? Why?
- Is a trapezoid also a parallelogram? Why or why not? (No, because it only has 1 pair of parallel sides.)
- Why is a rhombus classified as a parallelogram? (Because it has 2 pairs of parallel sides opposite each other.)
- Is a rhombus also a kite? Why or why not? (Yes, because it has two pairs of adjacent sides that are congruent; in fact, all 4 of its sides are congruent.)
- Are there any other quadrilaterals that could be called kites? Which one(s), and why? (A square is also a kite because it has two pairs of adjacent sides that are congruent.)
- Which one of these shapes could be given the most names? Why? (A square, because is can also be called a quadrilateral, a kite, a parallelogram, a rectangle, and a rhombus!)

Activity 2 Sorting & Classifying Quadrilaterals (cont.)

Set C1 Geometry: Triangles & Quadrilaterals Blackline Run one copy on a transparency.

Different Kinds of Quadrilaterals

A ***Quadrilateral*** is any polygon with 4 sides

 **trapezoid** a quadrilateral with exactly 1 pair of parallel sides	 **parallelogram** a quadrilateral with 2 pairs of parallel sides opposite each other	 **rectangle** a parallelogram with 4 right angles
 **rhombus** a parallelogram with 4 congruent sides	 **square** a parallelogram with 4 congruent sides and 4 right angles	 **kite** a quadrilateral with two pairs of adjacent sides that are congruent

3. Display the bottom portion of the overhead, and have students pair-share their responses to all five questions. Ask them to jot their answers down on a piece of scratch paper, and be prepared to explain and justify each. After a minute or two, reconvene the class. Invite a different volunteer to answer and explain his or her response to each question.

True or false?

1 This shape is a quadrilateral.

2 This shape is a trapezoid.

3 This shape is a rhombus.

4 This shape is a parallelogram.

5 This shape is a rectangle.

4. Next, ask students if any of the other quadrilateral names on the list applies to the shape at the bottom of the overhead. The shape is a rectangle, but it can also be called a quadrilateral and a parallelogram. It cannot be called a trapezoid or a rhombus.

- Can it be called a square or a kite? Why or why not? (Neither, because it does not have 4 congruent sides, nor does it have congruent sides that are adjacent to one another.)
- Which of the names describes the shape the most exactly and specifically? Why? (Rectangle, because a quadrilateral could be any 4-sided figure, and a parallelogram doesn't have to have 4 right angles.)

5. Now explain that the students are going to work in pairs to label and cut out a set of paper quadrilaterals. They will be sorting these quadrilaterals in a few minutes, but their first task is to label each with the name that describes it most exactly and specifically. Have students pair up and get out their scissors. They may also need rulers and protractors because they will probably have to measure the angles and side lengths of some of the shapes to identify them accurately.

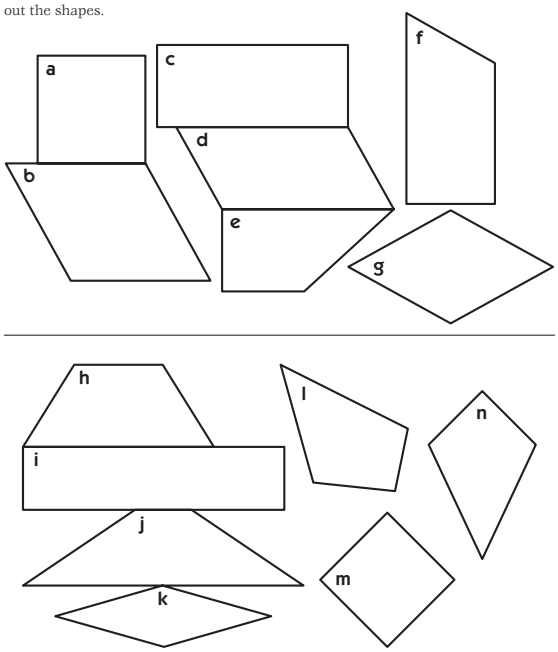
Give each pair a copy of the Paper Quadrilaterals sheet. Ask them to cut it in half so each partner can label and cut out half the shapes in the set.

Activity 2 Sorting & Classifying Quadrilaterals (cont.)

Set C1 Geometry: Triangles & Quadrilaterals Blackline Run a half class set single-sided on colored copy paper.

Paper Quadrilaterals

Label each quadrilateral with the most specific name you can find for it. Then cut out the shapes.



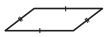
6. Once students understand the labeling and cutting procedures, have them go to work. Leave the Quadrilaterals overhead on display for their reference. Circulate to provide assistance as needed, but encourage students to help their partners and confirm their answers with other pairs nearby.

7. When most students have finished labeling and cutting out their shapes, confirm the name of each with the class. One simple way to do this is to have volunteers list the letters that belong in each shape group as you record at the overhead.

Set C1 Geometry: Triangles & Quadrilaterals Blackline Run one copy on a transparency.

Different Kinds of Quadrilaterals

A ***Quadrilateral*** is any polygon with 4 sides

 **trapezoid** a quadrilateral with exactly 1 pair of parallel sides	 **parallelogram** a quadrilateral with 2 pairs of parallel sides opposite each other	 **rectangle** a parallelogram with 4 right angles
 **rhombus** a parallelogram with 4 congruent sides	 **square** a parallelogram with 4 congruent sides and 4 right angles	 **kite** a quadrilateral with two pairs of adjacent sides that are congruent

Activity 2 Sorting & Classifying Quadrilaterals (cont.)

8. Next, give each student pair a Venn Diagram Mat, and explain that they are going to work together to sort their shapes in a variety of ways. Place the first prompt at the top of the Sorting Quadrilaterals overhead on display.


Set C1 Geometry: Triangles & Quadrilaterals Blackline Run one copy on a transparency.

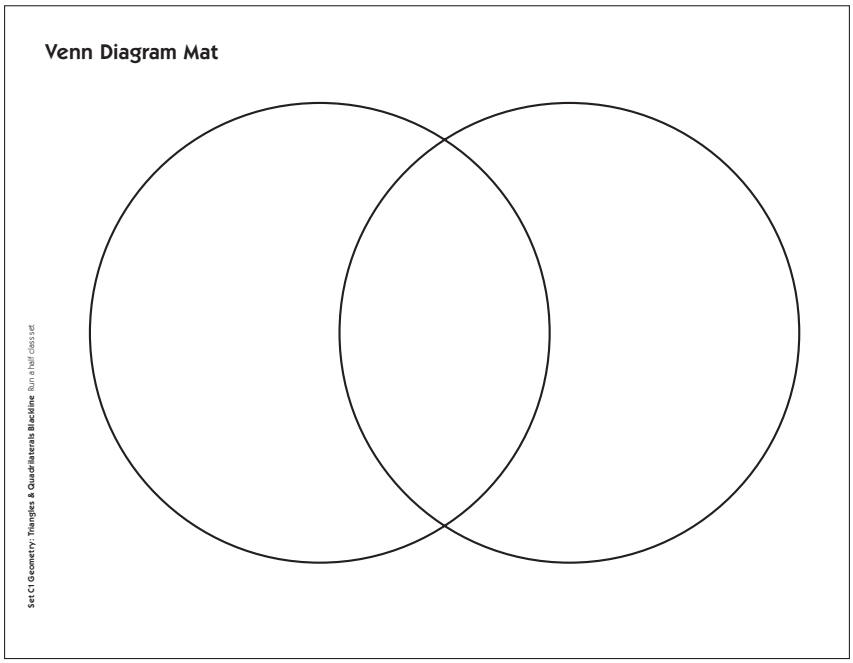
Sorting Quadrilaterals

1 Quadrilaterals/Trapezoids

Read the prompt with the class, and ask students to sort their shapes onto the mat, quadrilaterals in one circle and trapezoids in the other. If there are any shapes that qualify as both quadrilaterals and trapezoids, ask students to place them between the circles, at the intersection of the two sets. If there are shapes that don't fit either description, ask students to place them off to one side.

9. Encourage students to share and compare their results with other pairs nearby. When most pairs have finished, call on volunteers to share and explain their results. You may want to sketch a Venn diagram on the overhead and invite volunteers to sort their shapes for the class to see. You can also ask students to examine the speakers' work from where they are sitting, or stand if necessary.

> ***Students*** *There are only 4 trapezoids, and they had to go in the middle because they are also quadrilaterals.*
> *All the shapes went on the mat because they all have 4 sides. The ones in the middle are quadrilaterals and trapezoids.*



10. Repeat steps 8 and 9 as you display each of the other sorting prompts on the overhead one by one. Some of the prompts are more challenging than others, and may result in lively discussion and debate.

Activity 2 Sorting & Classifying Quadrilaterals (cont.)

Set C1 Geometry: Triangles & Quadrilaterals Blackline Run one copy on a transparency.

Sorting Quadrilaterals

1 Quadrilaterals/Trapezoids
2 Trapezoids/Parallelograms
3 Parallelograms/Rectangles
4 Rectangles/Rhombuses
5 Kites/Rectangles
6 Kites/Parallelograms

Extension

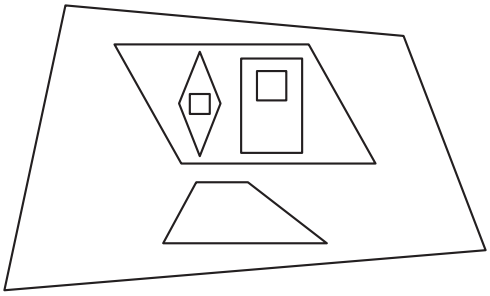
- Give students each a copy of The Logic of Quadrilaterals. The diagram on this sheet illustrates the relationships between the various quadrilaterals in a very succinct way. Students are asked to label each of the shapes, and then answer a series of questions designed to help them think about how the shapes have been placed in relation to one another, and why. After reviewing the instructions together, have students complete the sheet independently. Then discuss it as a group. (There is a copy of the diagram at the bottom of the Sorting Quadrilaterals overhead you can use to focus and direct the discussion.)

Set C1 Geometry: Triangles & Quadrilaterals Blackline Optional, run a class set.

NAME _____ **DATE** _____

The Logic of Quadrilaterals

1 Label each shape in this diagram with the name that describes it most exactly.



2 Why is the trapezoid inside the quadrilateral but outside the parallelogram?

3 Why are there a rhombus and a rectangle inside the parallelogram?

4 Why are there two squares, one inside the rhombus and one inside the rectangle?

5 Write at least 2 other observations to explain why the shapes in this diagram have been placed where they are in relation to each other.

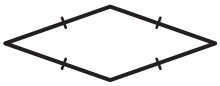
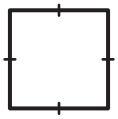
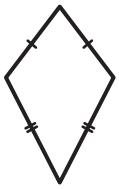
Activity 2 Sorting & Classifying Quadrilaterals (cont.)

INDEPENDENT WORKSHEET

Use Set C1 Independent Worksheets 3 and 4 to provide students with more practice classifying and drawing quadrilaterals from information given about sides and angles.

Different Kinds of Quadrilaterals

A ***Quadrilateral*** is any polygon with 4 sides

 **trapezoid** a quadrilateral with exactly 1 pair of parallel sides	 **parallelogram** a quadrilateral with 2 pairs of parallel sides opposite each other	 **rectangle** a parallelogram with 4 right angles
 **rhombus** a parallelogram with 4 congruent sides	 **square** a parallelogram with 4 congruent sides and 4 right angles	 **kite** a quadrilateral with two pairs of adjacent sides that are congruent

True or false?

1 This shape is a quadrilateral.

2 This shape is a trapezoid.

3 This shape is a rhombus.

4 This shape is a parallelogram.

5 This shape is a rectangle.

Sorting Quadrilaterals

1 Quadrilaterals/Trapezoids

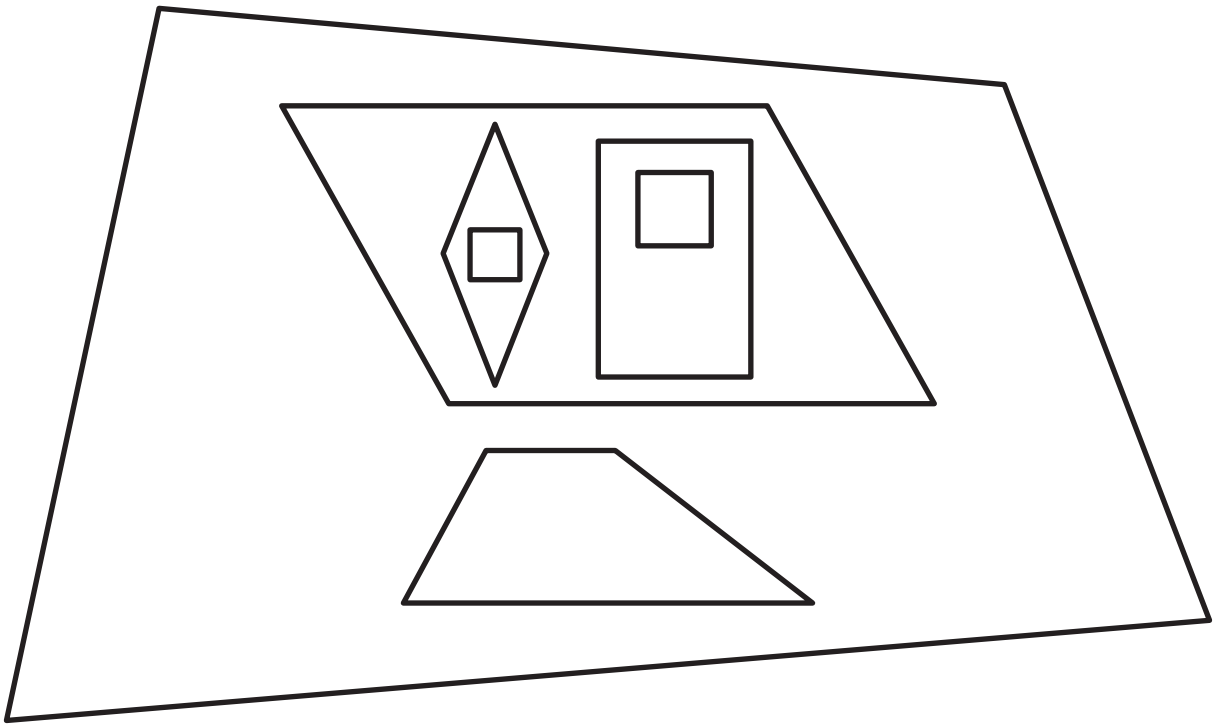
2 Trapezoids/Parallelograms

3 Parallelograms/Rectangles

4 Rectangles/Rhombuses

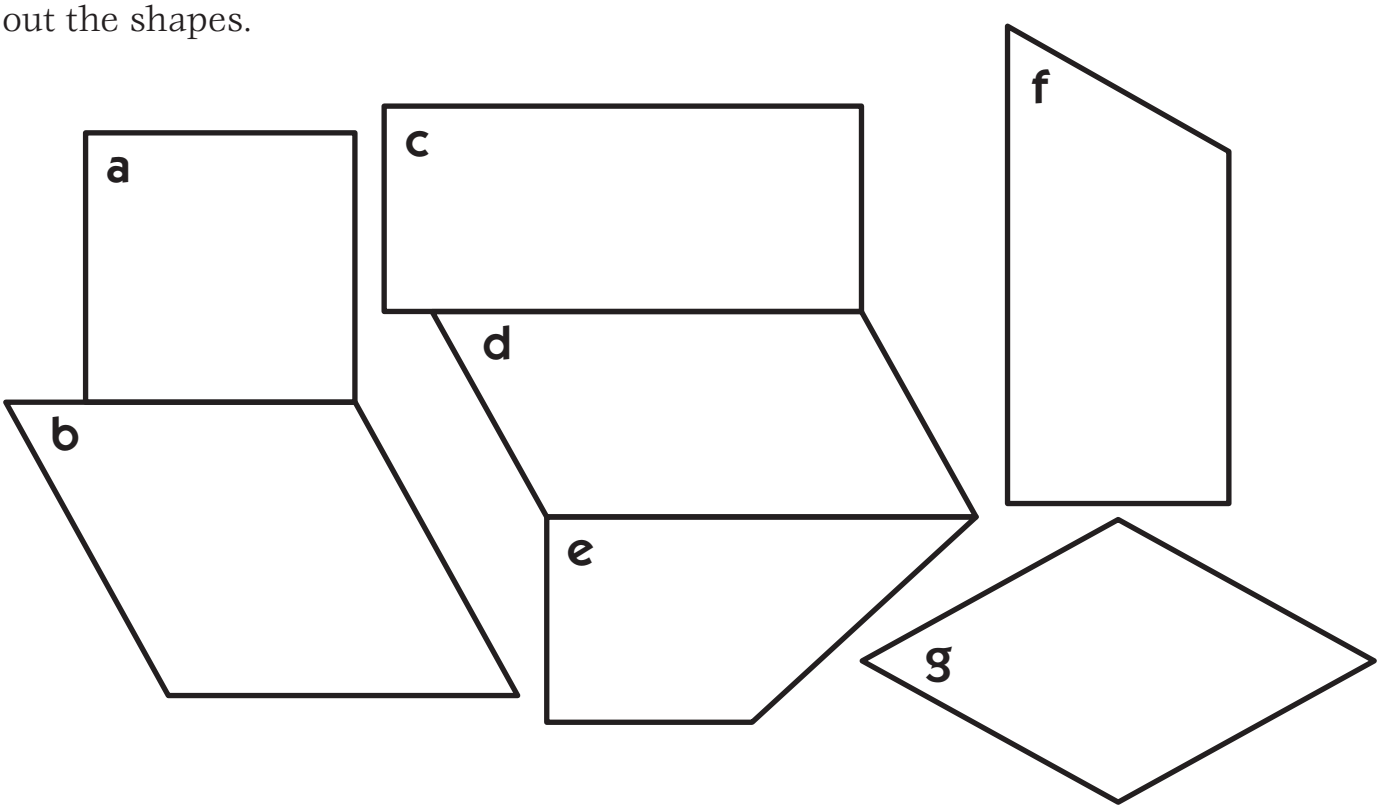
5 Kites/Rectangles

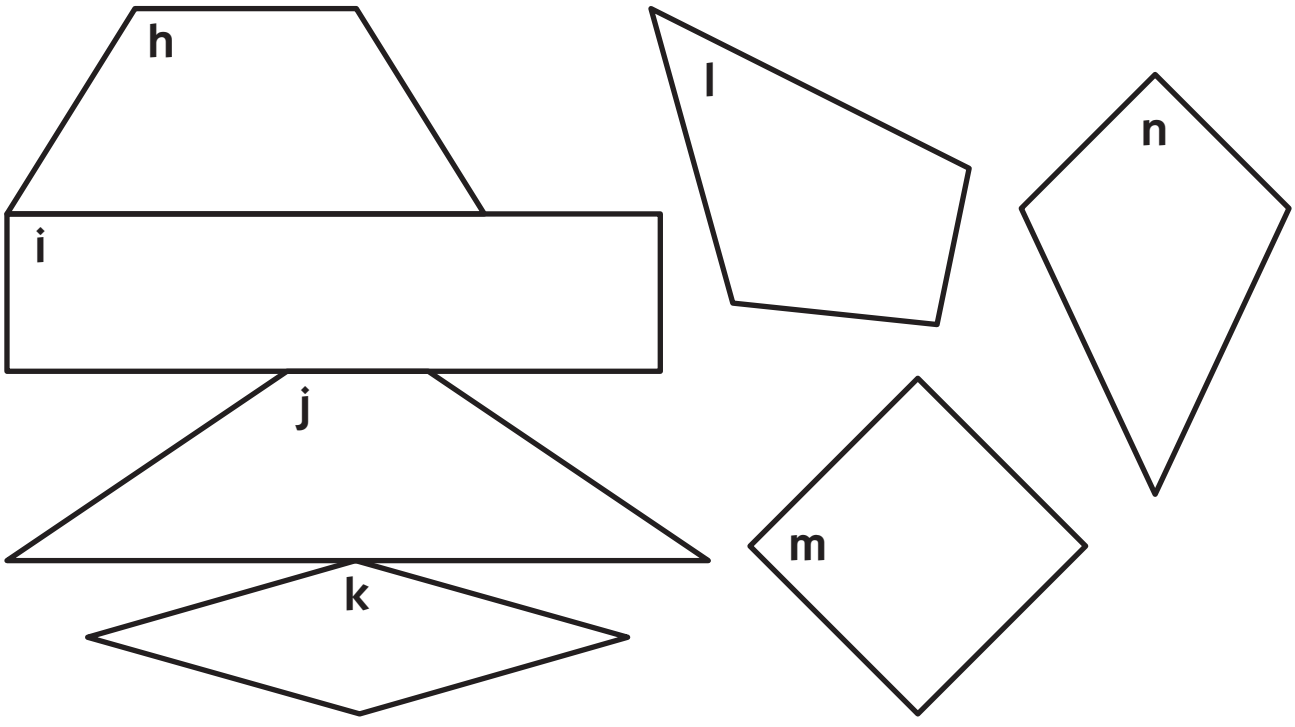
6 Kites/Parallelograms



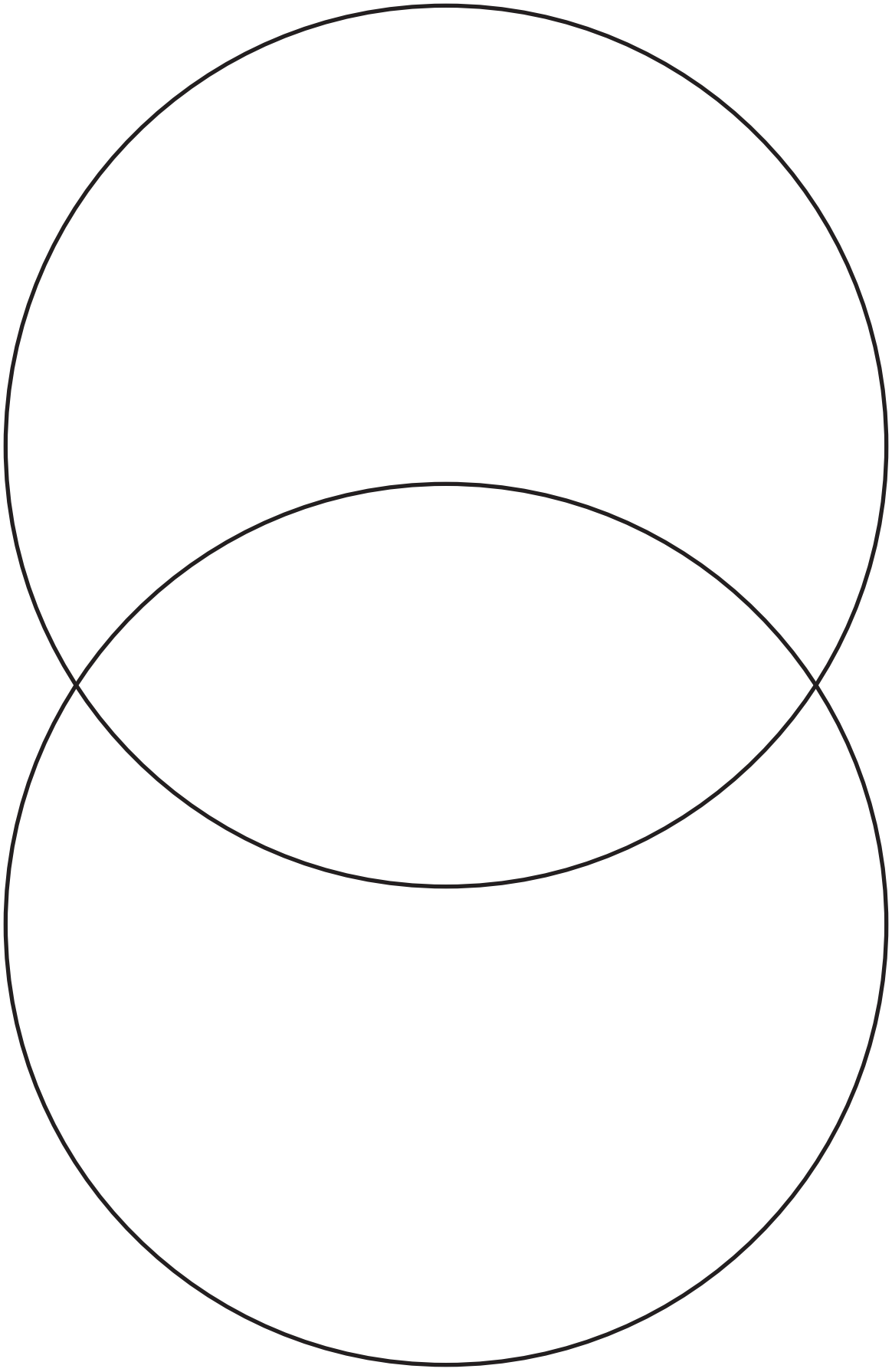
Paper Quadrilaterals

Label each quadrilateral with the most specific name you can find for it. Then cut out the shapes.





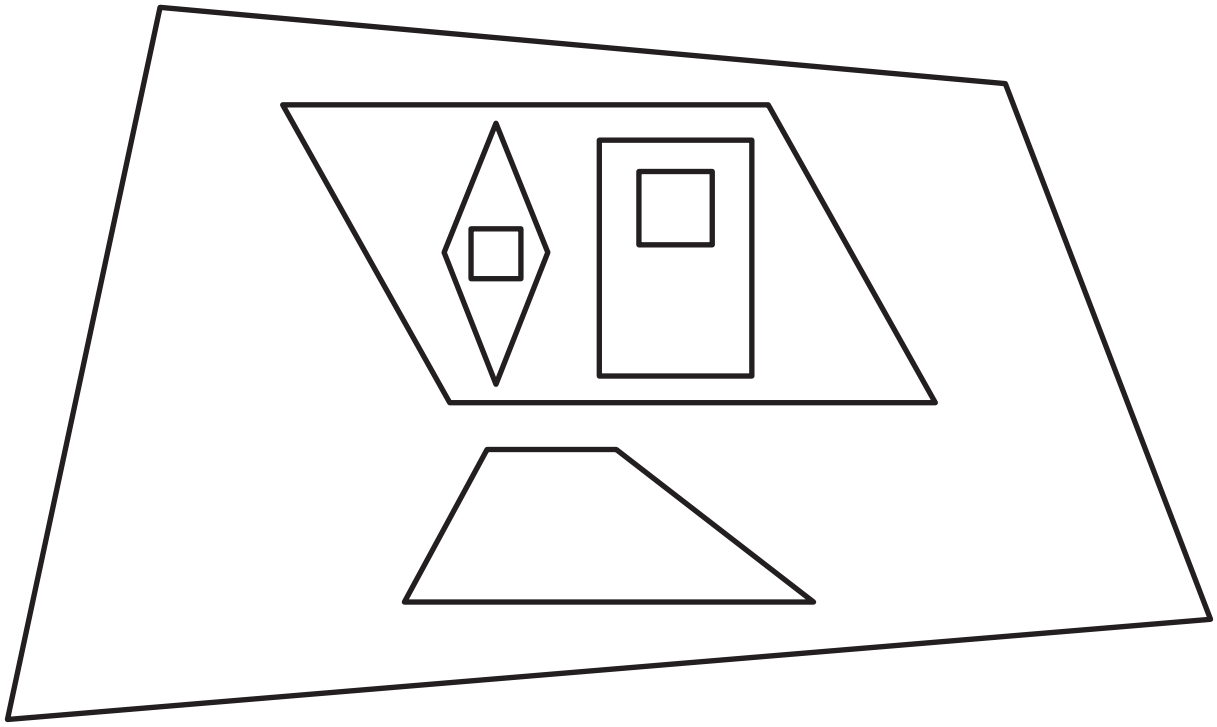
Venn Diagram Mat



NAME _____ **DATE** _____

The Logic of Quadrilaterals

1 Label each shape in this diagram with the name that describes it most exactly.



2 Why is the trapezoid inside the quadrilateral but outside the parallelogram?

3 Why are there a rhombus and a rectangle inside the parallelogram?

4 Why are there two squares, one inside the rhombus and one inside the rectangle?

5 Write at least 2 other observations to explain why the shapes in this diagram have been placed where they are in relation to each other.

Set C1 ★ Activity 3

ACTIVITY

Finding the Perimeter & Area of a Parallelogram

Overview

Students find the perimeter and area of an index card, then cut the card and tape the two resulting pieces together to form a parallelogram that is not a rectangle. Then they find the perimeter and area of the parallelogram. As they do so, they discover that multiplying the length of one side by the other does not yield the area of a non-rectangular parallelogram. After students investigate further by creating two more parallelograms, the teacher shares the formula for finding the area of a parallelogram, and asks the class to explain and apply it.

Skills & Concepts

★ classify quadrilaterals

★ determine the formula for the area of a parallelogram by relating it to the area of a rectangle

★ use formulas to determine the perimeters and areas of rectangles and parallelograms

★ use appropriate tools and units to measure objects to the precision of one-eighth inch

You'll need

★ Start with a Rectangle (page C1.30, run a copy on a transparency)

★ Square Inch Grid Paper (page C1.31, run several class sets and one copy on a transparency)

★ Finding the Area of Parallelograms (pages C1.32 and C1.33 , run a class set)

★ paper to mask parts of the overhead

★ overhead pens

★ 3" x 5" index cards or pieces of construction paper, 3 per student

★ class set of rulers

★ scissors

★ several rolls of scotch tape

Instructions for Finding the Perimeter & Area of a Parallelogram

1. Write the words *perimeter* and *area* on the board. Have students pair-share the definition of each term, and then ask volunteers to share their definitions with the class. Briefly review the formulas for finding the perimeter ($2l + 2w$) and area ($l \times w$) of a rectangle, and give students each an index card. Ask students to measure the length and the width of the index card in inches, and use the information to find its perimeter and the area. Have them use a piece of scratch paper or the card itself if they need to do any writing as they determine these measurements.

2. When most students have finished, display just the first instruction on the Start with a Rectangle overhead, and work with input from the class to record the perimeter and area of the index card. Then reveal the second task on the overhead. Write 3" in the blank as you read the instruction with the class, and give students time to measure and mark their cards as specified. Ask them to be as precise as possible in their measurements. Show the rest of the tasks on the overhead one by one. Read each task with the class and give students time to complete it before moving on to the next. Take time to discuss each question, and record the answers on the overhead. Ask students to be certain they have formed a parallelogram that is not a rectangle before they use any scotch tape.

Activity 3 Finding the Perimeter & Area of a Parallelogram (cont.)

Set C1 Geometry: Triangles & Quadrilaterals Blackline Run one copy on a transparency.

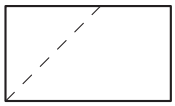
Start with a Rectangle

1 Find the perimeter of your rectangle in inches. Find the area of your rectangle in square inches.

Perimeter = 16" Area = 15 sq in

2 Measure over 3" along the top of your rectangle and make a small mark.

3 Draw a diagonal line from the lower left-hand corner to the mark.



4 Cut along the line. What 2 shapes do you have now? How do you know?
right isosceles triangle, trapezoid

5 Combine the 2 shapes to make a parallelogram that is not a rectangle. Tape the edges together.

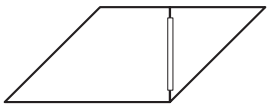
6 Find the perimeter of your parallelogram to the nearest eighth of an inch. Find the area of your parallelogram in square inches.

Perimeter = _____ Area = _____

3. The last question on the overhead asks students to find the perimeter and area of the parallelogram they formed when they cut and taped the index card. When you reach this point, make square-inch grid paper available, and give students some time to investigate at their tables. Some may believe that the area is still 15 square inches because they didn't add anything or take anything away when they formed their parallelogram. Press them to find a way to prove this, using the grid paper or some other method. Other students may need to trace the parallelogram onto the grid paper and count the squares and triangles to discover that the area has remained the same, even though the perimeter has changed.

4. When most students have found the perimeter and area of the parallelogram, reconvene the class. Ask volunteers to share their results and strategies. Most will likely report that the perimeter is 18 $^1/_2$ inches, and the area is 15 square inches. Here are some questions to pose during the discussion:

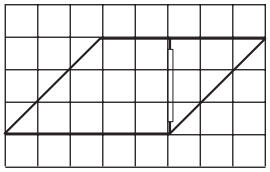
- Is the perimeter of the parallelogram the same as the perimeter of the original rectangle? Why or why not?
- Is the area the same? Why or why not?
- Does the formula for finding the perimeter of a rectangle still work with this parallelogram?
- Does the formula for finding the area of a rectangle help you find the area of the parallelogram? If so, how? If not, why?



Students *The perimeter changed when we made the card into a parallelogram. It was 3 by 5, so the perimeter was 16 inches. Now it's about 4 $^1/_4$ inches along the diagonal side and still 5 inches along the top. Two times 5 is 10, and two times 4 $^1/_4$ is 8 $^1/_2$, so that's 18 $^1/_2$ inches now instead of 16. When you cut it on the diagonal like that, it definitely makes the sides longer.*

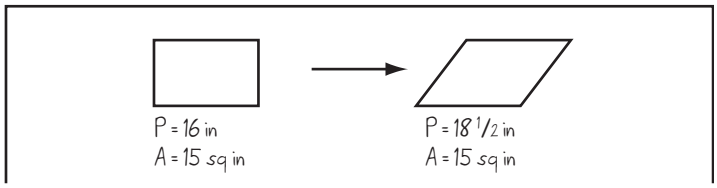
Students *It's still 15 square inches for the area, though. We traced it on the grid paper and counted the squares and triangles. It came out to be exactly 15 square inches.*

Activity 3 Finding the Perimeter & Area of a Parallelogram (cont.)

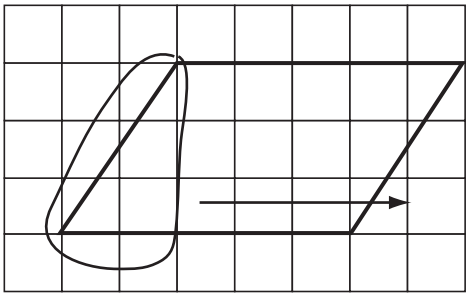


You can't use the regular formula to find the area of the parallelogram. If you multiply 4 $^1/_4$ times 5, it's more than 20 square inches. But you can see that the area is really 15 square inches, not 20 square inches.
I know one-fourth is .25, so I put in 5 × 4.25 on my calculator. It came out to be 21.25. That's 21 $^1/_4$ square inches, but the parallelogram is really only 15 square inches.

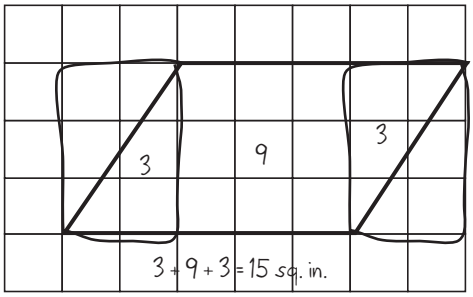
5. Work with students' input to summarize their findings by sketching the rectangle and the parallelogram on the whiteboard and recording the perimeter and area of each.



6. Erase the overhead. Give students each another index card. Repeat the process a second time, but have them measure and mark over 2 inches instead of 3 inches this time. When they cut along the line, they will discover that they have formed a right scalene triangle and a trapezoid. Have them combine these two shapes to make a second parallelogram, and find the perimeter and area of this figure. Invite a couple of volunteers to trace their new parallelograms on the Square Inch Grid overhead and share their strategies for determining the area.



Toby's Strategy



Eric's Strategy

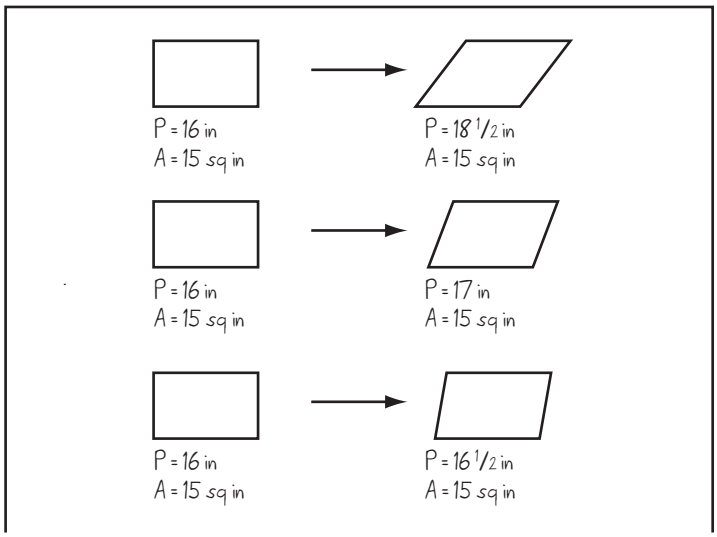
Toby *I just imagined cutting off the triangle at this end and sliding it over to the other side. You can see it will still be 15 square inches.*

Eric *I surrounded the triangle at this end with a rectangle. That rectangle is 6, so the triangle is 3 square inches. If you do that with the triangles at both ends, and then add their areas to the square in the middle, it comes out to be 3 + 9 + 3, and that's 15 square inches.*

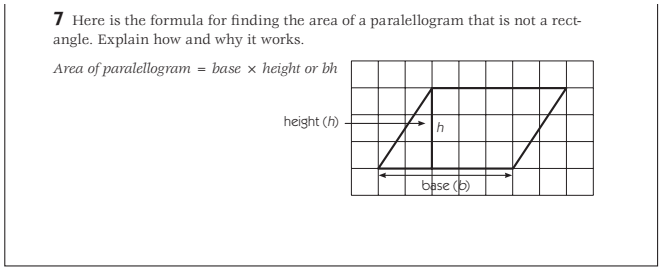
Activity 3 Finding the Perimeter & Area of a Parallelogram (cont.)

7. Summarize students' findings on the whiteboard. Then give them another index card, erase the overhead, and repeat the process once more. This time, have students measure and mark one inch over along the top of the card, draw the diagonal, make the cut, identify the two shapes that result (a right scalene triangle and a trapezoid), combine the two shapes to make a parallelogram, and find the perimeter and area. Invite a couple of volunteers to trace their parallelograms and share their strategies for finding the area.

8. Summarize the third set of findings on the whiteboard, and ask students to share any observations they can make. How and why did the perimeter change from one parallelogram to the next? Why did the area remain the same each time?



9. Display the information at the bottom of the overhead, which gives the formula for finding the area of a parallelogram that is not a rectangle. Ask students to discuss and explain how the formula works, based on their experiences during this activity.



10. Give students each a copy of Finding the Area of Parallelograms. Review the instructions on both sheets with the class. When students understand what to do, let them get started. Plan to assign unfinished work as homework or seatwork the following day.

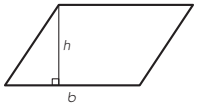
Activity 3 Finding the Perimeter & Area of a Parallelogram (cont.)

Set C1 Geometry: Triangles & Quadrilaterals Blackline Run a class set

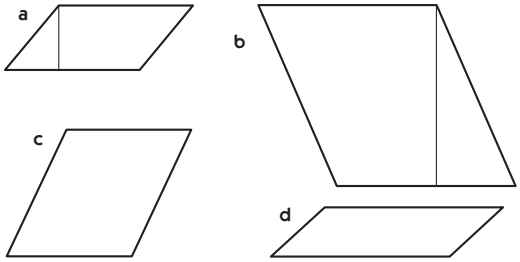
NAME _____ DATE _____

Finding the Area of Parallelograms page 1 of 2

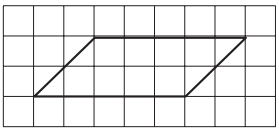
The height (*h*) of a parallelogram tells how far one side is from its opposite side. The height of a parallelogram must be perpendicular to the base (*b*) of the parallelogram.



1 Use the letter *h* to label the height of each parallelogram below. Use the letter *b* to label the base. If the height is not shown, use your ruler to draw it in, and then label it.



2 To find the area of a parallelogram, multiply base times height. Try it for yourself. Measure the base and the height of the parallelogram below in centimeters. Multiply the two measurements. Is the answer correct? Use a labeled sketch, numbers, and words to explain.



Set C1 Geometry: Triangles & Quadrilaterals Blackline Run a class set

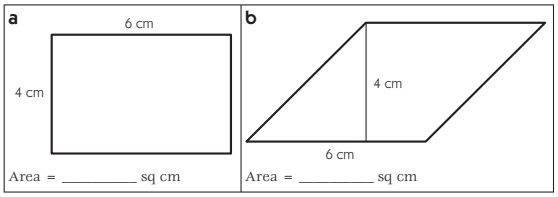
NAME _____ DATE _____

Finding the Area of Parallelograms page 2 of 2

Here are the formulas for the area of a rectangle and the area of a parallelogram.

- *The area of a rectangle = length × width or l × w or lw.*
- *The area of a parallelogram = base × height or b × h or bh.*

3 Find the area of each figure below. Use the formulas. Show your work.

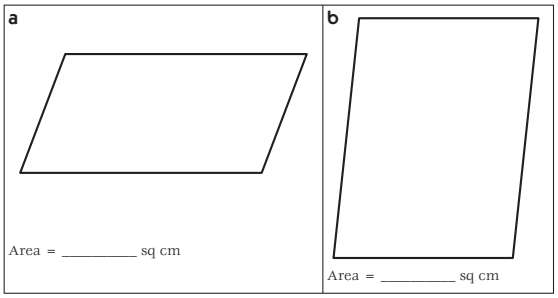


Area = _____ sq cm

Area = _____ sq cm

4 For each of the parallelograms below:

- draw in the height.
- measure and label the height and the base to the nearest centimeter.
- find and record the area and show your work..



Area = _____ sq cm

Area = _____ sq cm

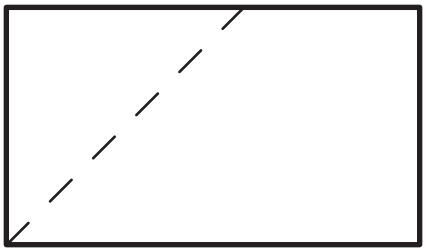
Start with a Rectangle

1 Find the perimeter of your rectangle in inches. Find the area of your rectangle in square inches.

Perimeter = _____ Area = _____

2 Measure over _____ along the top of your rectangle and make a small mark.

3 Draw a diagonal line from the lower left-hand corner to the mark.



4 Cut along the line. What 2 shapes do you have now? How do you know?

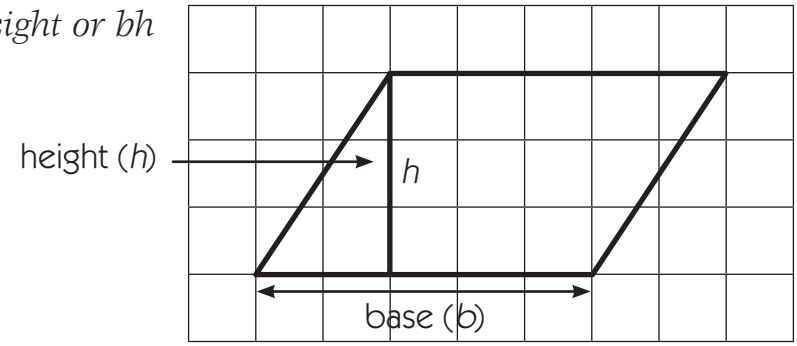
5 Combine the 2 shapes to make a parallelogram that is not a rectangle. Tape the edges together.

6 Find the perimeter of your parallelogram to the nearest eighth of an inch. Find the area of your parallelogram in square inches.

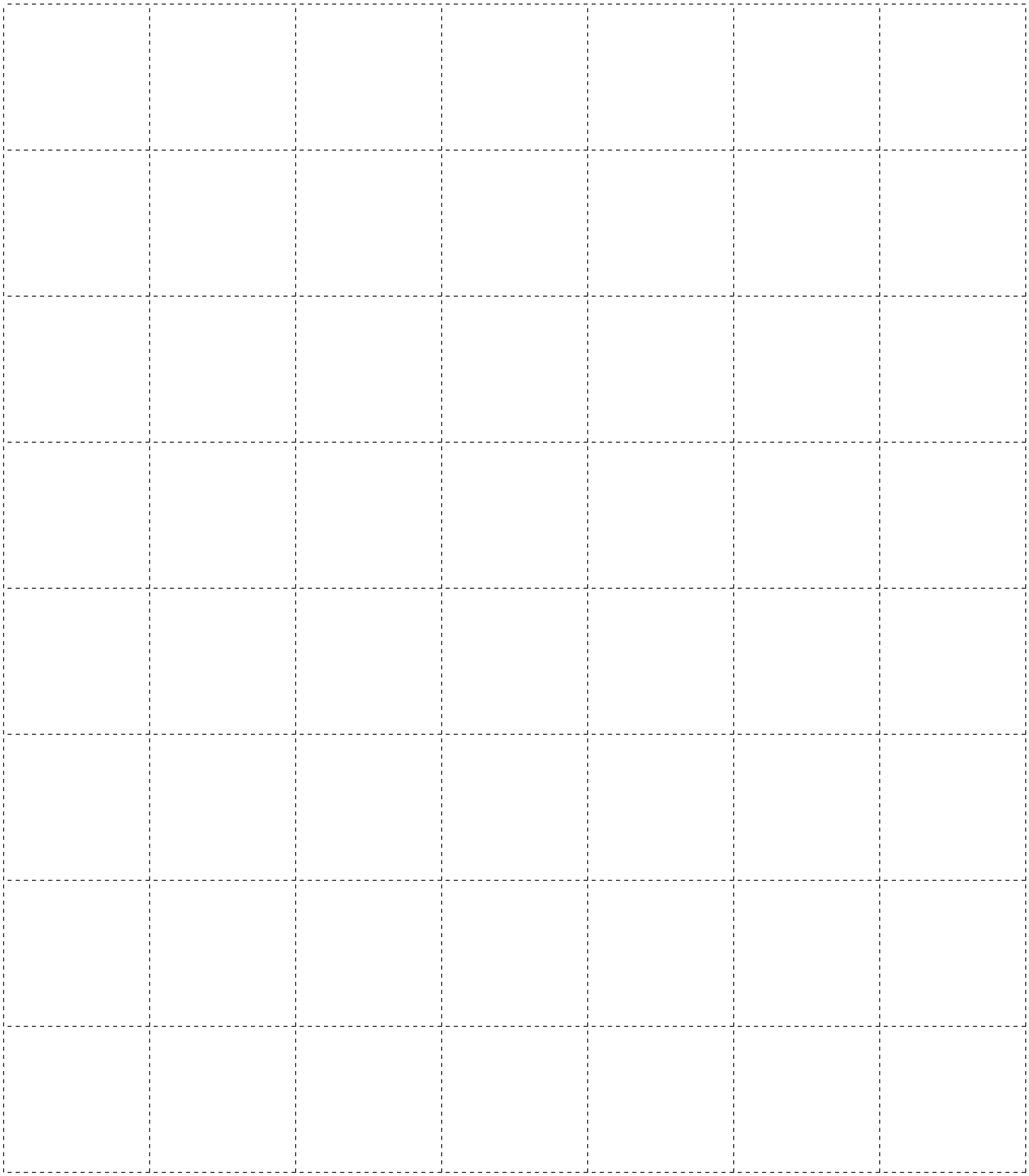
Perimeter = _____ Area = _____

7 Here is the formula for finding the area of a paralellogram that is not a rectangle. Explain how and why it works.

Area of paralellogram = base × height or bh



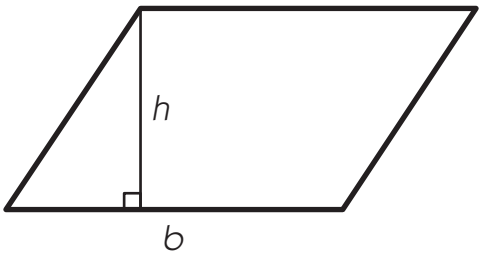
Square Inch Grid Paper



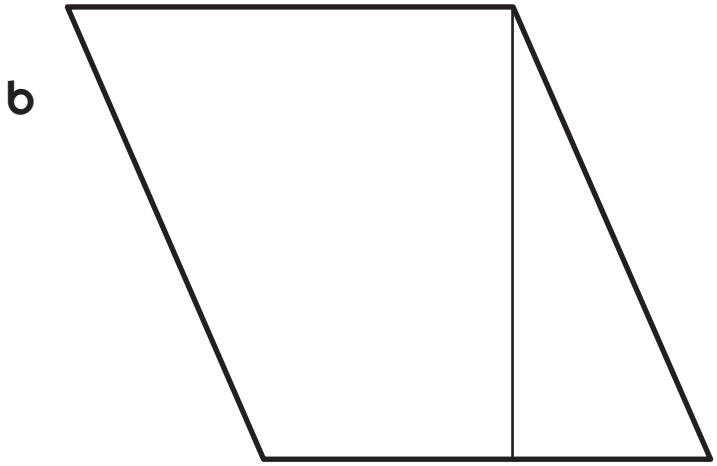
NAME _____ **DATE** _____

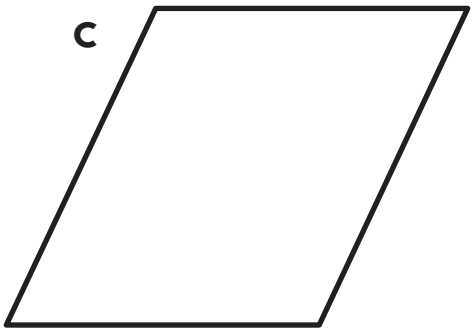
Finding the Area of Parallelograms page 1 of 2

The height (*h*) of a parallelogram tells how far one side is from its opposite side. The height of a parallelogram must be perpendicular to the base (*b*) of the parallelogram.

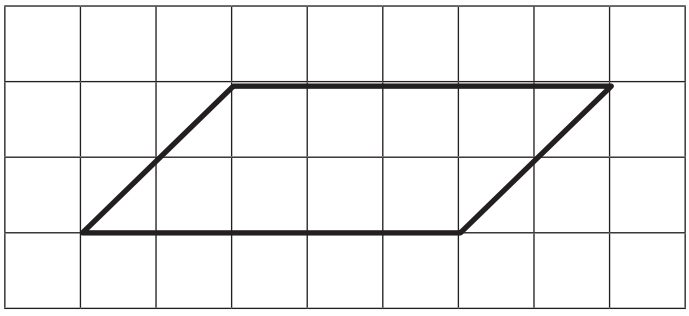


1 Use the letter *h* to label the height of each parallelogram below. Use the letter *b* to label the base. If the height is not shown, use your ruler to draw it in, and then label it.





2 To find the area of a parallelogram, multiply base times height. Try it for yourself. Measure the base and the height of the parallelogram below in centimeters. Multiply the two measurements. Is the answer correct? Use a labeled sketch, numbers, and words to explain.



NAME _____ **DATE** _____

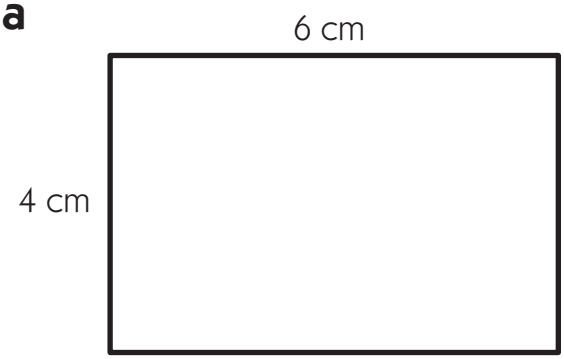
Finding the Area of Parallelograms page 2 of 2

Here is the formula for finding the area of a parallelogram.

• *The area of a parallelogram = base × height or b × h or bh. (Since a rectangle is a special kind of parallelogram, this is also the formula for the area of a rectangle.)*

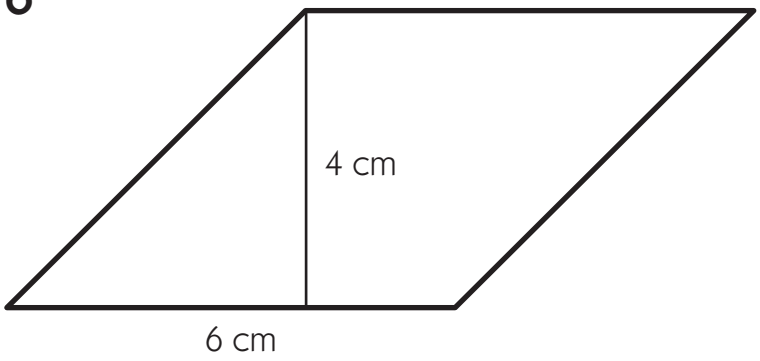
3 Find the area of each figure below. Use the formulas. Show your work.

a



Area = _____ sq cm

b



Area = _____ sq cm

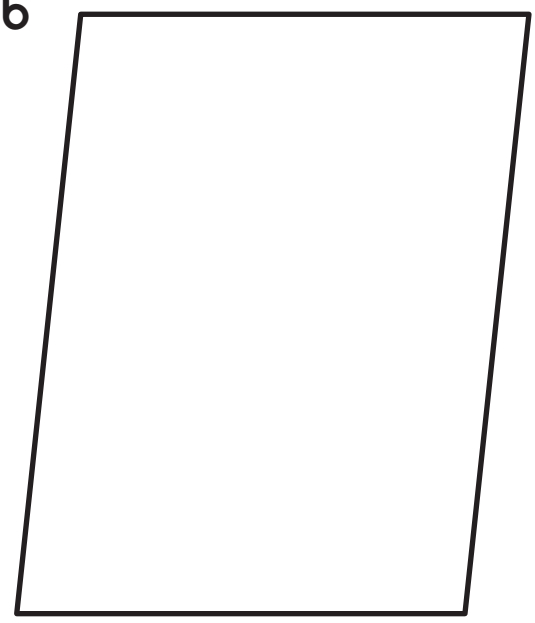
4 For each of the parallelograms below:

- draw in the height.
- measure and label the height and the base to the nearest centimeter.
- find and record the area and show your work..

a

Area = _____ sq cm

b



Area = _____ sq cm

Set C1 ★ Activity 4

ACTIVITY

Three Mathematical Ideas

Overview

Students investigate three mathematical ideas during this activity to generate and apply the formula for finding the area of a triangle.

Skills & Concepts

★ determine the formula for the area of a triangle by relating it to the area of a parallelogram

★ use formulas to determine the perimeters and areas of triangles and parallelograms

You'll need

★ Three Mathematical Ideas (page C1.40, run a copy on a transparency)

★ Finding the Area of Triangles (pages C1.41 and C1.42, run a class set)

★ paper to mask parts of the overhead

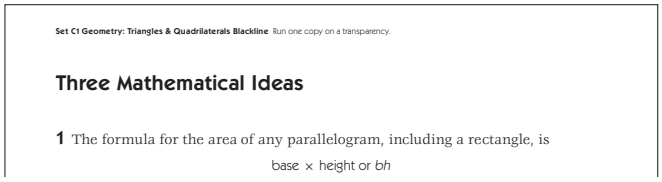
★ overhead pens

★ class set of geoboards and rubber bands

★ class set of rulers

Instructions for Three Mathematical Ideas

1. Let students know that you are going to spend some more time investigating perimeter and area today. Then place the top portion of the Three Ideas overhead on display, keeping the rest masked for now. Read the first statement with students, and ask them to take a minute to consider it privately. Do they agree? Why or why not?



Set C1 Geometry: Triangles & Quadrilaterals Blackline Run one copy on a transparency.

Three Mathematical Ideas

1 The formula for the area of any parallelogram, including a rectangle, is

base × height or *bh*

2. Ask students to pair-share their thoughts for a minute or two. Then invite volunteers to share their ideas with the class.

> ***Students*** *The formula for the area of a rectangle is length times width, not base times height. If you have a parallelogram that's slanted over, you have to find the height, and then multiply it by the base. You don't have to do that with a regular rectangle. You just multiply the two sides.*
> *I think you need two different ways to find the area, one for rectangles, and one for the other parallelograms.*
> *I agree. I don't think they can be the same.*

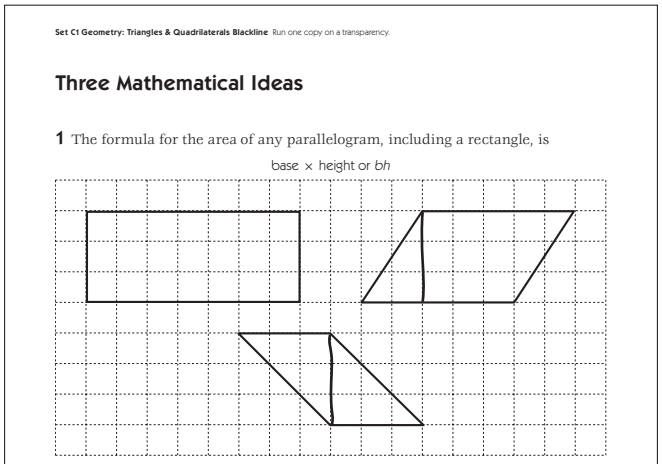
3. While some students may believe that the formula for the area of a rectangle is distinctly different from the formula for the area of a non-rectangular parallelogram, a few might challenge this assumption by pointing out that the height of a parallelogram is the same as the width of a rectangle. If students don't raise this issue, press their thinking by reviewing the definition of height with the class.

> ***Teacher*** *Let's think some more about this idea together. What is height? Who can tell us what that term means? Pair-share your ideas, and then let's hear from some of you.*

Activity 4 Three Mathematical Ideas (cont.)

Students *It's how high the shape is, like how far up it goes.*
It's how far it is from one side to the other, but it's up and down instead of sideways.
It has to make a right angle with the side on the bottom—the base.
It's kind of like the width of a rectangle, but you have to draw it in.

4. Reveal the figures below the first statement, and ask volunteers to show the height of each.


Set C1 Geometry: Triangles & Quadrilaterals Blackline Run one copy on a transparency.

Three Mathematical Ideas

1 The formula for the area of any parallelogram, including a rectangle, is

base × height or *bh*

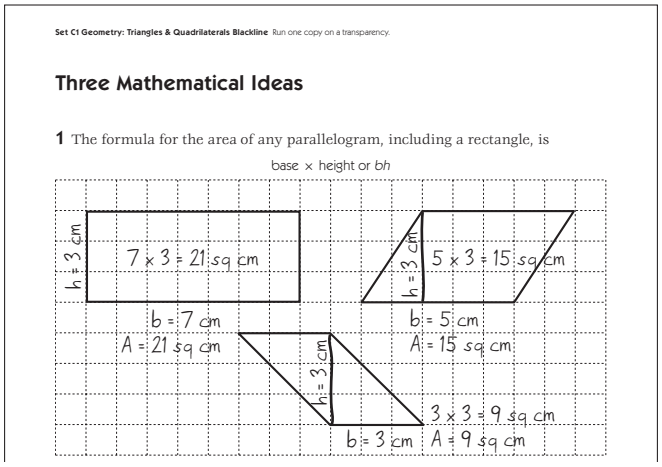
Teacher *Jessa and Carlos showed us the height of the two parallelograms. What about the height of the rectangle? Can anyone show us that?*

Lani *You don't have to. It's already there. You don't have to draw anything!*

Teacher *I thought you all agreed that the height of a figure tells how far one side is from its opposite side, and that the height has to be perpendicular to the base. Let's look more closely at the width of the rectangle. Doesn't it tell how far it is from one side of the rectangle to its opposite side?*

Austin *Yes, and it's also perpendicular to the base! You don't have to draw it, but it's the same as the height on the other parallelograms!*

5. Even though you may not have total agreement, ask students to give the formula a road test. Work with their input to determine the base and height of each figure, multiply the two dimensions, and record the area. As you do so, let them know that the grid is marked off in centimeters. Then ask volunteers to verify the answers visually. Are they all correct?



Activity 4 Three Mathematical Ideas (cont.)

Students *You can see that if you slide the triangle over on the bottom parallelogram, it's going to make a 3-by-3 square. That's 9 square centimeters.*
On that other parallelogram, if you think about cutting off the triangle and moving it over, you'll get a 3-by-5 rectangle. That's 15 square centimeters.
They're all right, because three rows of seven is 21, so the rectangle is 21 square centimeters.

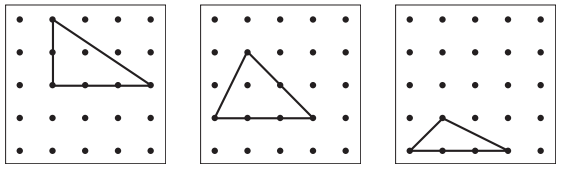
6. Now reveal the second mathematical idea on the overhead and read it with the class. Do students agree with this statement? Why or why not? Give them a minute to consider it privately. Then have them pair-share their thinking, and call on a few volunteers to share their ideas with the class.

2 Any triangle is half of a parallelogram.

Students *That seems right. You can put two triangles together to make a rectangle or a square.*
I bet I could make a triangle that wouldn't work.
I think you can split any parallelogram into 2 triangles. I think it's right.

7. Show the illustrations below the second statement.

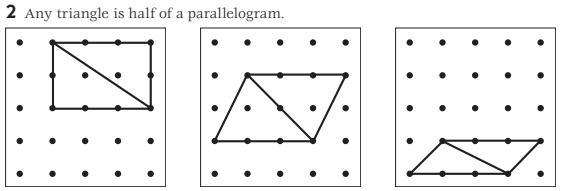
2 Any triangle is half of a parallelogram.



Ask students to imagine that each of the triangles is only half of a larger figure. Could that larger figure be a parallelogram? Give students each a geoboard and some rubber bands, and ask them to test the idea for themselves. Suggest they work in pairs, that each partner create one copy of the same triangle, and they superimpose one of their boards on top of the other to make a parallelogram. Ask them to experiment with all three of the triangles shown on the overhead, and if they have extra time, to test the idea with other triangles on their geoboards.

8. After a few minutes, invite volunteers up to share their results by placing their geoboards on the overhead or sketching on the transparency. Did each triangle turn out to be half of a parallelogram? Did anyone find a triangle that didn't appear to be half of a parallelogram? Are they convinced that the statement is true?

2 Any triangle is half of a parallelogram.



9. Now display the third idea. Read it with the class, and clarify as needed. Does it make sense? Will it work?

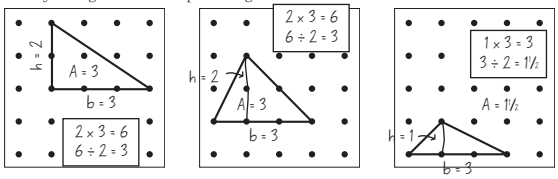
Activity 4 Three Mathematical Ideas (cont.)

3 If any triangle is half of a parallelogram, and the area of any parallelogram is base x height, the formula for the area of any triangle must be

½ base × height, or ½ *bh*.

10. Erase any marks that may have been made on the lower half of the transparency so only the triangles remain. Work with input from the class to determine the base and height of the first triangle. Then have students multiply the two dimensions and divide the result in half to find the area of the triangle as you record on the transparency. Repeat this with the second and third triangles.

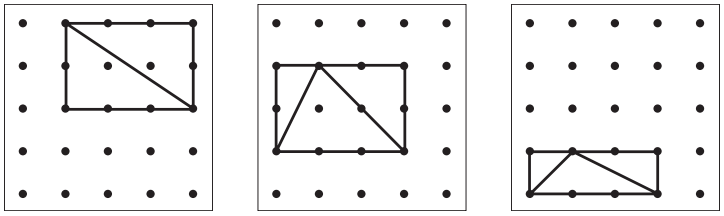
2 Any triangle is half of a parallelogram.



3 If any triangle is half of a parallelogram, and the area of any parallelogram is base x height, the formula for the area of any triangle must be

½ base × height, or ½ *bh*.

11. Then ask volunteers to build each of the triangles on their geoboard and verify the answers. Is the area of the first triangle actually 3? What about the second triangle? Can they convince one another that the area of the third triangle is 1 ½? Ask volunteers to bring their geoboards to the overhead to demonstrate that the areas are correct.



Darius Rosa Sam

Darius *I made the first triangle on my board. Then I made a rectangle around it. You can see that the area of the rectangle is 6 squares, so the triangle has to be 3. The formula worked on that one.*

Rosa *I put the second triangle on my board and made 2 rectangles to help figure out the area. You can see that the little part of the triangle is worth 1, and the bigger part is worth 2. That's 3 in all, so the formula gave us the right answer.*

Sam *I did the same thing as Rosa on the third triangle. It came out to be half a square on the left part of the triangle, and half a rectangle of 2 on the right hand triangle. That's a half and one. The formula said the area was 1 ½, so it worked.*

12. Give students each a copy of Finding the Area of Triangles. Review the instructions on both sheets with the class. When students understand what to do, let them get started. Plan to assign unfinished work as homework or seatwork the following day.

Activity 4 Three Mathematical Ideas (cont.)

Set C1 Geometry: Triangles & Quadrilaterals Blackline Run a class set

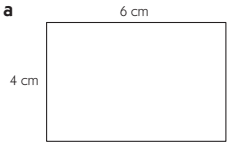
NAME _____ DATE _____

Finding the Area of Triangles page 1 of 2

The formula for finding the area of all parallelograms, including rectangles is base x height, or *bh*.

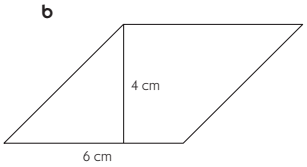
1 Use the formula to find the area of the two parallelograms below.

a



Area = _____ sq cm

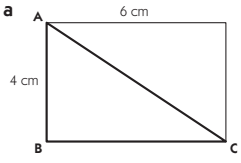
b



Area = _____ sq cm

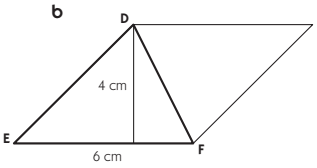
2 Find the area of Triangle ABC and Triangle DEF. Use numbers, words, and labels on the sketches to explain your answers.

a



Area = _____ sq cm

b



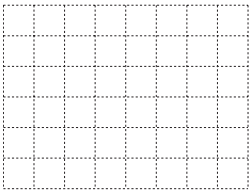
Area = _____ sq cm

Set C1 Geometry: Triangles & Quadrilaterals Blackline Run a class set

NAME _____ DATE _____

Finding the Area of Triangles page 2 of 2

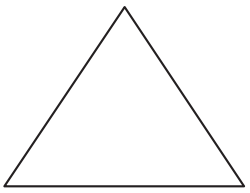
3 The formula for the area of a triangle is $\frac{1}{2}$ base x height, or $\frac{1}{2}$ *bh*. Use labeled sketches, numbers, and words to explain why this works.



4 For each of the triangles below:

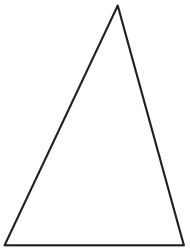
- draw in the height.
- measure and label the height and the base to the nearest centimeter.
- find and record the area.
- show your work.

a



Area = _____ sq cm

b



Area = _____ sq cm

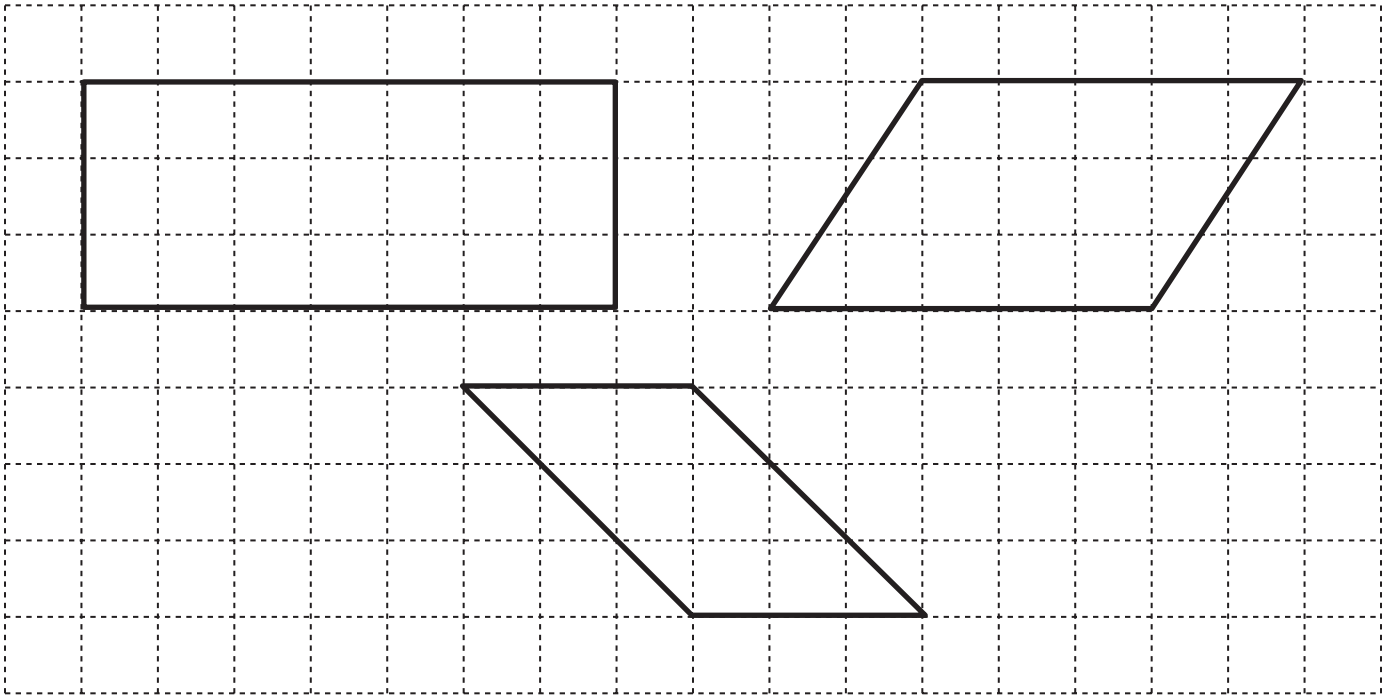
INDEPENDENT WORKSHEET

Use Set C1 Independent Worksheets 5 & 6 to provide students with more practice using formulas to determine the perimeters and areas of triangles and parallelograms.

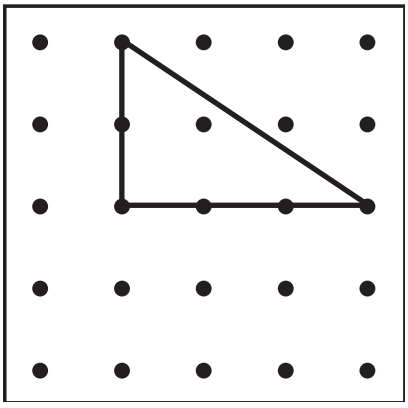
Three Mathematical Ideas

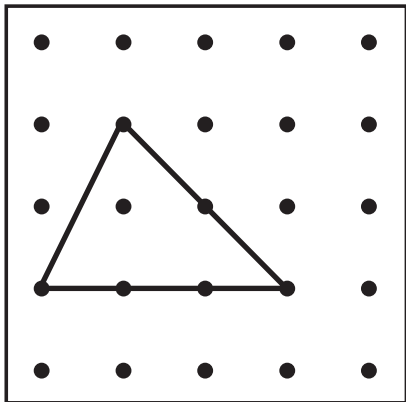
1 The formula for the area of any parallelogram, including a rectangle, is

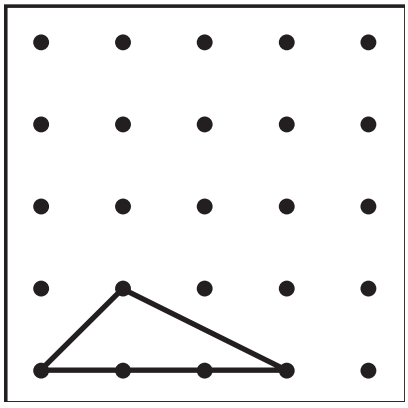
base × *height or bh*



2 Any triangle is half of a parallelogram.







3 If any triangle is half of a parallelogram, and the area of any parallelogram is base × height, the formula for the area of any triangle must be $\frac{1}{2}$ *base* × *height, or* $\frac{1}{2}$ *bh.*

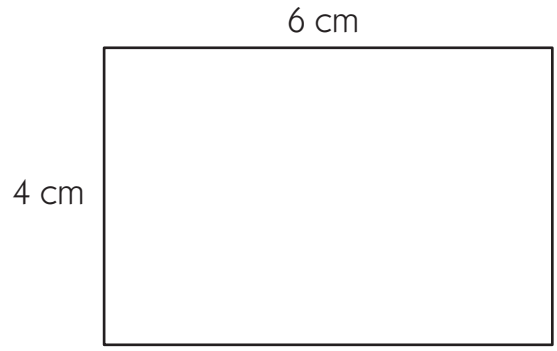
NAME _____ **DATE** _____

Finding the Area of Triangles page 1 of 2

The formula for finding the area of all parallelograms, including rectangles is base × height, or *bh*.

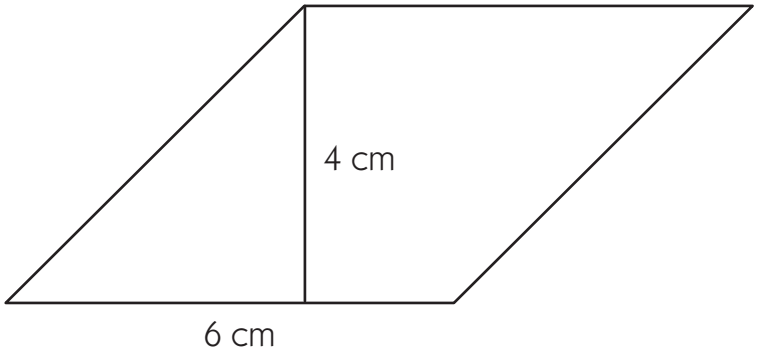
1 Use the formula to find the area of the two parallelograms below.

a



Area = _____ sq cm

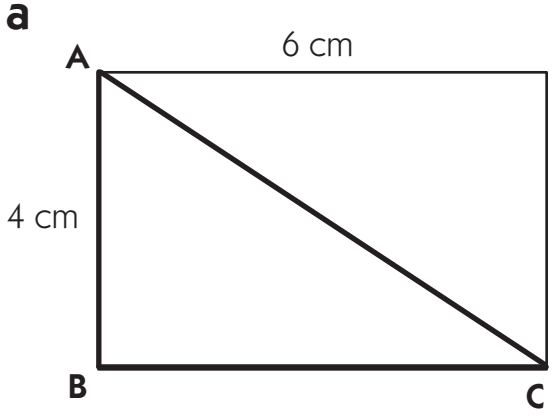
b



Area = _____ sq cm

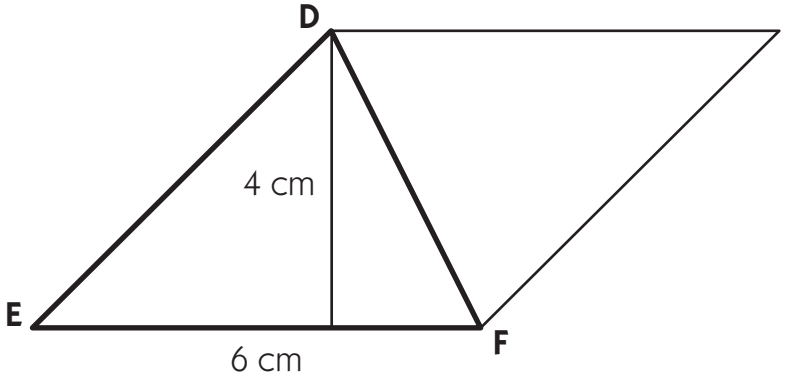
2 Find the area of Triangle ABC and Triangle DEF. Use numbers, words, and labels on the sketches to explain your answers.

a



Area = _____ sq cm

b

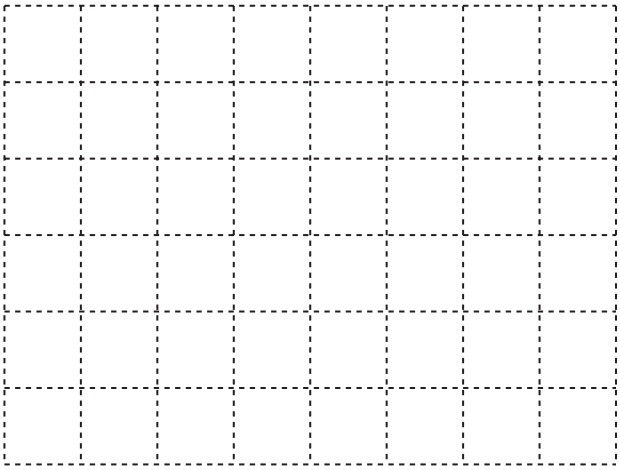


Area = _____ sq cm

NAME _____ **DATE** _____

Finding the Area of Triangles page 2 of 2

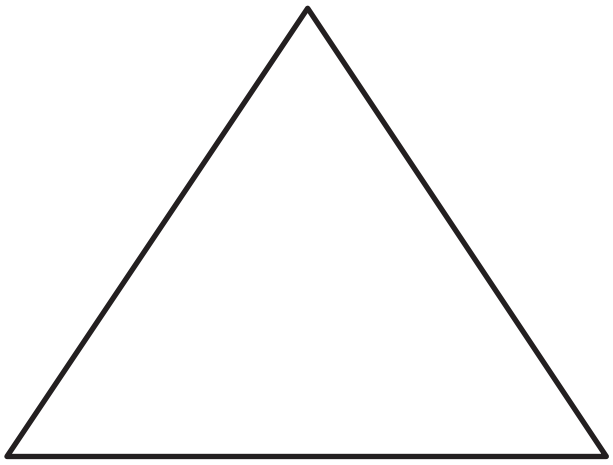
3 The formula for the area of a triangle is $\frac{1}{2}$ base × height, or $\frac{1}{2}$ *bh*. Use labeled sketches, numbers, and words to explain why this works.



4 For each of the triangles below:

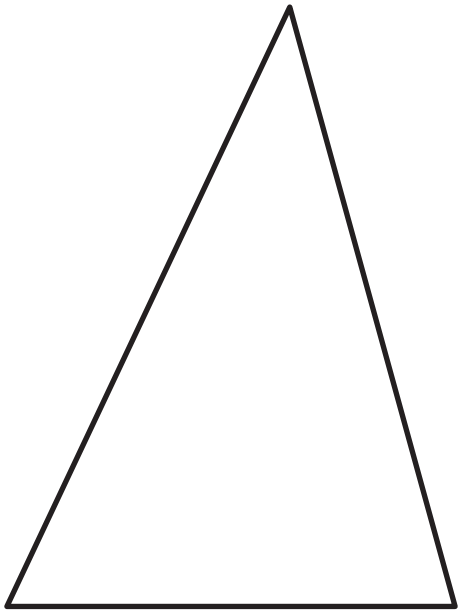
- draw in the height.
- measure and label the height and the base to the nearest centimeter.
- find and record the area.
- show your work.

a



Area = _____ sq cm

b



Area = _____ sq cm

NAME _____ **DATE** _____

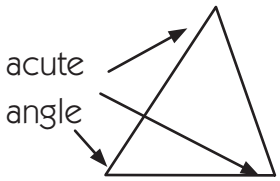
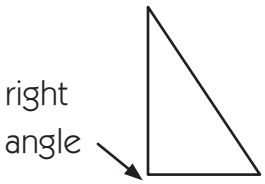
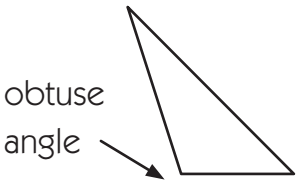
Set C2 ★ Independent Worksheet 1

INDEPENDENT WORKSHEET

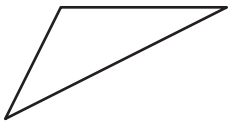
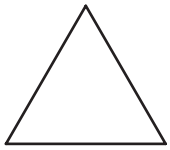
More Geoboard Triangles

Remember that you can classify and describe triangles in two different ways:

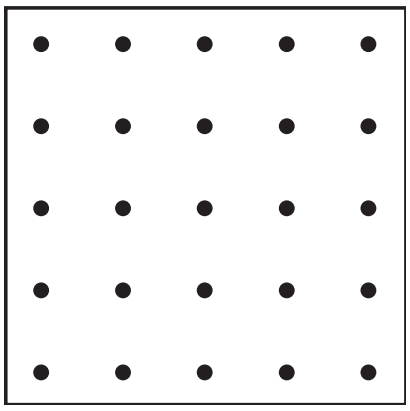
- by the size of their angles

 **Acute Triangle** All 3 angles are acute.	 **Right Triangle** One of the angles is a right angle	 **Obtuse Triangle** One of the angles is obtuse.

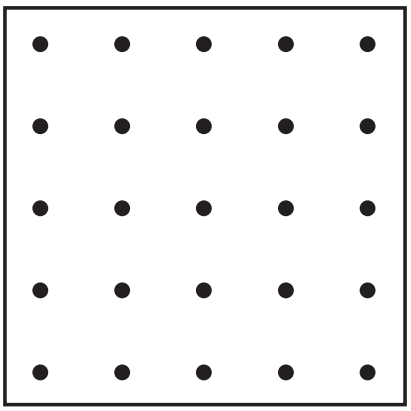
- by the length of their sides

 **Isosceles Triangle** Two sides are the same length	 **Scalene Triangle** Each side is a different length.	 **Equilateral Triangle** All 3 sides are the same length

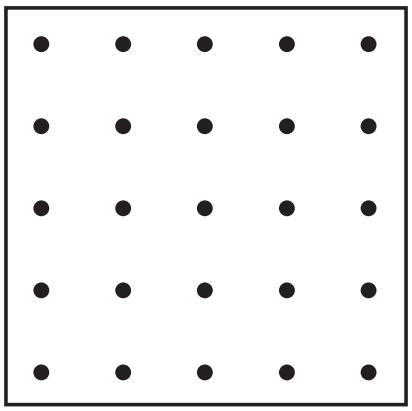
Follow the instructions below each geoboard to draw some different triangles
Hint Build your triangles on a geoboard first. Then copy them onto the paper.



1 A Right Triangle



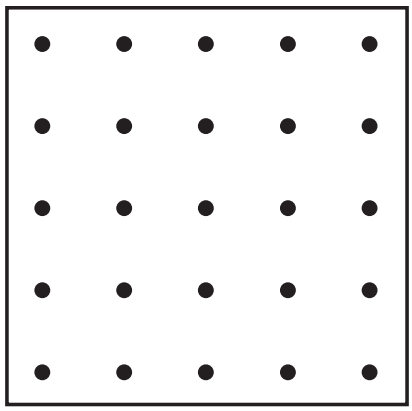
2 An Isosceles Triangle



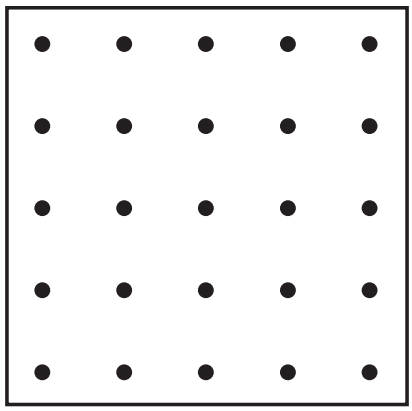
3 An Acute Triangle

(Continued on back.)

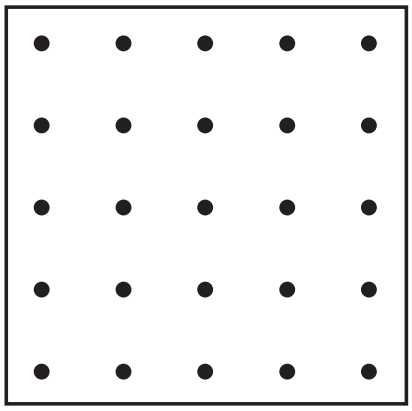
Independent Worksheet 1 More Geoboard Triangles (cont.)



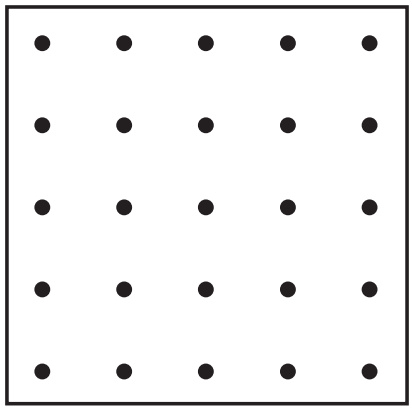
4 An Obtuse Triangle



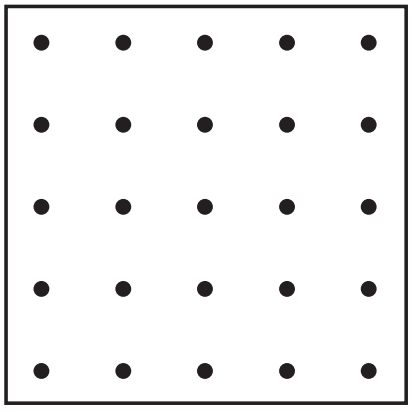
5 A Scalene Triangle



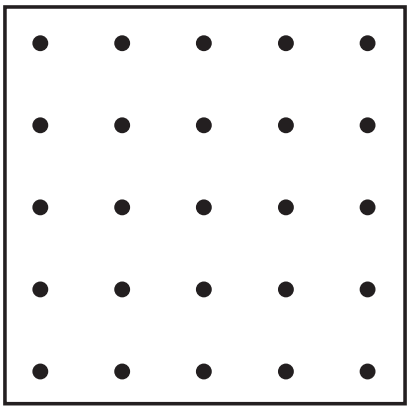
6 A Right Triangle that is also Isosceles



7 A Right Triangle that is also Scalene



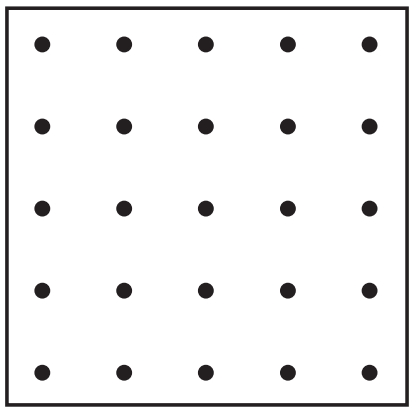
8 An Obtuse Triangle that is also Isosceles

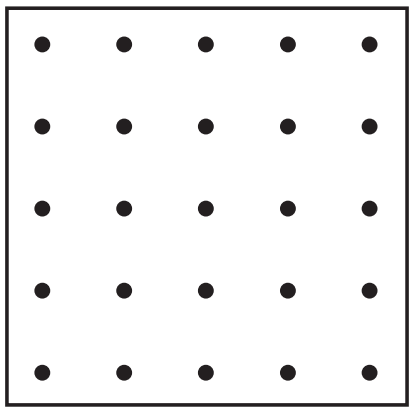


9 A Scalene Triangle that is not Obtuse

CHALLENGE

10 Dana says it is impossible to draw a right triangle that is also acute. Do you agree with her? Why or why not? Use the geoboards below to test your ideas. Explain your ideas in writing.





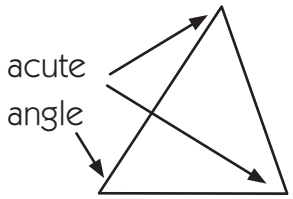
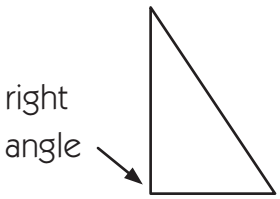
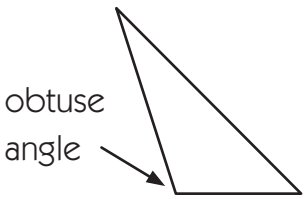
NAME _____ **DATE** _____

Set C1 ★ Independent Worksheet 2

INDEPENDENT WORKSHEET

Color & Construct Triangles

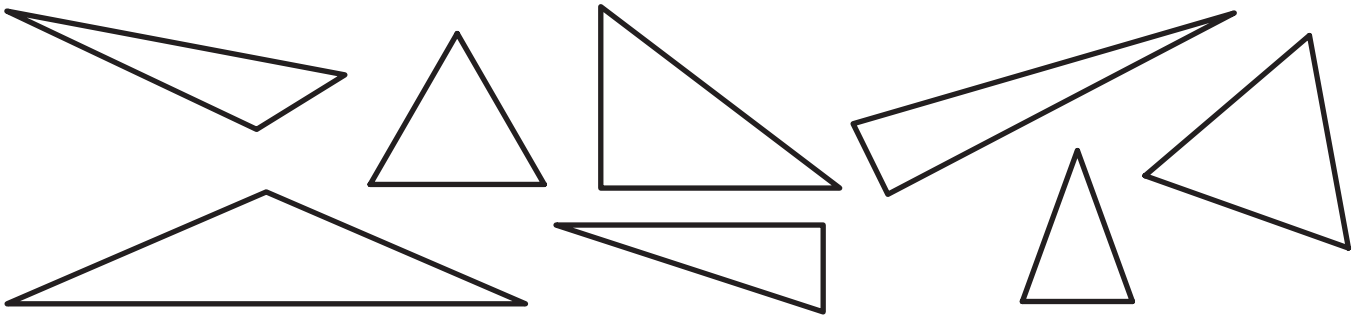
You can classify triangles by the size of their angles,

 **Acute Triangle** All 3 angles are acute.	 **Right Triangle** One of the angles is a right angle.	 **Obtuse Triangle** One of the angles is obtuse

1 Look at the triangles below. Color:

- the acute triangles green.
- the right triangles red.
- the obtuse triangles orange.

Hint Use the corner of a piece of paper, a tile, or a square pattern block to help test the angles. Some of these triangles might fool you!



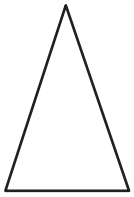
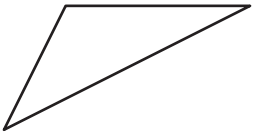
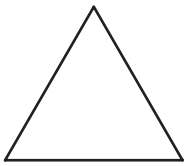
2 Follow the instructions below to draw your own triangles.

a Draw a right triangle with no congruent sides.	**b** Draw an acute triangle with 3 congruent sides.	**c** Draw an obtuse triangle with 2 congruent sides.

(Continued on back.)

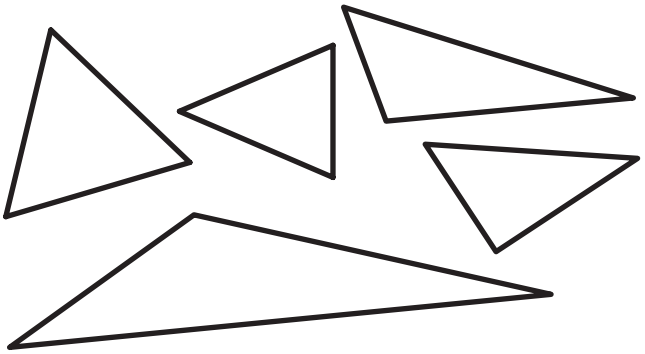
Independent Worksheet 2 Color & Construct Triangles (cont.)

You can also classify triangles by the length of their sides.

		
Isosceles Triangle Two sides are the same length.	**Scalene Triangle** Each side is a different length.	**Equilateral Triangle** All 3 sides are the same length.

3 Look at the triangles below. Color:
- the isosceles triangles purple.
- the scalene triangles yellow.
- the equilateral triangles blue.

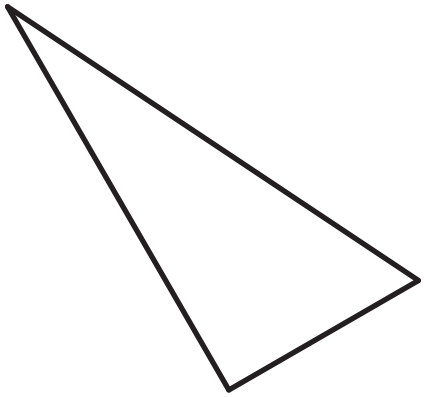
Hint If you are not sure whether the side lengths are equal or not, use your ruler to help. Measure to the nearest half inch, or even the nearest centimeter.



4 Draw an isosceles triangle that is also a right triangle.

5 Draw a scalene triangle that is not an obtuse triangle.

6 Measure and label this triangle to show the length of each side and the measure of each angle.



7 Is the triangle in problem 6 acute, right, or obtuse? Is it isosceles, scalene, or equilateral? How do you know?

NAME _____ **DATE** _____

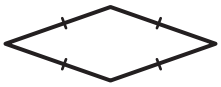
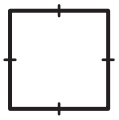
Set C1 ★ Independent Worksheet 3

INDEPENDENT WORKSHEET

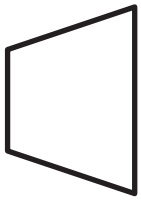
Classifying Quadrilaterals

A quadrilateral is any polygon that has 4 sides. There are many kinds of quadrilaterals, including:

 **trapezoid** a quadrilateral with exactly 1 pair of parallel sides	 **parallelogram** a quadrilateral with 2 pairs of parallel sides opposite each other

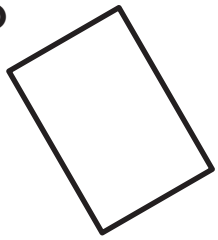
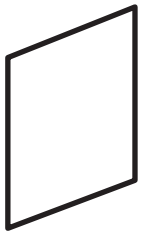
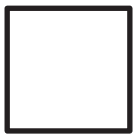
 **rectangle** a parallelogram with 4 right angles	 **rhombus** a parallelogram with 4 congruent sides	 **square** a parallelogram with 4 congruent sides and 4 right angles

1 Look carefully at the figures below. Find out how many right angles, pairs of parallel sides, and pairs of congruent sides each has. Then circle all the words that describe the figure.

Figure	How many right angles?	How many pairs of congruent sides?	How many pairs of parallel sides?	Circle the word(s) that describe(s) the figure.
a 				trapezoid parallelogram rectangle rhombus square

(Continued on back.)

Independent Worksheet 3 Classifying Quadrilaterals (cont.)

Figure	How many right angles?	How many pairs of congruent sides?	How many pairs of parallel sides?	Circle the word(s) that describe(s) the figure.
b 				trapezoid parallelogram rectangle rhombus square
c 				trapezoid parallelogram rectangle rhombus square
d 				trapezoid parallelogram rectangle rhombus square
e 				trapezoid parallelogram rectangle rhombus square

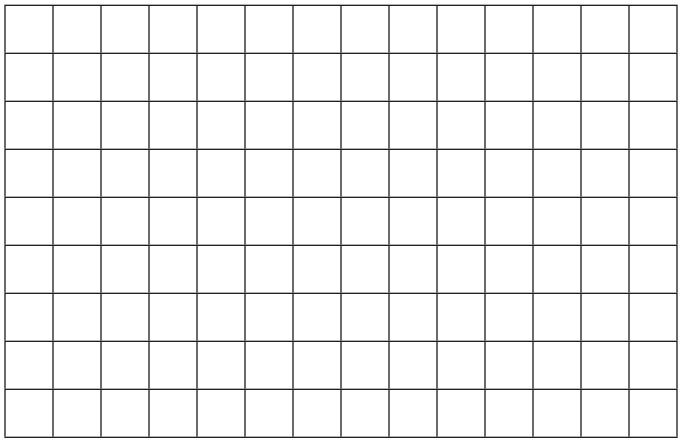
(Continued on next page.)

NAME _____ **DATE** _____

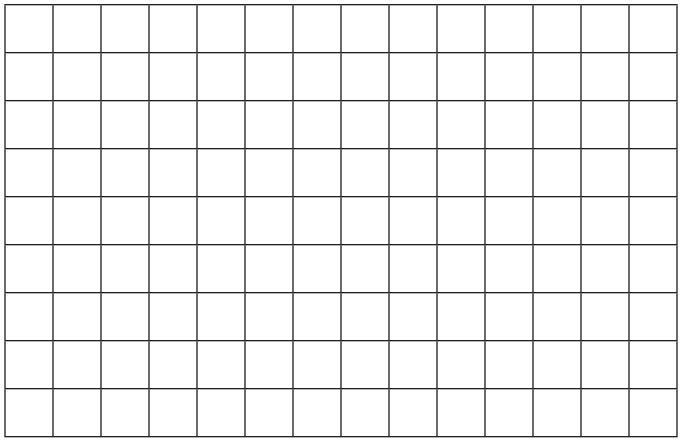
Independent Worksheet 3 Classifying Quadrilaterals (cont.)

Use a ruler marked in inches and the grid lines below to draw the following figures.

2 A rectangle with 4 congruent sides that are each $1\frac{4}{8}$ inches long



3 A parallelogram with two sides that are each $2\frac{2}{8}$ inches long



NAME _____ **DATE** _____

Set C1 ★ Independent Worksheet 4

INDEPENDENT WORKSHEET

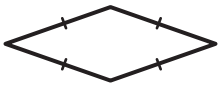
Quad Construction

A quadrilateral is any polygon that has 4 sides. There are many kinds of quadrilaterals, including:

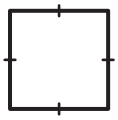
trapezoid
a quadrilateral with exactly 1 pair of parallel sides

parallelogram
a quadrilateral with 2 pairs of parallel sides opposite each other

rectangle
a parallelogram with 4 right angles



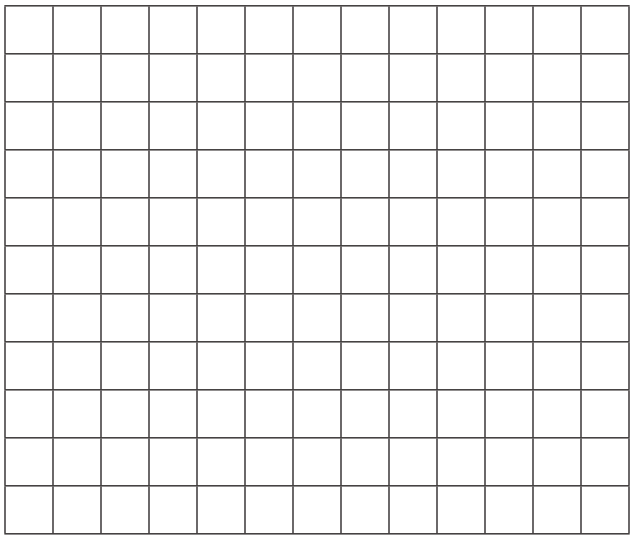
rhombus
a parallelogram with 4 congruent sides



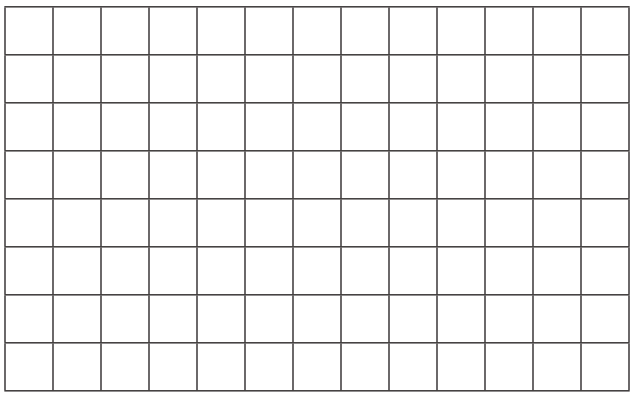
square
a parallelogram with 4 congruent sides and 4 right angles

Use a ruler marked in inches and the grid lines below to draw the following figures.

1 A trapzoid with one right angle, one side length of $1\frac{7}{8}$ inches and one side length of $2\frac{5}{8}$ inches.



2 A parallelogram that is not a rectangle with an area of 18 square units. (The smallest square on the grid has an area of 1 square unit.) Label your drawing to prove that the area is 18 square units.



(Continued on back.)

Independent Worksheet 4 Quad Construction (cont.)

3 A parallelogram with 4 right angles and an area of 32 square units. Label your drawing to prove that the area is 32 square units.

4 A parallelogram that is not a rectangle with an area of 32 square units. Label your drawing to prove that the area is 32 square units.

CHALLENGE

5 Darius says it is impossible for a trapezoid to have parallel sides that are also the same length. Remember that a trapzoid is any quadrilateral with exactly 1 pair of parallel sides. Explain why you agree or disagree with Darius. Draw on the grid to help explain your answer.

NAME _____ **DATE** _____

Set C1 ★ Independent Worksheet 5

INDEPENDENT WORKSHEET

Perimeter & Area Puzzles

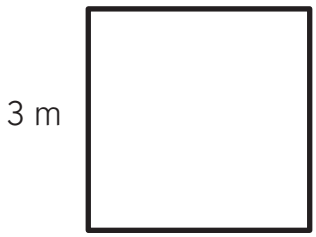
To find the perimeter of any triangle or quadrilateral, add the side lengths. For rectangles, you can use the formula 2 times length plus 2 times width, or $2l + 2w$.

The formula for finding the area of all parallelograms, including rectangles is base × height, or bh.

The formula for finding the area of all triangles is $\frac{1}{2}$ base × height, or $\frac{1}{2}\ bh$.

1 Use the formulas above to find the perimeter and area of each figure on this page. Show your work.

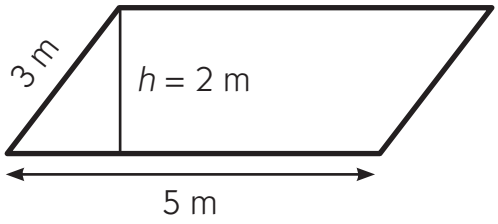
a Square



Perimeter = _____ meters

Area = _____ square meters

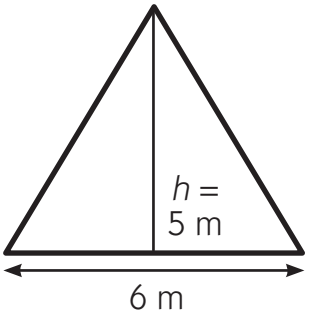
b Parallelogram



Perimeter = _____ meters

Area = _____ square meters

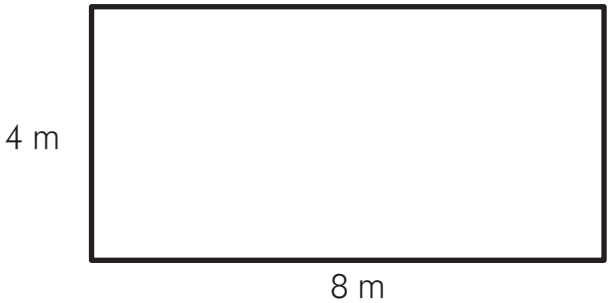
c Equilateral Triangle



Perimeter = _____ meters

Area = _____ square meters

d Rectangle



Perimeter = _____ meters

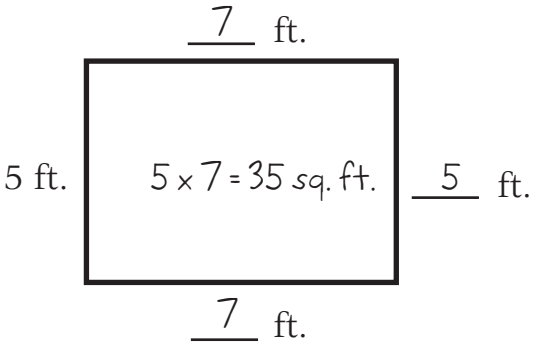
Area = _____ square meters

(Continued on back.)

Independent Worksheet 5 Perimeter & Area Puzzles (cont.)

2 Fill in the blanks to label each of the shapes below with its dimensions, perimeter, and/or area. Use the information in each drawing to help. Show your work.

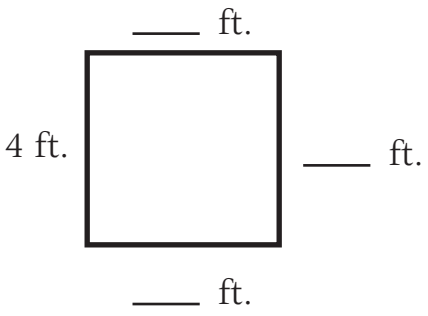
example Rectangle



Perimeter = 24 feet

Area = 35 square feet

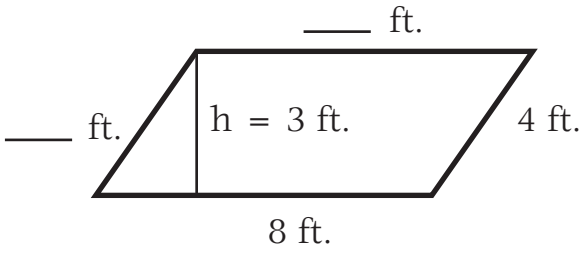
a Square



Perimeter = 16 feet

Area = _____ square feet

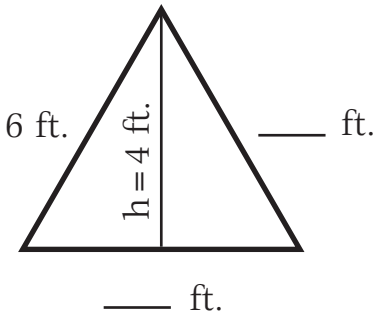
b Parallelogram



Perimeter = _____ feet

Area = _____ square feet

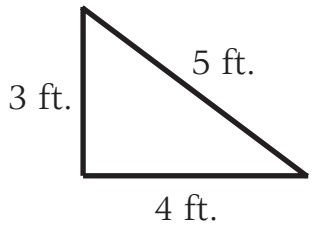
c Equilateral Triangle



Perimeter = _____ feet

Area = _____ square feet

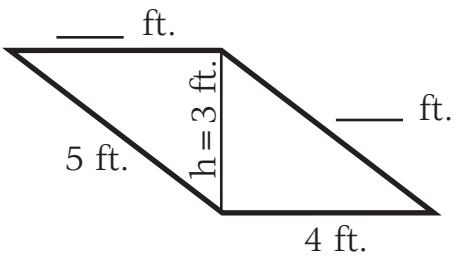
d Right Triangle



Perimeter = _____ feet

Area = _____ square feet

e Parallelogram



Perimeter = _____ feet

Area = _____ square feet

NAME _____ **DATE** _____

Set C1 ★ Independent Worksheet 6

INDEPENDENT WORKSHEET

Ebony's Quilt

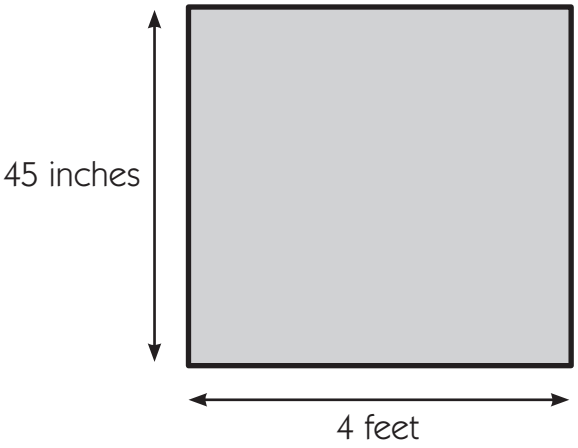
Ebony and her mom are going to make a quilt for Ebony's bed. When it is finished, the quilt will be 72 inches by 90 inches.

1 How many square inches will Ebony's quilt be in all? Show your work.

2 Ebony and her mom went to the store to buy fabric for the quilt. They picked out 4 colors they liked. The fabric was 45 inches wide. Ebony said, "Let's buy 4 feet of each color."

Will that be enough fabric to make the quilt? Show all your work.

Here is one of the 4 pieces of fabric they bought.



(Continued on back.)

Independent Worksheet 6 Ebony's Quilt (cont.)

3 Ebony's quilt will be made out of squares that are 9 inches on each side. Make a labeled sketch on the grid below to show how Ebony and her mom will have to arrange the squares to make a 72" by 90" quilt.

4 Ebony is planning how she wants each 9-inch square to look. Here is her first plan. What is the area of the light grey triangle? Show your work.

The area of the light grey triangle is _____ square inches.

5 Her brother Noah said, "Why don't you use all 4 colors in each quilt square? Here's a different plan." What is the area of the light grey triangle in Noah's plan? Show your work.

The area of the light grey triangle is _____ square inches.

BRIDGES IN MATHEMATICS 5

GRADE 5 SUPPLEMENT

Set D2 Measurement: Volume

Includes

Skills & Concepts

- ★ determine volume by finding the total number of same-sized units of volume that fill a three-dimensional shape without gaps or overlaps
- ★ understand a cube that is one unit on an edge is the standard unit for measuring volume
- ★ select appropriate units, strategies, and tools for solving problems that involve estimating or measuring volume
- ★ measure necessary attributes of shapes to use volume formulas to solve problems

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Set D2 Measurement: Volume

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P0509

Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set D2 ★ Activity 1

ACTIVITY

Introducing Volume

Overview

In this activity, students move toward increasingly efficient methods of finding the volume of cubes and rectangular solids.

Skills & Concepts

- ★ determine volume by finding the total number of same-sized units of volume that fill a three-dimensional shape without gaps or overlaps
- ★ understand a cube that is one unit on an edge is the standard unit for measuring volume
- ★ select appropriate units, strategies, and tools for solving problems that involve estimating or measuring volume
- ★ measure necessary attributes of shapes to use volume formulas to solve problems

You'll need

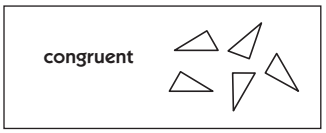
- ★ Cubes & Rectangular Solids (page D2.4, run 1 copy on a transparency)
- ★ Paper Box Pattern (page D2.5, run a class set)
- ★ centimeter cubes (class set)
- ★ scissors
- ★ scotch tape
- ★ rulers (class set)
- ★ Student Math Journals
- ★ Word Resource Cards (*congruent, edge, face, parallel, perpendicular, vertex*)

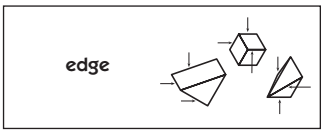
Advance Preparation Display the Word Resource Cards where students can see them before conducting the activity.

Instructions for Introducing Volume

1. Give students each a centimeter cube and allow several minutes for them to record as many observations as they can about the cube in their math journals. Call their attention to the Word Resource Cards before they start writing and challenge them to include at least 3 of the words in their observations.

2. Have them pair-share their observations, and then call for whole-group sharing. Record some of their observations at the top of the Cubes and Rectangular Solids overhead, keeping the rest of the transparency covered for now. If it doesn't come up in the discussion, ask students to find examples of parallel, perpendicular, and congruent edges and faces as they examine their cubes.





3. Ask students to estimate the length of one of the edges of their cube. Then have a volunteer measure to confirm that each edge is 1 centimeter. Next, ask students to determine the area of one of the cube's faces. Finally, explain that because their cube is 1 centimeter long, wide, and high, it is called a *cubic centimeter*. Just as centimeters are used to measure length and square centimeters are used to measure area, *cubic centimeters* are used to measure *volume*. Add this information to the overhead, along with the abbreviations for each measure.

Activity 1 Introducing Volume (cont.)

4. Next, reveal the picture of the rectangular solid on the overhead. Have students write at least 3 observations about this figure in their journals. Then invite volunteers to share their observations with the class as you record at the overhead. After you've recorded 8–10 observations, work with input from the students to label all 3 dimensions of the solid: length, width, and height.

Set D2 Measurement: Volume Blackline Run 1 copy on a transparency.

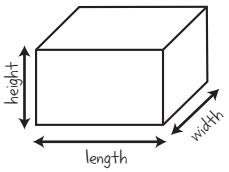
Cubes and Rectagular Solids

Cube

length of edge = 1 cm
area of face = 1 sq cm (cm^2)
volume of cube = 1 cubic cm (cm^3)

- square on every side
- 8 vertices
- has parallel and perpendicular sides
- all faces are congruent
- all edges are congruent
- has 3 pairs of parallel faces
- sides that touch are perpendicular
- 6 faces
- 12 edges

Rectangular Solid



- faces are rectangles
- 6 faces, 8 vertices, 12 edges
- all right angles
- sides that touch are perpendicular
- 3 pairs of parallel sides
- opposite sides are congruent

5. Give each table a good supply of centimeter cubes. Ask each student to build several different rectangular solids that have a volume of exactly 12 cubic centimeters. Be sure they understand that their constructions have to be solidly filled in, without gaps or holes between cubes. Ask them to share and compare their constructions as they're working.

6. After a few minutes, call a halt to the construction process. Ask several volunteers to describe their constructions by length, width, and height. Record each description at the board, along with an equation to confirm that the total is 12 cubic centimeters.

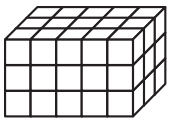
Rectangular Solids with Volume = 12 cm^3

Length = 2 cm	Length = 6 cm	Length = 12 cm
Width = 2 cm	Width = 2cm	Width = 1 cm
Height = 3 cm	Height = 1cm	Height = 1 cm
$2 \times 2 \times 3 = 12\ cm^3$	$6 \times 2 \times 1 = 12\ cm^3$	$12 \times 1 \times 1 = 12\ cm^3$

7. Now reveal the rectangular solid at the bottom of the overhead. Ask students to replicate it with their cubes and determine its volume without counting every cube one by one. As they finish, invite volunteers to share their strategies with the class, as you record at the overhead. If it doesn't come from one of the students, ask them what would happen if you multiplied length × width × height. Would it result in the same answer they've shared? Why or why not? Press them to explain their thinking and then work with their input to write the equation and solve the multiplication problem.

Activity 1 Introducing Volume (cont.)

Build this rectangular solid with your centimeter cubes. Find the volume *without* counting each cube 1 by 1.



$15 + 15 + 15 = 45\ cm^3$

$9 \times 5 = 45\ cm^3$

counted by rows of 5 ($5 \times 9 = 45\ cm^3$)

$18 + 18 = 36\ \ 36 + 9 = 45\ cm^3$

length x width x height

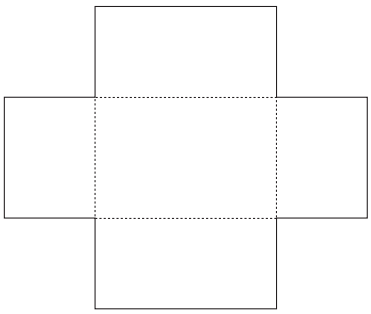
$5 \times 3 \times 3 = 45\ cm^3$

8. Ask students to clear their cubes to the side for now and get out their scissors. Give each student a copy of the Paper Box Pattern and supply each table with some scotch tape. Have them cut, fold, and tape their paper patterns to make a box. Ask early finishers to help others near them.

Set D2 Measurement: Volume Blackline Run a class set.

Paper Box Pattern

Cut out this pattern. Fold along the dashed lines and tape to make a box.



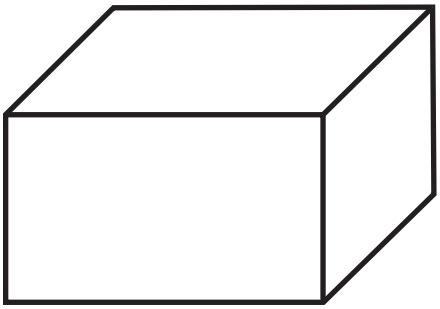
9. When everyone has finished, ask students to estimate the volume of the box. How many centimeter cubes do they think it will take to fill the box completely? Record some of their estimates on the board. Then challenge them to work in pairs to determine the actual volume of the box *without* filling it to the top with cubes, dumping them out, and counting them one by one. As they finish, have them record their solution in their journal, along with a detailed description of their strategy.

10. Toward the end of the period, reconvene the class. Ask volunteers to share their strategies and solutions with the class. If the idea of measuring the dimensions of the box and multiplying them doesn't come from one of the students, ask them to get out their rulers and try it. Does it result in the same solution they got using other methods? Why? (Students should find that the taped box holds 54 centimeter cubes. It is 6 centimeters long, 3 centimeters wide, and 3 centimeters high. $6 \times 3 \times 3 = 54\ cm^3$.)

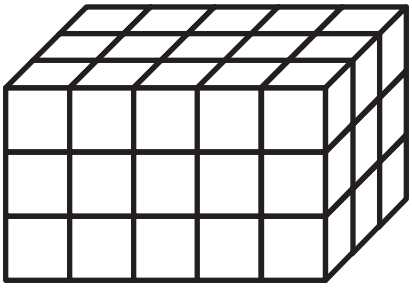
Cubes & Rectagular Solids

Cube

Rectangular Solid

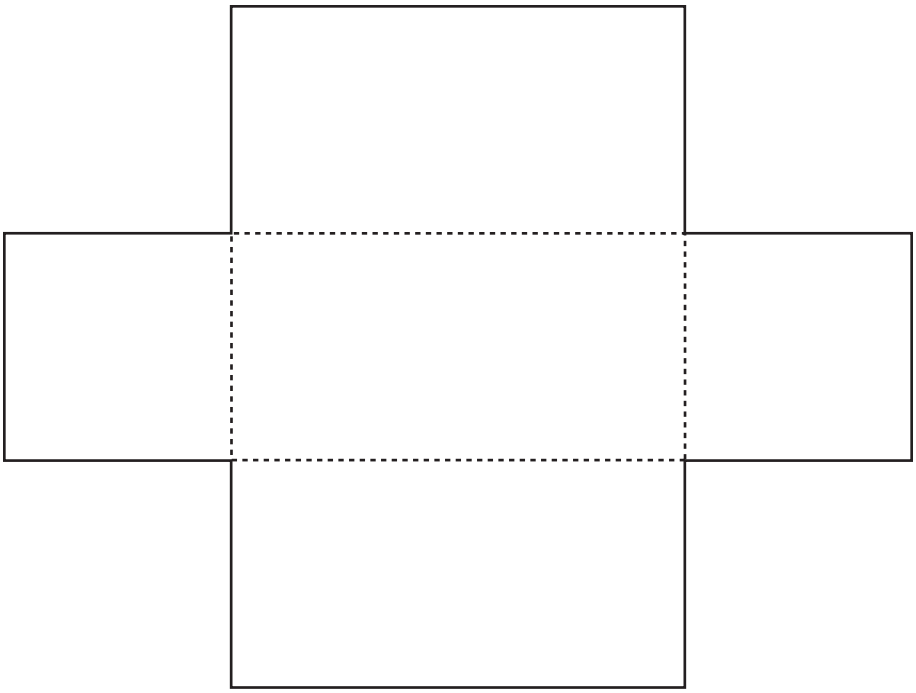


Build this rectangular solid with your centimeter cubes. Find the volume *without* counting each cube 1 by 1.



Paper Box Pattern

Cut out this pattern. Fold along the dashed lines and tape to make a box.



Set D2 ★ Activity 2

ACTIVITY

More Paper Boxes

Overview

Using paper boxes and centimeter cubes, students work together to generate efficient methods, including the standard formulas, for finding the volume of cubes and rectangular solids.

Skills & Concepts

- ★ determine volume by finding the total number of same-sized units of volume that fill a three-dimensional shape without gaps or overlaps
- ★ select appropriate units, strategies, and tools for solving problems that involve estimating or measuring volume
- ★ measure necessary attributes of shapes to use volume formulas to solve problems

You'll need

- ★ More Paper Boxes (page D2.10, half-class set, plus a few extra)
- ★ centimeter cubes (class set)
- ★ scissors
- ★ scotch tape
- ★ rulers (class set)
- ★ Student Math Journals
- ★ *Counting on Frank* by Rod Clement (optional)

Recommended Timing

Anytime after Set D2 Activity 1

Instructions for More Paper Boxes

1. Ask students to pair up, or assign partners. Students will need their rulers, scissors, and journals for this activity. Give each pair a copy of More Paper Boxes, along with some scotch tape. Have them cut out and tape together Box A, leaving Boxes B and C uncut for now. Ask early finishers to help others nearby.

2. When most students have finished constructing Box A, ask them to estimate how many centimeter cubes it will take to fill the box completely. Have them each record an estimate in their journals. Then ask volunteers to share and explain their estimates as you record at the board.

> ***Lauren*** *It looks like it's going to take about 10 to fill the bottom, and it's about 3 cubes high, so I think 30 cubes will do it.*
>
> ***Tonio*** *I say 40 because it's maybe 10 on the bottom and 4 up. That would be 4 × 10, so that's 40.*
>
> ***Marisa*** *I said 54 cubes because it looks like it's 3 across and maybe 6 long. That's 18. I think it's going to be 3 layers high, so I multiplied 3 × 18 to get 54.*

3. Distribute centimeter cubes and ask student pairs to find the actual volume of Box A. Explain that they can use any method they want except filling the box completely, dumping out the cubes, and counting them one by one. As they finish, have them record their answer, along with a description of their strategy in their journal.

Activity 2 More Paper Boxes (cont.)

4. After they've had a few minutes to work, ask volunteers to share their solutions and strategies with the class.

> ***Carter*** *It took 21 cubes to cover the bottom of the box. Then we stacked cubes in one corner to find out how high the box was. It was 4 cubes up, so we said 4 × 21 is 84 cubes.*
>
> ***Abby*** *We just used the cubes to make kind of an outline inside the box. It was 7 on the long side and 3 on the short side, so we knew the first layer would be 21. Then we went up one corner like Carter and Xavier, and it was 4. Then we knew it was 84 cubic centimeters because 4 × 21 is 84.*

5. If the idea of measuring the dimensions of the box and multiplying them doesn't come from the students, ask them to get out their rulers and try it. Does this strategy result in the same solution they got using other methods? Why? Work with class input to record an equation that matches what they just did: $7 \times 3 \times 4 = 84$ cm^3.

6. Ask students to cut out and tape together Box B and record an estimate of the volume in their journals. As they're working, collect the centimeter cubes. When most have finished, ask volunteers to share their estimates as you record at the board. Then challenge students to find the actual volume of the box using their rulers instead of cubes. Have them record the answer, along with any computations they made, in their journal.

7. After they've had some time to work, ask volunteers to share their solutions and strategies with the class. Then work with input from the class to write a general formula for finding the volume of a rectangular solid (length × width × height = volume), along with an equation for Box B ($6 \times 4 \times 2 = 48$ cm^3). Have students record this information in their journals.

8. Now tell them that some fifth graders in another class said they thought they could find the volume of Box C without cutting and taping it together. Do your students agree with these fifth graders? Why or why not? Have them pair-share their responses and then ask volunteers to share their thinking with the class.

> ***Students*** *We said you could do it by just using a ruler, but you should cut out the box and put it together first.*
> *We think they're right. It looks like it's going to be a cube, so if you just measured one edge, you could figure it out.*

9. Ask students to measure one or more edges of the uncut box to help make as accurate an estimate as possible. Have them record their estimate, along with an explanation in their journal. (If they're sure their estimate matches the actual volume, that's fine.)

10. After a few volunteers have shared and explained their estimates, ask students to cut out and tape together Box C. Have them measure it to determine the actual volume, and record the answer, along with any calculations they made, in their journals.

11. Have volunteers share and explain their solutions and strategies. Was it possible to determine the volume of the figure by measuring only 1 edge? Why or why not? Would it have been possible to find the answer without cutting and taping the cube? Why or why not? Then have students write an equation for the volume of Box C ($4 \times 4 \times 4 = 64$ cm^3) in their journals.

Activity 2 More Paper Boxes (cont.)

Extensions

- Explain that because the length, width, and height of a cube are all equal, mathematicians generally represent $s \times s \times s$ by s^3. Using this notation, the volume of a cube is s^3 where s is the length of one edge of the cube.

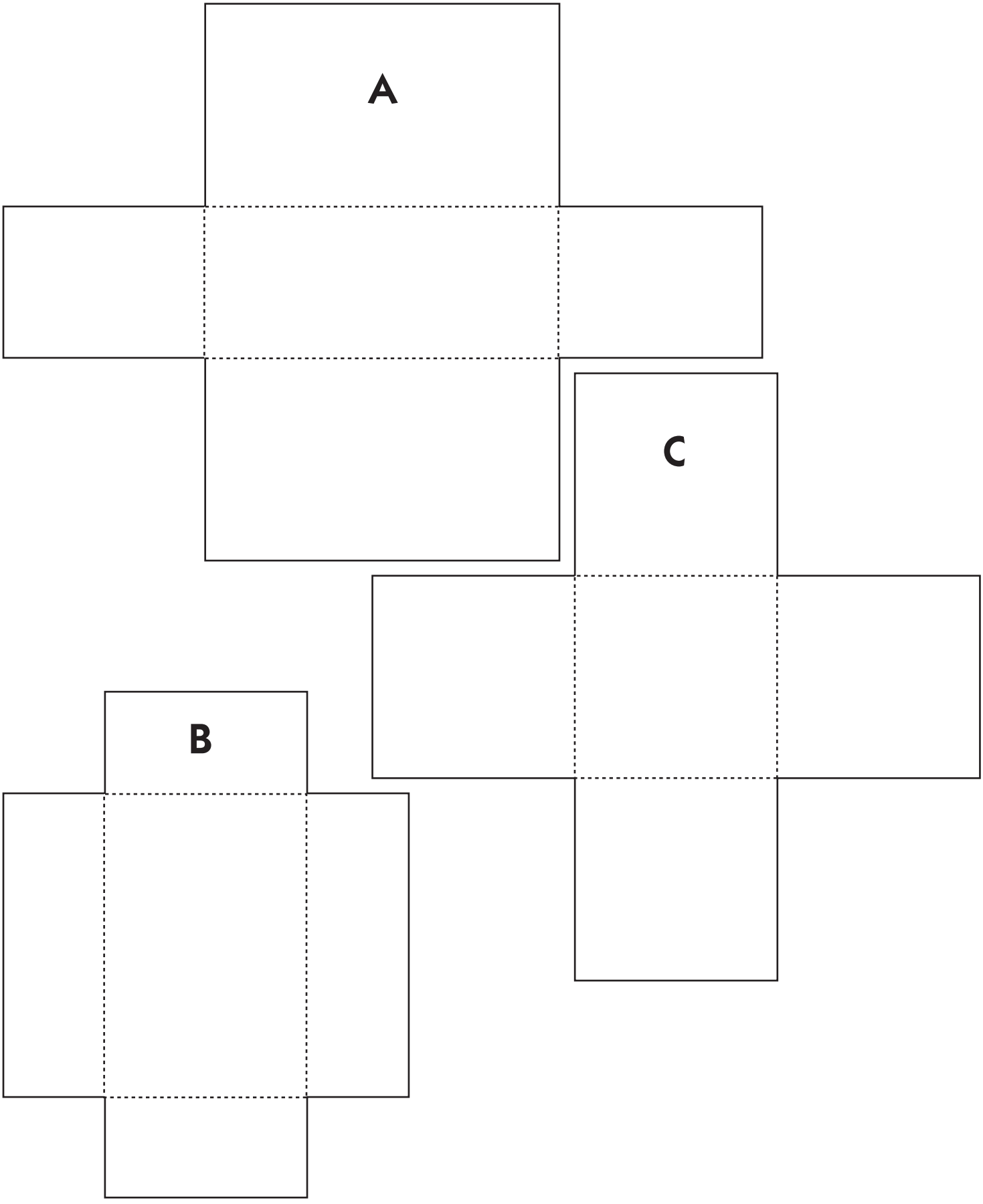
  $$s \times s \times s = s^3$$

  Record this at the board, and ask students to compare it to the formula for finding the volume of a rectangular prism. How are the two alike? How are they different? Ask them to record the general formula for finding the volume of a cube in their journals.
- Have volunteers use lightweight cardboard and tape to construct a cubic inch and a cubic foot, and share them with the class. Ask students to list in their journals some of the things they'd measure in cubic inches and some of the things they'd measure in cubic feet.
- Read *Counting on Frank* by Rod Clement before or after this session.

INDEPENDENT WORKSHEET

See Set D2 Independent Worksheets 1 and 2 for more practice selecting and using appropriate units and formulas to determine length, area, and volume.

More Paper Boxes



NAME _____ **DATE** _____

Set D2 ★ Independent Worksheet 1

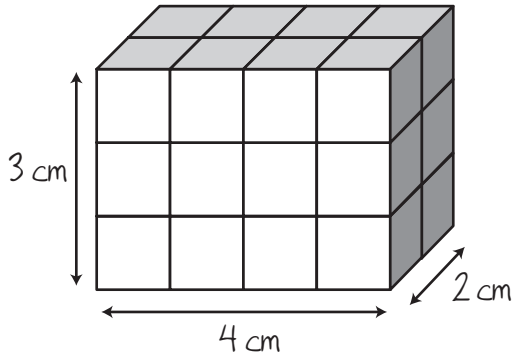
INDEPENDENT WORKSHEET

Volume Review

Volume is the measure of the space occupied by a 3-dimensional object. Volume is measured in cubes of a given size, such as cubic centimeters, cubic inches and cubic feet.

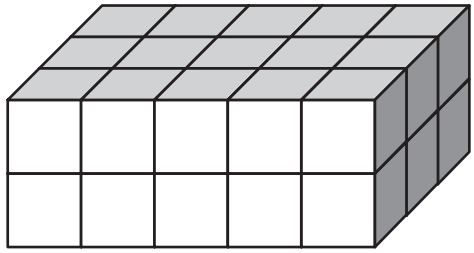
1 Each of the rectangular solids below was built with centimeter cubes. Label each with its dimensions (length, width, and height) and find the volume. Show your work.

example



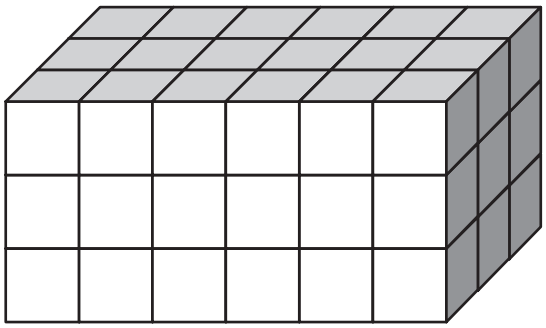
Volume $4 \times 2 \times 3 = 24$ cubic cm (or cm^3)

a



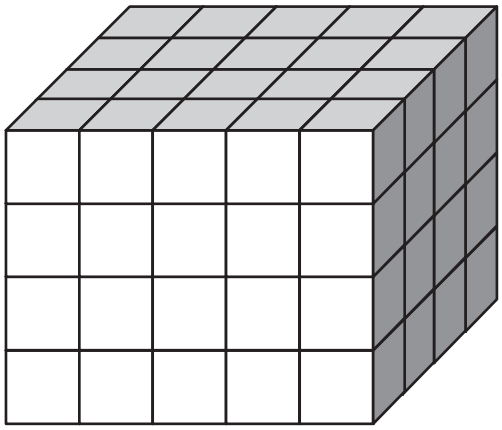
Volume

b



Volume

c



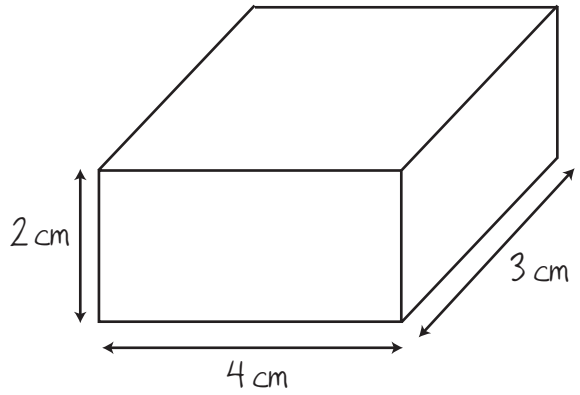
Volume

(Continued on back.)

Independent Worksheet 1 Volume Review (cont.)

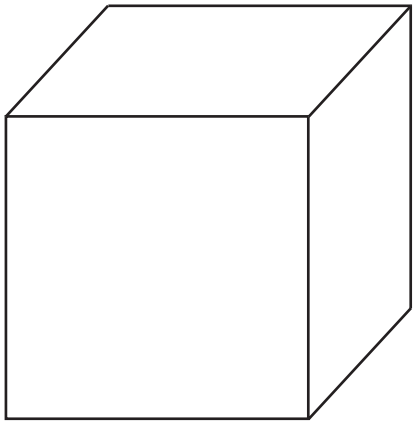
2 Use the centimeter side of your ruler to measure the dimensions of each rectangular solid below. Then find its volume. Show your work.

example



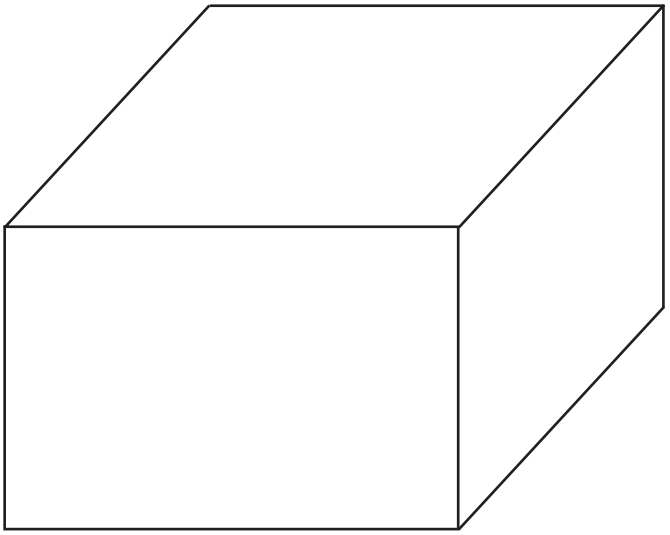
Volume $4 \times 3 \times 2 = 24$ cubic cm (or cm^3)

a



Volume

b



Volume

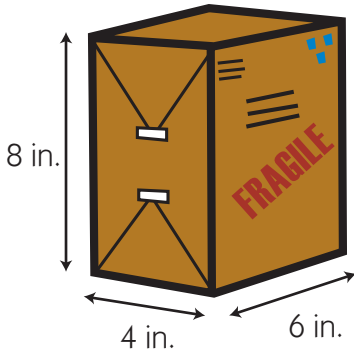
(Continued on next page.)

NAME _____ **DATE** _____

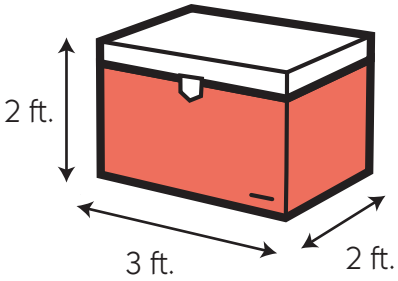
Independent Worksheet 1 Volume Review (cont.)

3 Miguel says you only need to measure one edge of a cube to find its volume. Do you agree with him? Why or why not? Use numbers, labeled sketches, and words to explain your answer.

4 Mia has already measured the dimensions of this packing box. Help her find the volume. Show your work.

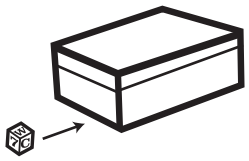


5 Brandon is going on a fishing trip with his family. He wants to find the volume of the family's ice chest. Which expression should he use?



- ○ 2×3
- ○ $3 \times 2 \times 2$
- ○ $3 + 2 + 2$
- ○ $(3 \times 2) - 2$

6 Jeff's little brother is trying to find out how many alphabet blocks will fit into a shoebox. He is measuring:



- ○ the volume of the shoebox
- ○ the area of the shoebox
- ○ the length of the shoebox

(Continued on back.)

Independent Worksheet 1 Volume Review (cont.)

7 Which of these situations is about volume?

○ determining the amount of fencing it takes to go around a square garden

○ determining how many tiles it will take to cover the kitchen floor

○ determining how many rectangular containers of food will fit into a freezer

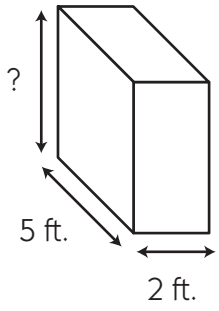
8 Vanesa wants to find the volume of her lunchbox. Which of these units should she use?

○ cubic feet

○ cubic inches

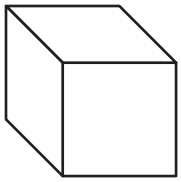
○ cubic yards

9 The volume of this rectangular solid is 40 cubic feet. What is its height? Show your work.



CHALLENGE

10 The volume of this cube is 125 cubic inches. What is the length of each edge? Show your work.



NAME _____ **DATE** _____

Set D2 ★ Independent Worksheet 2

INDEPENDENT WORKSHEET

The Camping Trip

The Gomez family is going on a camping trip next week. There are 4 people in the family: Mr. and Mrs. Gomez and the 11-year-old twins, Ramon and Dora. Help them do some planning for their trip. Circle a correct answer to each question below.

1 Mrs. Gomez wants to cut a piece of rope that's long enough to dry the family's laundry on every day. Which of these units should she use to measure the rope?

inches feet yards miles

2 Mr. Gomez wants to figure out how far they'll have to drive to get to the campsite. He already knows that it will take about a day to get there. Which of these units should he use?

inches feet yards miles

3 The shoelaces on Ramon's tennis shoes are almost worn out. He has to measure them so he gets the right length at the store. Which of these units should he use?

millimeters centimeters meters kilometers

4 Mrs. Gomez says it's going to be a 3-minute walk from their tent to the lake. Dora wants to measure the distance when they get there. Which of these units should she use?

millimeters centimeters meters kilometers

5 Ramon wants to find the area of his sleeping bag to see how much room he'll have in the family's tent. Which of these units should he use?

square inches square feet square yards square miles

Independent Worksheet 2 The Camping Trip (cont.)

6 Which formula should Ramon use to find the area of his sleeping bag?

Area = Length + Width Area = Length × Width Area = Length ÷ Width

7 Dora says when they get there, she's going to measure the area of their campsite. Mrs. Gomez says the campsite is big enough for their car, their tent, their picnic table and chairs, and their campfire, with a little room left over. Which of these units should she use?

square inches square feet square yards square miles

8 Which formula should Dora use to find the area of the campsite?

$A = (2 \times l) + (2 \times w)$ $A = (3 \times l) - (2 \times w)$ $A = l \times w$

9 Mr. Gomez wants to find the volume of the family car trunk so he'll know how much luggage will fit back there. Which of these units should he use?

cubic inches cubic feet cubic yards

10 Ramon wants to measure the volume of a shoebox to find out how many CD's he can fit into it for the trip. Which of these units should he use?

cubic inches cubic feet cubic yards

11 Dora is going to collect tiny pebbles at the lake. She wants to measure the volume of a metal band-aid box to keep them in. Which of these units should she use?

cubic centimeters cubic meters cubic kilometers

BRIDGES GRADE 5

PUBLISHER'S CORRELATIONS TO COMMON CORE STATE STANDARDS FOR MATHEMATICS, GRADE 5

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P0810

Bridges Grade 5 Correlations to Common Core State Standards

Common Core State Standards for Mathematics, Grade 5

In Grade 5, instructional time should focus on three critical areas: (1) developing fluency with addition and subtraction of fractions, anddeveloping understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions); (2) extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations; and (3) developing understanding of volume.

(1) Students apply their understanding of fractions and fraction models to represent the addition and subtraction of fractions with unlike denominators as equivalent calculations with like denominators. They develop fluency in calculating sums and differences of fractions, and make reasonable estimates of them. Students also use the meaning of fractions, of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for multiplying and dividing fractions make sense. (Note: this is limited to the case of dividing unit fractions by whole numbers and whole numbers by unit fractions.)

(2) Students develop understanding of why division procedures work based on the meaning of base-ten numerals and properties of operations. They finalize fluency with multi-digit addition, subtraction, multiplication, and division. They apply their understandings of models for decimals, decimal notation, and properties of operations to add and subtract decimals to hundredths. They develop fluency in these computations, and make reasonable estimates of their results. Students use the relationship between decimals and fractions, as well as the relationship between finite decimals and whole numbers (i.e., a finite decimal multiplied by an appropriate power of 10 is a whole number), to understand and explain why the procedures for multiplying and dividing finite decimals make sense. They compute products and quotients of decimals to hundredths efficiently and accurately.

(3) Students recognize volume as an attribute of three-dimensional space. They understand that volume can be measured by finding the total number of same-size units of volume required to fill the space without gaps or overlaps. They understand that a 1-unit by 1-unit by 1-unit cube is the standard unit for measuring volume. They select appropriate units, strategies, and tools for solving problems that involve estimating and measuring volume. They decompose three-dimensional shapes and find volumes of right rectangular prisms by viewing them as decomposed into layers of arrays of cubes. They measure necessary attributes of shapes in order to determine volumes to solve real world and mathematical problems.

Taken from the Common Core State Standards for Mathematics 2010, pages 33 & 34.

Grade 5 Overview

Operations & Algebraic Thinking
- Write and interpret numerical expressions.
- Analyze patterns and relationships.

Number & Operations in Base Ten
- Understand the place value system.
- Perform operations with multi-digit whole numbers and with decimals to hundredths.

Number & 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 & Data
- Convert like measurement units within a given measurement system.
- Represent and interpret data.
- Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.

Geometry
- Graph points on the coordinate plane to solve real-world and mathematical problems.
- Classify two-dimensional figures into categories based on their properties.

Mathematical Practices
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make us of structure.
8. Look for and express regularity in repeated reasoning.

Bridges Grade 5 Correlations to Common Core State Standards (cont.)

OPERATIONS AND ALGEBRAIC THINKING 5.OA				
Standard	**Bridges**	**Number Corner**	**Bridges Supplement**	**Assessments**
Write and interpret numerical expressions.				
1. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.	Unit 1, Sessions 13, 14 Unit 1, pp 107–109 (WP 1B) Unit 2, Sessions 2, 3, 5–9, 11, 13 Unit 4, Session 3 Unit 7, Sessions 1 & 2 Unit 7, p 972 (Challenge) Home Connections, Vol. 1 HC's 6, 7, 13, 14, 17, 18, 33, 41 Home Connections, Vol. 2 HC's 42, 47, 48, 59, 60, 61	Sept. Computational Fluency	Bridges Practice Book, pp 11, 12, 121, 122, 124	**Formal** Bridges, Vol. 1, pp 32–39, 138–144 (Unit 1 Pre & Post Assessments) Bridges, Vol. 4, pp 942–947, 1020–1024 (Unit 7 Pre & Post Assessments)
2. Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.	Unit 7, Sessions 4, 5, 7, 9, 11–13 Home Connections, Vol. 2 HC's 52, 61, 62, 63, 64		Set B1 Algebra: Diagrams & Equations, Activity 1 and Ind. Worksheets 1 & 2 Bridges Practice Book, pp 1, 31, 125, 126, 128	**Formal** Bridges, Vol. 4, pp 942–947, 1020–1024 (Unit 7 Pre & Post Assessments)
Analyze patterns and relationships.				
3. Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.	Unit 1, Sessions 5, 6, 16–18 Unit 7, Sessions 4–7, 9 Home Connections, Vol. 1 HC's 2, 8 Home Connections, Vol. 2 HC's 61–64		Bridges Practice Book, pp 6, 7, 8, 33	**Formal** Bridges, Vol. 1, pp 32–39, 138–44 (Unit 1 Pre- and Post-Assessments) Bridges, Vol. 4, pp 942–948, 1020–1024 (Unit 7 Pre- and Post-Assessments)

Bridges Grade 5 Correlations to Common Core State Standards (cont.)

NUMBER AND OPERATIONS IN BASE TEN 5.NBT				
Standard	**Bridges**	**Number Corner**	**Bridges Supplement**	**Assessments**
Understand the place value system.				
1. Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.	Unit 2, Sessions 1 & 2 Unit 6, Sessions 8–12 Unit 6, pp 887–890, 894–895 (Work Place 6C) Home Connections, Vol. 2: HC's 53, 54, 58	November Calendar Grid February Calendar Grid Mar. Computational Fluency	Set A11 Number & Operations: Multiplying Decimals, Activities 1 & 2 and Ind. Worksheets 1 & 2 Bridges Practice Book, pp 111, 112, 113, 130	**Formal** Bridges, Vol 3, pp 779–783, 902–907 (Unit 6 Pre- and Post-Assessments) Number Corner Teacher's Guide, Vol. 1, pp 57–60, 110–114 (Baseline Assessment, Checkup 1) Number Corner Teacher's Guide, Vol. 2, pp 232–236, 320–324, 400–404 (Checkups 2–4)
2a. Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10.	Unit 2, Sessions 1 & 2 Unit 4, Sessions 3–5 Unit 6, Sessions 8, 11 Home Connections, Vol. 1 HC 33	Nov. Computational Fluency Dec. Computational Fluency	Set A11 Number & Operations: Multiplying Decimals, Activities 1, 2, 4 Bridges Practice Book, pp 22, 23	
2b. Use whole-number exponents to denote powers of 10.			Set A11 Number & Operations: Multiplying Decimals, Activity 2 (Extension 3)	
3. Read, write, and compare decimals to thousandths.				
a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2 × (1/1000).	Unit 6, Sessions 8–13, 15 Unit 6, pp 894–895 (WP 6C) Home Connections, Vol. 2: HC's 53, 54, 56, 58	November Calendar Grid February Calendar Grid Mar. Computational Fluency	Bridges Practice Book, pp 111, 112, 113, 130	**Informal** Bridges Practice Book, pp 111, 112, 113, 130 **Formal** Bridges, Vol 3, pp 779–783, 902–907 (Unit 6 Pre- and Post-Assessments) Number Corner, Vol. 1 & 2, pp 57–60, 232–236, 320–324, 400–404 (Baseline, Checkups 2, 3, 4)
b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.	Unit 6, Sessions 9, 13, 16, 17 Unit 6, pp 894–895 (WP 6C) Home Connections, Vol. 2: HC's 51, 53, 54, 58	November Calendar Grid February Calendar Grid		**Formal** Bridges, Vol 3, pp 779–783, 902–907 (Unit 6 Pre- and Post-Assessments)

Bridges Grade 5 Correlations to Common Core State Standards (cont.)

NUMBER AND OPERATIONS IN BASE TEN 5.NBT				
Standard	**Bridges**	**Number Corner**	**Bridges Supplement**	**Assessments**
Understand the place value system.				
4. Use place value understanding to round decimals to any place.			Set A11 Number & Operations: Multiplying Decimals, Ind. Worksheet 1 Bridges Practice Book, p 14	Number Corner Teacher's Guide, Vol. 1, pp 110–114 (Checkup 1) Number Corner Teacher's Guid, Vol. 2, pp 232–236, 320–321 (Checkups 2, 3)
Perform operations with multi-digit whole numbers and with decimals to hundredths.				
5. Fluently multiply multi-digit whole numbers using the standard algorithm.	Unit 2, Sessions 10–12 Home Connections, Vol. 1: HC's 16, 17, 21 Home Connections, Vol. 2: HC's 49, 60, 61	Nov. Computational Fluency Dec. Computational Fluency Jan. Computational Fluency	Bridges Practice Book, pp 25, 26, 28, 29, 30, 81	**Formal** Bridges, Vol. 1, pp 195–203, 298–306 (Unit 2 Pre & Post Assessments) Number Corner, Vol. 1, pp 57–60 (Baseline) Number Corner, Vol. 2, pp 232–236, 320–324 (Checkups 2, 3)
6. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	Unit 1, Sessions 7, 8, 11, 12 Unit 2, Sessions 13–20 Unit 2, p 289 (Division Challenge Problems) Unit 4, Sessions 2, 4–10 Unit 4, pp 548-550 (WP 4B) Unit 6, Sessions 2, 10 Home Connections, Vol. 1: HC's 2–4, 19, 21, 23, 32, 34–37, 41 Home Connections, Vol. 2: HC's 42, 47–49, 52, 57, 58, 60, 61, 64	October Calendar Collector Dec. Computational Fluency Feb. Computational Fluency May Computational Fluency	Set A4 Number & Operations: Long Division, Activities 1 & 2 Set A11 Number & Operations: Multiplying Decimals, Activities 1–4 and Ind. Worksheets 1–5 Bridges Practice Book, pp 1, 5, 9, 21, 22, 30, 32, 35–39, 61, 63, 64, 66–68, 70, 79, 81–83, 85, 90, 92, 99, 100, 131	**Informal** Unit 2, Sessions 17 & 20 (Work Samples) Unit 5, Session 13 (Work Sample) Bridges Practice Book, pp 37–39, 64, 85, 91, 99, 131 **Formal** Bridges, Vol. 1, pp 195–203, 298–306 (Unit 2 Pre & Post Assessments) Bridges, Vol. 2, pp 498–504, 626–632 (Unit 4 Pre- and Post-Assessments) Number Corner, Vol. 1, pp 57–60, 110–114 (Baseline, Checkup 1) Number Corner Teacher's Guid, Vol. 2, pp 232–236, 320–324 (Checkups 2, 3)

Bridges Grade 5 Correlations to Common Core State Standards (cont.)

NUMBER AND OPERATIONS IN BASE TEN 5.NBT				
Standard	**Bridges**	**Number Corner**	**Bridges Supplement**	**Assessments**
Perform operations with multi-digit whole numbers and with decimals to hundredths.				
7a. Add and subtract decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.	Unit 6, Session 14 Unit 6, p 873 (Challenge) Home Connections, Vol. 2: HC's 55, 56, 58	Mar Computational Fluency	Set A11 Number & Operations: Multiplying Decimals, Activity 4 Bridges Practice Book, pp 112, 113, 114, 115, 116, 120, 130, 137, 138	Bridges, Vol 3, pp 779–783, 902–907 (Unit 6 Pre- and Post-Assessments) Number Corner Vol. 2, pp 320–324 (Checkup 3)
7a. Multiply and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.	Unit 2, Sessions 11, 12 Home Connections, Vol. 2: HC's 53 (Challege)	Mar Computational Fluency	Set A11 Number & Operations: Multiplying Decimals, Activities 1–4 and Ind. Worksheets 3–5 Bridges Practice Book, pp 28, 34, 38	**Formal** Bridges, Vol. 1, pp 298–306 (Unit 2 Post Assessment)

NUMBER AND OPERATIONS—FRACTIONS 5.NF				
Standard	**Bridges**	**Number Corner**	**Bridges Supplement**	**Assessments**
Use equivalent fractions as a strategy to add and subtract fractions.				
1. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example, $\frac{2}{3} + \frac{5}{4} = \frac{8}{12} + \frac{15}{12} = \frac{23}{12}$. (In general, $\frac{a}{b} + \frac{c}{d} = \frac{(ad + bc)}{bd}$.)	Unit 4, Sessions 11–16, 19, 20 Unit 4, pp 617–619 (Dozens of Eggs) Unit 6, Sessions 5–7, 14 Home Connections, Vol. 1 HC's 23, 40, 41 Home Connections, Vol. 2 HC's 51, 52, 58	November Calendar Grid Nov. Calendar Collector Mar Computational Fluency Apr Computational Fluency	Set A6 Number & Operations: Fraction Concepts, Activities 1 & 2 and Ind. Worksheets 1–3 Bridges Practice Book, pp 76–79, 80, 84, 107–110, 114, 115, 117–119, 127, 129, 133–135, 137	**Formal** Bridges, Vol. 2, pp 498–504, 626–632 (Unit 4 Pre- and Post-Assessments) Bridges, Vol 3, pp 779–783, 902–907 (Unit 6 Pre- and Post-Assessments) Number Corner Vol. 1, pp 57–68 (Baseline) Number Corner, Vol. 2, pp 320–324, 400–404 (Checkups 3 & 4)

Bridges Grade 5 Correlations to Common Core State Standards (cont.)

NUMBER AND OPERATIONS—FRACTIONS 5.NF				
Standard	**Bridges**	**Number Corner**	**Bridges Supplement**	**Assessments**
Use equivalent fractions as a strategy to add and subtract fractions.				
2. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. For example, recognize an incorrect result $\frac{2}{5} + \frac{1}{2} = \frac{3}{7}$, by observing that $\frac{3}{7} < \frac{1}{2}$.	Unit 4, Sessions 11–16, 19, 20–22 Unit 6, Sessions 5–7, 14 Unit 6, page 890 (Challenge) Unit 6, page 895 (Challenge) Home Connections, Vol. 1: HC's 23, 40, 41 Home Connections, Vol. 2: HC 51, 52, 56, 58	November Calendar Grid Nov. Calendar Collector Mar Computational Fluency Apr Computational Fluency Number Corner Student Book, page 58	Set A9 Number & Operations: Multiplying Fractions, Activity 1 Set A11 Number & Operations: Multiplying Decimals, Activity 3 Bridges Practice Book, pp 78, 80, 93, 94, 119, 133, 134, 135, 136	**Informal** Work Samples: Unit 4, Sessions 15, 16 Unit 6, Sessions 6, 14 **Formal** Bridges, Vol. 2, pp 498–504, 626–632 (Unit 4 Pre- and Post-Assessments) Bridges, Vol 3, pp 779–783, 902–907 (Unit 6 Pre- and Post-Assessments) Number Corner Teacher's Guide, pages 57–60, 320–324, 400–404 (Baseline Assessment, Checkups 3 & 4)
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.				
3. Interpret a fraction as division of the numerator by the denominator ($\frac{a}{b} = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. For example, interpret $\frac{3}{4}$ as the result of dividing 3 by 4, noting that $\frac{3}{4}$ multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size $\frac{3}{4}$. Between what two whole numbers does your answer lie?	Unit 4, p 567 (Discussing the Connection between Division and Fractions) Unit 6, Session 2 Unit 6, pp 856–857 (Challenge) Unit 6, pp 896–898 (WP 6D) Home Connections, Vol. 1 HC 37	Mar Computational Fluency		
4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.				
a. Interpret the product $(\frac{a}{b}) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$. For example, use a visual fraction model to show $(\frac{2}{3}) \times 4 = \frac{8}{3}$, and create a story context for this equation. Do the same with $(\frac{2}{3}) \times (\frac{4}{5}) = \frac{8}{15}$. (In general, $(\frac{a}{b}) \times (\frac{c}{d}) = \frac{ac}{bd}$.)	Unit 4, Sessions 13, 15, 16 Home Connections, Vol. 1 HC 36	Mar Computational Fluency April Problem Solving	Set A11 Number & Operations: Multiplying Decimals, Activities 1, 3	

Bridges Grade 5 Correlations to Common Core State Standards (cont.)

NUMBER AND OPERATIONS—FRACTIONS 5.NF				
Standard	**Bridges**	**Number Corner**	**Bridges Supplement**	**Assessments**
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.				
4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.				
b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.			Set A9 Number & Operations: Multiplying Fractions, Activities 2–4 and Ind. Worksheets 1–3 Set A11 Number & Operations: Multiplying Decimals, Activity 4	
5. Interpret multiplication as scaling (resizing) by:				
a. comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.	Unit 4, Sessions 3–5, 10 Unit 7, Sessions 8, 10, 11 Home Connections, Vol. 1 HC 33 Home Connections, Vol. 2 HC 65		Set A11 Number & Operations: Multiplying Decimals, Activities 1, 2, 4	
5. Interpret multiplication as scaling (resizing) by:				
b. explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence $\frac{a}{b} = \frac{(n \times a)}{(n \times b)}$ to the effect of multiplying $\frac{a}{b}$ by 1.	Unit 6, Sessions 3, 4, 5, 6, 7 Home Connections, Vol 2 HC's 50, 51		Set A9 Number & Operations: Multiplying Fractions, Activities 2, 3, 4 Practice Book, pp 103, 104, 106, 127, 129	
6. Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.	Unit 4, Sessions 13, 15, 16, 20 Unit 4, p 602 (Eggsplorations) Unit 6, Sessions 3, 4, 16 Unit 6, pp 892–893 (WP 6B) Home Connections, Vol. 1 HC's 36, 39, 40 Home Connections, Vol. 2 HC's 52, 57, 58	April Problem Solving	Set A9 Number & Operations: Multiplying Fractions, Activities 2, 3 and Ind. Worksheets 1, 3 Set A11 Number & Operations: Multiplying Decimals, Actvity 1	

Bridges Grade 5 Correlations to Common Core State Standards (cont.)

NUMBER AND OPERATIONS—FRACTIONS 5.NF				
Standard	**Bridges**	**Number Corner**	**Bridges Supplement**	**Assessments**
Apply and extend previous understandings of multiplication and division to multiply and divide fractions.				
7. Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (Note: Division of a fraction by a fraction is not a requirement at this grade.)				
a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. For example, create a story context for $(\frac{1}{3}) \div 4$, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that $(\frac{1}{3}) \div 4 = \frac{1}{12}$ because $(\frac{1}{12}) \times 4 = \frac{1}{3}$.	Not Yet Addressed			
b. Interpret division of a whole number by a unit fraction, and compute such quotients. For example, create a story context for $4 \div (\frac{1}{5})$, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that $4 \div (\frac{1}{5}) = 20$ because $20 \times (\frac{1}{5}) = 4$.	Not Yet Addressed			
c. Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. For example, how much chocolate will each person get if 3 people share ½lb of chocolate equally? How many ⅓-cup servings are in 2 cups of raisins?	Unit 4, Session 20 Home Connections, Vol. 1 HC 40			

Bridges Grade 5 Correlations to Common Core State Standards (cont.)

MEASUREMENT AND DATA 5.MD				
Standard	**Bridges**	**Number Corner**	**Bridges Supplement**	**Assessments**
Convert like measurement units within a given measurement system.				
1. Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.	Unit 1, Session 1 Unit 2, Sessions 1 & 2 Unit 4, Sessions 6, 9 Unit 4, p 517 (Timely Problems) Unit 4, p 553 (WP 4C) Unit 6, Session 13 Unit 7, Session 8 Home Connections, Vol. 1: HC's 11, 15, 18 Home Connections, Vol. 2: HC 62	November Calendar Collector March Calendar Grid March Calendar Collector April Problem Solving	Bridges Practice Book, pp 17, 27, 28, 54, 72, 74, 86, 91	**Formal** Number Corner Teacher's Guide, Vol. 2, pp 232–236, (Checkup 2)
Represent and interpret data.				
2. Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.	Not Yet Addressed			
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.				
3. Recognize volume as an attribute of solid figures and understand concepts of volume measurement.				
a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.	Unit 3, Session 20 Home Connections, Vol. 1: HC 31	January Calendar Grid April Calendar Grid	Set D2 Measurement: Volume, Activities 1 & 2, and Independent Worksheets 1 & 2	
b. A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.		January Calendar Grid April Calendar Grid	Set D2 Measurement: Volume, Activities 1 & 2, and Independent Worksheets 1 & 2	
4. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.		January Calendar Grid April Calendar Grid	Set D2 Measurement: Volume, Activities 1 & 2, and Independent Worksheets 1 & 2	Number Corner Teacher's Guid, Vol. 2, pp 232–236, (Checkup 2)

Bridges Grade 5 Correlations to Common Core State Standards (cont.)

MEASUREMENT AND DATA 5.MD				
Standard	**Bridges**	**Number Corner**	**Bridges Supplement**	**Assessments**
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.				
5. Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.				
a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.	Unit 3, Session 20 Home Connections, Vol. 1: HC 31	January Calendar Grid April Calendar Grid	Set D2 Measurement: Volume, Activities 1 & 2 and Ind. Worksheets 1 & 2	
b. Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.		April Calendar Grid	Set D2 Measurement: Volume, Activities 1 & 2 and Ind. Worksheets 1 & 2 Bridges Practice Book, pp 57, 59, 60, 65, 69	**Formal** Bridges, Vol. 2, pp 463–468 (Unit 3 Post-Assessment) Number Corner Teacher's Guide, pp 232–236, 400–404 (Checkups 2 and 4)
c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.		January Calendar Grid		

Bridges Grade 5 Correlations to Common Core State Standards (cont.)

GEOMETRY 5.G				
Standard	**Bridges**	**Number Corner**	**Bridges Supplement**	**Assessments**
Graph points on the coordinate plane to solve real-world and mathematical problems.				
1. Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).	Unit 1, Session 18 Unit 3, Session 17 Unit 7, Sessions 4–6 Home Connections, Vol. 1 HC's 28, 29	March Calendar Grid	Set A10 Number & Operations: Integers, Activity 3 and Independent Worksheets 2 & 3	**Formal** Bridges, Vol. 2, pp 356–361, 463–468 (Unit 3 Pre- and Post-Assessments) Number Corner, Vol. 2, pp 320–324 (Checkup 3)
2. Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.	Unit 3, Session 17	Oct. Computational Fluency March Calendar Grid	Set A10 Number & Operations: Integers, Activity 3 and Independent Worksheets 2, 3 Bridges Practice Book, pp 55, 98	
Classify two-dimensional figures into categories based on their properties.				
3. Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares arerectangles, so all squares have four right angles.	Unit 3, Sessions 1, 8, 13, 14 Unit 3, pp 432–433 (WP 3B) Home Connections, Vol. 1 HC 24	September Calendar Grid October Calendar Grid	Set C1 Geometry: Triangles & Quadrilaterals, Activities 1 & 2 and Ind. Worksheets 1–4 Bridges Practice Book, pp 41, 43, 44, 97, 140	**Informal** Bridges Practice Book, pp 41, 43, 97
4. Classify two-dimensional figures in a hierarchy based on properties.			Set C1 Geometry: Triangles & Quadrilaterals, Activities 1 & 2 and Ind. Worksheets 1–4	

Bridges in Mathematics & the Common Core State Standards (CCSS) – Grade 5

	OPERATIONS & ALG. THINKING	NUMBER /OPS. IN BASE TEN	FRACTIONS	MEASUREMENT/DATA	GEOMETRY
5	• *Numerical Expressions* • *Patterns & Relationships* Bridges Units: 1, 2, 7 Number Corner: Sep Supplemental Set: B1	• *Operations with Multi-Digit Whole Numbers & Decimals* Bridges Units: 1, 2, 4, 6 Number Corner: Oct–Feb, Mar, May Supplemental Sets: A4, A11	• *Add, Subtract, Multiply, and Divide Fractions* Bridges Units: 4, 6 Number Corner: Nov, Mar, Apr Supplemental Sets: A6, A9, A11	• *Measurement Conversions, Data, Volume* Bridges Units: 3 Number Corner: Jan, Apr Supplemental Sets: D2	• *Coordinate Grids, Classify Two-Dimensional Shapes* Bridges Units: 3, 7 Number Corner: Sep, Oct, Mar Supplemental Sets: A10, C1

Pacing Guide (165 Sessions Total)

	SEPT 21 SESSIONS	OCT–MID-NOV 21 SESSIONS	MID-NOV–DEC 26 SESSIONS	JAN–MID-FEB 23 SESSIONS	MID-FEB–MID-MAR 16 SESSIONS	MID-MAR–MID-APR 27 SESSIONS	MID-APR–MID-MAY 19 SESSIONS	MID-MAY–JUNE 12 SESSIONS
Units	**UNIT 1** **21 Sessions** Connecting Math Topics	**UNIT 2** **21 Sessions** Multi-Digit Multiplication & Division	**UNIT 3** **19 Sessions** Geometry & Measurement	**UNIT 4** **23 Sessions** Multiplication, Division & Fractions	**UNIT 5** **14 Sessions** Probability & Data Analysis	**UNIT 6** **17 S Sessions** Fractions, Decimals, & Percents	**UNIT 7** **15 Sessions** Algebraic Thinking	**UNIT 8** **12 Sessions** Spinning Tops
CCSS Supplement Sets			**SET C1:** Triangles & Quadrilaterals **4 Sessions** **6 IWS** **IWS** = Independent Worksheets to be used as homework or seatwork **SET D2:** Volume **3 Sessions**		**SET A4:** Long Division **2 Sessions**	**SET A6:** Fractions **2 Sessions** **3 IWS** **SET A9:** Multiplying Fractions **4 Sessions** **3 IWS** **SET A11:** Multiplying Decimals **4 Sessions** **4 IWS**	**SET A10:** Introducing Integers **3 Sessions** **3 IWS** **SET B1:** Diagrams & Equations **1 Sessions** **2 IWS**	

	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY/JUNE
Number Corner	Basic facts; repeating patterns; 2-D shapes; line and rotational symmetry; probability and data	Basic facts (×); factors; repeating patterns; similar figures; area; range, mode, median and mean	Multi-digit multiplication; fractions and decimals; number patterns; capacity	Rounding and estimation; multi-digit multiplication; repeating patterns; congruent figures; line and rotational symmetry; weight; and line graphs	Multi-digit multiplication; number patterns; temperature; line graphs; volume; and data analysis	Multi-digit division; fractions and decimals; patterns and functions; probability and data	Primes; composites; factors and multiples; fractions and decimals; coordinate grids; elapsed time; and line graphs	Place value; fractions; number patterns; volume and surface area	Multi-digit division; number patterns; angle measure and transformations