Kenmore-Town of Tonawanda UFSD

We educate, prepare, and inspire all students to achieve their highest potential

Grade 5 Module 5
Parent Handbook

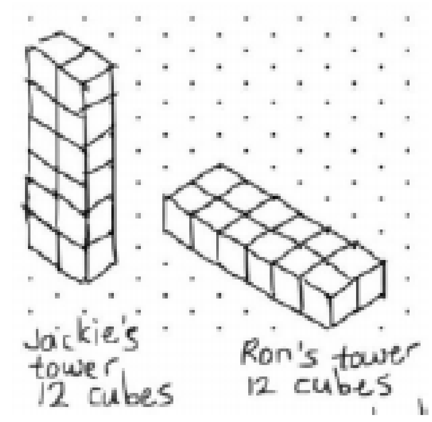
The materials contained within this packet have been taken from the Great Minds curriculum Eureka Math.

Eureka Math™ Tips for Parents

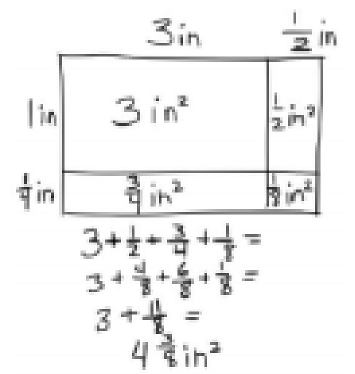
Grade 5
Module 5

Addition and Multiplication with Volume and Area

In Module 6, students begin by reasoning about and working with three-dimensional shapes. They explore cubic units and move toward calculations of volumes of rectangular prisms. Students also extend their two-dimensional work with area to figures with fractional side lengths. This module bridges the Grade 4 work on area with the Grade 6 work on volume and area to come.



Two orientations of 12 unit cubes



An area calculation for 3½ × 1¼

What Came Before this Module:

Students learned to multiply fractions and decimal fractions and began work on fraction division, working from concrete to abstract representations.

What Comes After this Module:

In Module 6, students begin to explore the coordinate plane, working from the familiar number line toward plotting points and creating lines and patterns.

New Terms in this Module:

Base: one face of a three-dimensional solid—often thought of as the surface upon which the solid rests

Bisect: divide into two equal parts

Cubic units: cubes of the same size used for measuring

Height: adjacent layers of the base that form a rectangular prism

Hierarchy: series of ordered groupings of shapes

Unit cube: cube whose sides all measure 1 unit

Volume of a solid: measurement of space or capacity

Unit Cubes

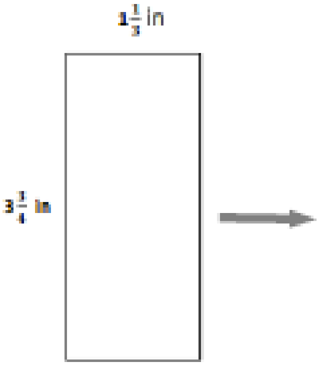
How You Can Help at Home:

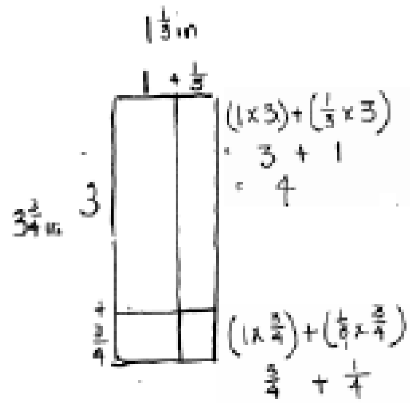
- Begin to discuss and notice the volume of various household containers—this is also a good opportunity to talk about what units are often used to measure volume.
- Keep practicing those multiplication and division facts, especially as problems become more complex.

Key Common Core Standards:

- *Apply and extend previous understanding of multiplication and division to multiply and divide fractions.*
  - Multiply a fraction or whole number by a fraction.
  - Solve real world problems involving multiplication of fractions and mixed numbers.
- *Geometric measurement: understand concepts of volume and relate volume to multiplication and addition.*
  - Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
  - Measure volumes by counting unit cubes of various units.
  - Relate volume to the operations of multiplication and addition.
- *Classify two-dimensional figures into categories based on their properties.*
  - Understand that attributes belonging to a category of figures also belong to all subcategories of that category.

Prepared by Erin Schweng, Math Coach





$= 1$

$4 + 1 = 5$

$A = 5$ square inches

Note that in the area problem above, the numbers are first decomposed and drawn as whole number and fractional parts, and then they are multiplied: 1 × 3, 1/3 × 3, 1 × 3/4, 1/3 × 3/4. Each of these products is then added together to find the total area of the rectangle.

Spotlight on Math Models:

Area Model with Fractional Parts

We will revisit this mathematical representation in Module 5 of *A Story of Units*.

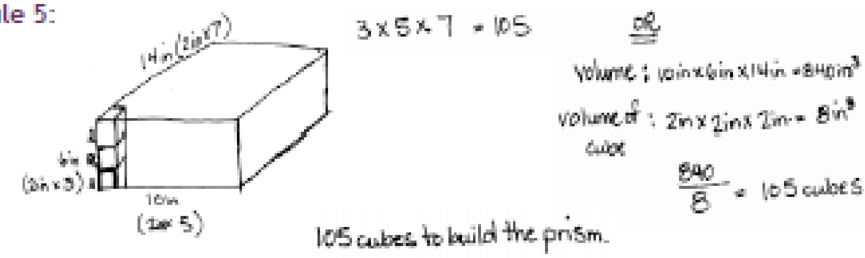
A Story of Units has several key mathematical "models" that will be used throughout a student's elementary years.

Earlier in Grade 5, we moved beyond using the area model for multiplication of whole numbers and begin to use this powerful model to illustrate mathematical operations on fractions. Now, we move a step further and use the area model in various real world problems, e.g., finding the area of a wall minus the space for two windows, or finding the area of a mat surrounding a picture in a frame.

The numbers we use in our area models now are often mixed whole numbers and fractions, giving students a chance to demonstrate their understanding in diagrams in which they show the multiplication of both the whole number and fractional parts of the problem.

Sample Volume Problem from Module 5:
(Example taken from Module 5, Lesson 18)

How many 2-inch cubes are needed to build a rectangular prism that measures 10 inches by 6 inches by 14 inches?



Note that the student here shows two ways to solve the problem!

Grade 5 • Module 5

Addition and Multiplication with Volume and Area

OVERVIEW

In this 25-day module, students work with two- and three-dimensional figures. Volume is introduced to students through concrete exploration of cubic units and culminates with the development of the volume formula for right rectangular prisms. The second half of the module turns to extending students' understanding of two-dimensional figures. Students combine prior knowledge of area with newly acquired knowledge of fraction multiplication to determine the area of rectangular figures with fractional side lengths. They then engage in hands-on construction of two-dimensional shapes, developing a foundation for classifying the shapes by reasoning about their attributes. This module fills a gap between Grade 4's work with two-dimensional figures and Grade 6's work with volume and area.

In Topic A, students extend their spatial structuring to three dimensions through an exploration of volume. Students come to see volume as an attribute of solid figures and understand that cubic units are used to measure it (**5.MD.3**). Using improvised, customary, and metric units, they build three-dimensional shapes, including right rectangular prisms, and count units to find the volume (**5.MD.4**). By developing a systematic approach to counting the unit cubes, students make connections between area and volume. They partition a rectangular prism into layers of unit cubes and reason that the number of unit cubes in a single layer corresponds to the number of unit squares on a face. They begin to conceptualize the layers themselves, oriented in any one of three directions, as iterated units. This understanding allows students to reason about containers formed by box templates and nets, reasonably predict the number of cubes required to fill them, and test their predictions by packing the containers.

Concrete understanding of volume and multiplicative reasoning (**5.MD.3**) come together in Topic B as the systematic counting from Topic A leads naturally to formulas for finding the volume of a right rectangular prism (**5.MD.5**). Students solidify the connection between volume as *packing* and volume as *filling* by comparing the amount of liquid that fills a container to the number of cubes that can be packed into it. This connection is formalized as students see that 1 cubic centimeter is equal to 1 milliliter. Complexity increases as students use their knowledge that volume is additive to partition and calculate the total volume of solid figures composed of non-overlapping, rectangular prisms. Word problems involving the volume of rectangular prisms with whole number edge lengths solidify understanding and give students the opportunity to reason about scaling in the context of volume. Topic B concludes with a design project that gives students the opportunity to apply the concepts and formulas they have learned throughout Topics A and B to create a sculpture of a specified volume composed of varied rectangular prisms with parameters given in the project description.

In Topic C, students extend their understanding of area as they use rulers and set squares to construct and measure rectangles with fractional side lengths and find their areas. Students apply their extensive knowledge of fraction multiplication to interpret areas of rectangles with fractional side lengths (**5.NF.4b**) and solve real world problems involving these figures (**5.NF.6**), including reasoning about scaling through contexts in which volumes are compared. Visual models and equations are used to represent the problems through the Read-Draw-Write (RDW) protocol.

In Topic D, students draw two-dimensional shapes to analyze their attributes and use those attributes to classify them. Familiar figures, such as parallelograms, rhombuses, squares, trapezoids, etc., have all been defined in earlier grades and, in Grade 4, students have gained an understanding of shapes beyond the intuitive level. Grade 5 extends this understanding through an in-depth analysis of the properties and defining attributes of quadrilaterals. Grade 4's work with the protractor is applied to construct various quadrilaterals. Using measurement tools illuminates the attributes used to define and recognize each quadrilateral (**5.G.3**). Students see, for example, that the same process they used to construct a parallelogram will also produce a rectangle when all angles are constructed to measure 90°. Students then analyze defining attributes and create a hierarchical classification of quadrilaterals (**5.G.4**).

Terminology

New or Recently Introduced Terms

- Base (one face of a three-dimensional solid—often thought of as the surface on which the solid rests)
- Bisect (divide into two equal parts)
- Cubic units (cubes of the same size used for measuring volume)
- Height (adjacent layers of the base that form a rectangular prism)
- Hierarchy (series of ordered groupings of shapes)
- Unit cube (cube whose sides all measure 1 unit; cubes of the same size used for measuring volume)
- Volume of a solid (measurement of space or capacity)

Familiar Terms and Symbols

- Angle (the union of two different rays sharing a common vertex)
- Area (the number of square units that covers a two-dimensional shape)
- Attribute (given quality or characteristic)
- Cube (three-dimensional figure with six square sides)
- Degree measure of an angle (subdivide the length around a circle into 360 arcs of equal length; a central angle for any of these arcs is called a *one-degree angle* and is said to have angle measure of 1 degree)
- Face (any flat surface of a three-dimensional figure)
- Kite (quadrilateral with two pairs of two equal sides that are also adjacent; a kite can be a rhombus if all sides are equal)
- Parallel lines (two lines in a plane that do not intersect)
- Parallelogram (four-sided closed figure with opposite sides that are parallel and equal)
- Perpendicular (two lines are *perpendicular* if they intersect, and any of the angles formed between the lines are 90° angles)
- Perpendicular bisector (line that cuts a line segment into two equal parts at 90°)
- Plane (flat surface that extends infinitely in all directions)
- Polygon (closed figure made up of line segments)
- Quadrilateral (closed figure with four sides)
- Rectangle (parallelogram with four 90° angles)
- Rectangular prism (three-dimensional figure with six rectangular sides)
- Rhombus (parallelogram with four equal sides)
- Right angle (angle formed by perpendicular lines; angle measuring 90°)
- Right rectangular prism (rectangular prism with only 90° angles)
- Solid figure (three-dimensional figure)
- Square units (squares of the same size—used for measuring)
- Three-dimensional figures (solid figures)
- Trapezoid (quadrilateral with at least one pair of parallel sides)
- Two-dimensional figures (figures on a plane)

Suggested Tools and Representations

- Area model
- Centimeter cubes
- Centimeter grid paper
- Isometric dot paper
- Patty paper (measuring 5.5 in. × 5.5 in.)
- Protractor
- Ruler
- Set square or right angle template
- Tape diagram

Grade 5 Module 5 Topic A

Concepts of Volume

Focus Standards:

5.MD.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.
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.

5.MD.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

Instructional Days Recommended: 3

In Topic A, students extend their spatial structuring to three dimensions through an exploration of volume. They come to see volume as an attribute of solid figures and understand that cubic units are used to measure it (**5.MD.3**). Using unit cubes, both customary and metric, students build three-dimensional shapes, including right rectangular prisms, and count to find the volume (**5.MD.4**). By developing a systematic approach to counting the unit cubes, they make connections between area and volume.

Next, students pack rectangular prisms made from nets with centimeter cubes. This helps them visualize the layers of cubic units that compose volumes—an understanding that allows them to reasonably predict the number of cubes required to fill the containers and then test their predictions by packing the containers. Finally, students compose and decompose a rectangular prism from and into layers of unit cubes and reason that the number of unit cubes in a single layer corresponds to the number of unit squares on a face. They begin to conceptualize the layers themselves, oriented in any one of three directions, as iterated units.

**The sample homework responses contained in this manual are intended to provide insight into the skills expected of students and instructional strategies used in Eureka Math.*

Lesson 1

Objective: Explore volume by building with and counting unit cubes.

Homework Key

1. Explanations will vary
   a. 2 cm^3
   b. 4 cm^3
   c. 6 cm^3
   d. 6 cm^3
   e. 12 cm^3
   f. 16 cm^3
2. Answers will vary.
3. A cube is hidden under the second layer, explanations will vary.
4. Answers will vary.

Homework Sample

1. The following solids are made up of 1 cm cubes. Find the total volume of each figure, and write it in the chart below.

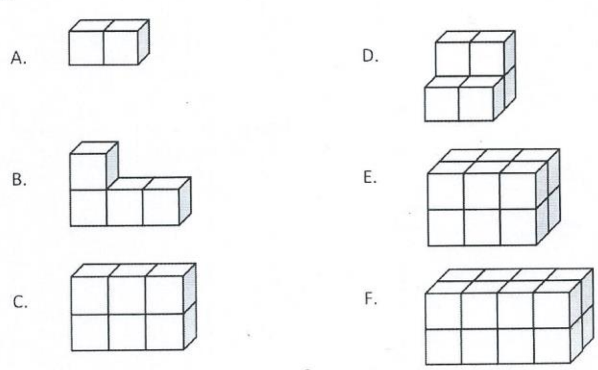


Figure	Volume	Explanation
A	2 cm^3	I counted 2 cubes.
B	4 cm^3	I counted 3 cubes and 1 more.
C	6 cm^3	I counted 2 rows of 3 cubes.
D	6 cm^3	I counted the front layer of 2 and knew there were 2 cubes behind that and 2 cubes above that.
E	12 cm^3	I counted 2 rows of 3 and doubled it. 6x2=12
F	16 cm^3	I counted 8 and doubled it. 8x2=16

Lesson 2

Objective: Find the volume of a right rectangular prism by packing with cubic units and counting.

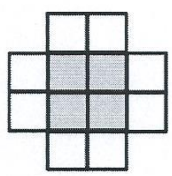
Homework Key

1. Explanations will vary.
   - a. 4
   - b. 12
   - c. 24
2. Explanations will vary.
   - a. 6
   - b. 12
   - c. 32
3. Answers will vary.

Homework Sample

1. Make the following boxes on centimeter grid paper. Cut and fold each to make 3 open boxes, taping them so they hold their shapes. How many cubes would fill each box? Explain how you found the number.

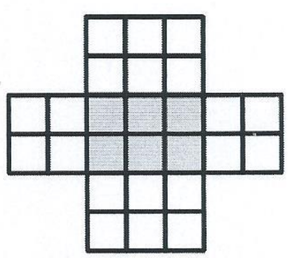
a.



Number of cubes: 4

2 wide, 2 long and 1 high = 4 cubes

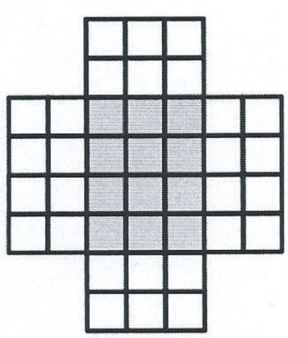
b.



Number of cubes: 12

3 across, 2 deep and 2 high = 12 cubes

c.



Number of cubes: 24

3 across, 4 deep and 2 high = 24

Lesson 3

Objective: Compose and decompose right rectangular prisms using layers.

Homework Key

1. Answers will vary.
2. Explanations will vary.
3. 48 in^3; 80 in^3; 112 in^3; explanations will vary.
4. 3; 8; 24 m^3

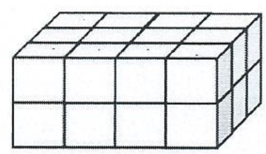
Homework Sample

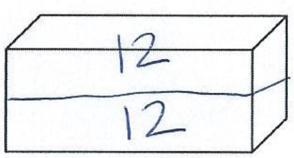
1. Use the prisms to find the volume.

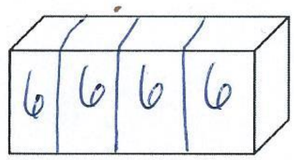
- The rectangular prisms pictured below were constructed with 1 cm cubes.
- Decompose each prism into layers in three different ways, and show your thinking on the blank prisms.
- Complete each table.

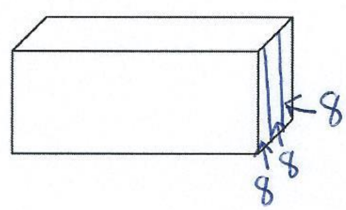
a.

Number of Layers	Number of Cubes in Each Layer	Volume of the Prism
2	12	24 cubic cm
4	6	24 cubic cm
3	8	24 cubic cm









Grade 5 Module 5 Topic B

Volume and the Operations of Multiplication and Addition

Focus Standards:

5.MD.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.

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.

5.MD.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.

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.

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.

Instructional Days Recommended: 6

Concrete understanding of volume and multiplicative reasoning (**5.MD.3**) come together in Topic B as the systematic counting from Topic A leads naturally to formulas for finding the volume of a right rectangular prism (**5.MD.5**). Students come to see that multiplying the edge lengths or multiplying the height by the area of the base yields an equivalent volume to that found by packing and counting unit cubes.

Next, students solidify the connection of volume as *packing* with volume as *filling* by comparing the amount of liquid that fills a container to the number of cubes that can be packed into it. This connection is formalized as students see that 1 cubic centimeter is equal to 1 milliliter. Complexity increases as students use their knowledge that volume is additive to partition and calculate the total volume of solid figures composed of non-overlapping rectangular prisms.

Word problems involving the volume of rectangular prisms with whole number edge lengths solidify understanding and give students the opportunity to reason about scaling in the context of volume. This topic concludes with a design project that allows students to apply the concepts and formulas they have learned throughout Topics A and B to create a sculpture of a specified volume composed of varied rectangular prisms with parameters stipulated in the project description.

**The sample homework responses contained in this manual are intended to provide insight into the skills expected of students and instructional strategies used in Eureka Math.*

Lesson 4

Objective: Use multiplication to calculate volume.

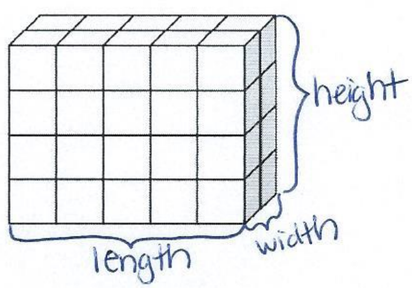
Homework Key

1. a. 5; 2; 4; 40
   b. 3; 2; 5; 30
   c. 4; 2; 4; 32
   d. 8; 3; 3; 72
2. a. 5 cm × 2 cm × 4 cm = 40 cm3 (or variant)
   b. 3 cm × 2 cm × 5 cm = 30 cm3 (or variant)
   c. 4 cm × 2 cm × 4 cm = 32 cm3 (or variant)
   d. 8 cm × 3 cm × 3 cm = 72 cm3 (or variant)
3. a. 8 in × 4 in × 8 in = 256 cubic in
   b. 10 m × 3 m × 7 m = 210 cubic m
4. 20,160 cubic in
5. a. 224 cubic m
   b. 2,366 cubic in

Homework Sample

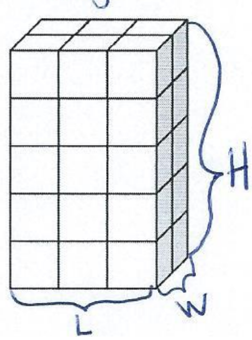
1. Each rectangular prism is built from centimeter cubes. State the dimensions, and find the volume.

a.



Length: 5 cm
Width: 2 cm
Height: 4 cm
Volume: 40 cm^3

b.



Length: 3 cm
Width: 2 cm
Height: 5 cm
Volume: 30 cm^3

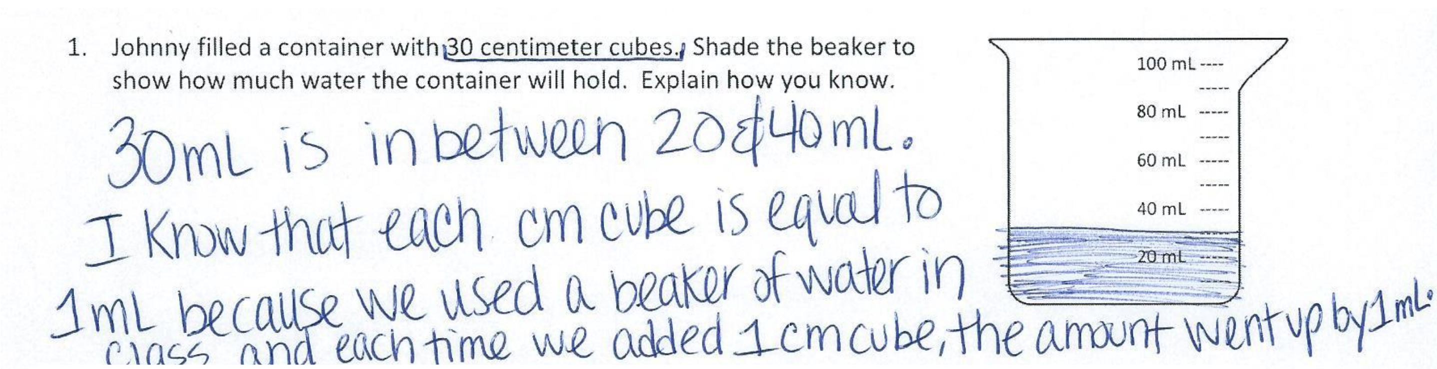
Lesson 5

Objective: Use multiplication to connect volume as *packing* with volume as *filling.*

Homework Key

1. Beaker shaded to line between 20 mL and 40 mL; explanations will vary.
2. A; C; explanations will vary.
3. Answers will vary.

Homework Sample


1. Johnny filled a container with 30 centimeter cubes. Shade the beaker to show how much water the container will hold. Explain how you know.

30mL is in between 20&40mL. I Know that each cm cube is equal to 1mL because we used a beaker of water in class and each time we added 1cm cube, the amount went up by 1mL.

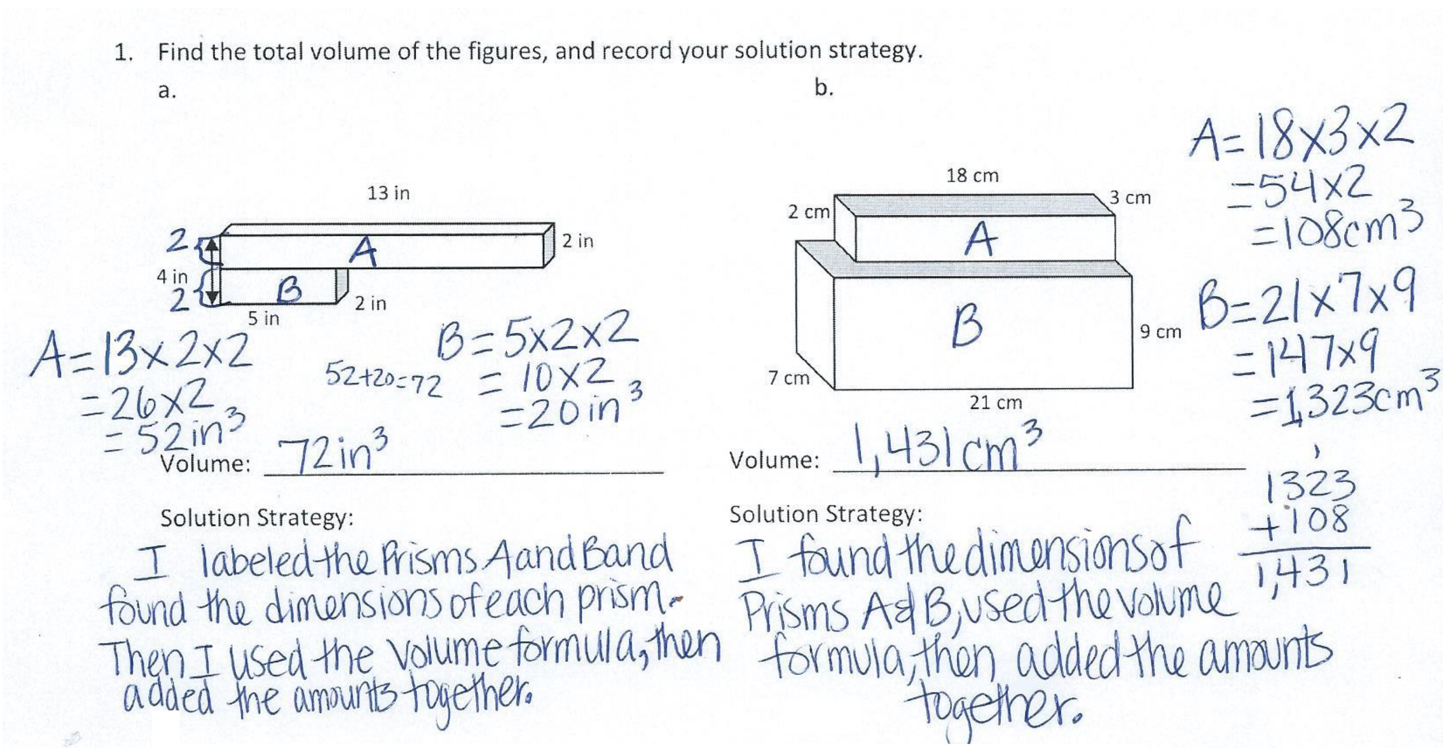
Lesson 6

Objective: Find the total volume of solid figures composed of two non-overlapping rectangular prisms.

Homework Key

1. a. 72 cubic in; strategies will vary.
   b. 1,431 cubic cm; strategies will vary.
   c. 249 cubic mm; strategies will vary.
   d. 472 cubic m; strategies will vary.
2. 1,254 cubic in
3. 5 cm
4. 585 cubic cm or 585 mL
5. A: 74 cubic ft; B and C: 222 cubic ft

Homework Sample



1. Find the total volume of the figures, and record your solution strategy.

a.

$A = 13 \times 2 \times 2$
$= 26 \times 2$
$= 52 in^3$

$52 + 20 = 72$

$B = 5 \times 2 \times 2$
$= 10 \times 2$
$= 20 in^3$

Volume: $72 in^3$

Solution Strategy:
I labeled the Prisms A and B and found the dimensions of each prism. Then I used the volume formula, then added the amounts together.

b.

$A = 18 \times 3 \times 2$
$= 54 \times 2$
$= 108 cm^3$

$B = 21 \times 7 \times 9$
$= 147 \times 9$
$= 1,323 cm^3$

Volume: $1,431 cm^3$

$1,323 + 108 = 1,431$

Solution Strategy:
I found the dimensions of Prisms A & B, used the volume formula, then added the amounts together.

Lesson 7

Objective: Solve word problems involving the volume of rectangular prisms with whole number edge lengths.

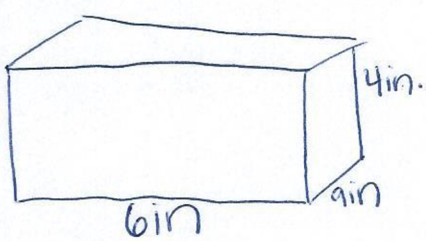
Homework Key

1. 216 cubic in; diagrams will vary.
2. Three different diagrams drawn
3. Answers will vary.
4. a. No; explanations will vary.
   b. Answers will vary.
   c. Answers will vary.
   d. Answers and explanations will vary.

Homework Sample

Wren makes some rectangular display boxes.

1. Wren's first display box is 6 inches long, 9 inches wide, and 4 inches high. What is the volume of the display box? Explain your work using a diagram.



$V = l \times w \times h$
$= 6in. \times 9in. \times 4in.$
$= 54 \times 4$
$= 216\ inches^3$

Lesson 8 - 9

Objective: Apply concepts and formulas of volume to design a sculpture using rectangular prisms within given parameters.

Homework Key (8)

1. 1,080 cm^3; answers will vary.
2. Answers will vary.

Homework Sample

1. I have a prism with the dimensions of 6 cm by 12 cm by 15 cm. Calculate the volume of the prism, and then give the dimensions of three different prisms that each have $\frac{1}{3}$ of the volume.

$V = l \times w \times h$
$= 6 \times 12 \times 15$
$= 1{,}080\ cm^3$
$1{,}080 \div 3 = 360$

	Length	Width	Height	Volume
Original Prism	6 cm	12 cm	15 cm	1,080 cm^3
Prism 1	36	10	1	360 cm^3
Prism 2	6	6	10	360 cm^3
Prism 3	9	4	10	360 cm^3

Lesson 9

Homework Key

Answers will vary.

Homework Sample

1. Find three rectangular prisms around your house. Describe the item you are measuring (cereal box, tissue box, etc.), and then measure each dimension to the nearest whole inch, and calculate the volume.

   a. Rectangular Prism A

   Item: Kleenex Box

   Height: 5 inches

   Length: $4\frac{1}{2}$ inches

   Width: $4\frac{1}{2}$ inches

   Volume: $101\frac{1}{4}$ cubic inches

$$4\tfrac{1}{2} \times 4\tfrac{1}{2} = 20\tfrac{1}{4}$$

$$20\tfrac{1}{4} \times 5 = 101\tfrac{1}{4}$$

Grade 5 Module 5 Topic C

Area of Rectangular Figures with Fractional Side Lengths

Focus Standards:

5.NF.4b Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

c. 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.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.

Instructional Days Recommended: 6

In Topic C, students extend their understanding of area as they use rulers and right angle templates to construct and measure rectangles with fractional side lengths and find their areas. They apply their extensive knowledge of fraction multiplication to interpret areas of rectangles with fractional side lengths (**5.NF.4b**) and solve real world problems involving these figures (**5.NF.6**), including reasoning about scaling through contexts in which areas are compared. Visual models and equations are used to represent the problems through the Read-Draw-Write (RDW) protocol.

**The sample homework responses contained in this manual are intended to provide insight into the skills expected of students and instructional strategies used in Eureka Math.*

Lesson 10

Objective: Find the area of rectangles with whole-by-mixed and whole-by-fractional number side lengths by tiling, record by drawing, and relate to fraction multiplication.

Homework Key

1. a. $7\frac{1}{2}$

   b. 4; $2\frac{1}{4}$; 9

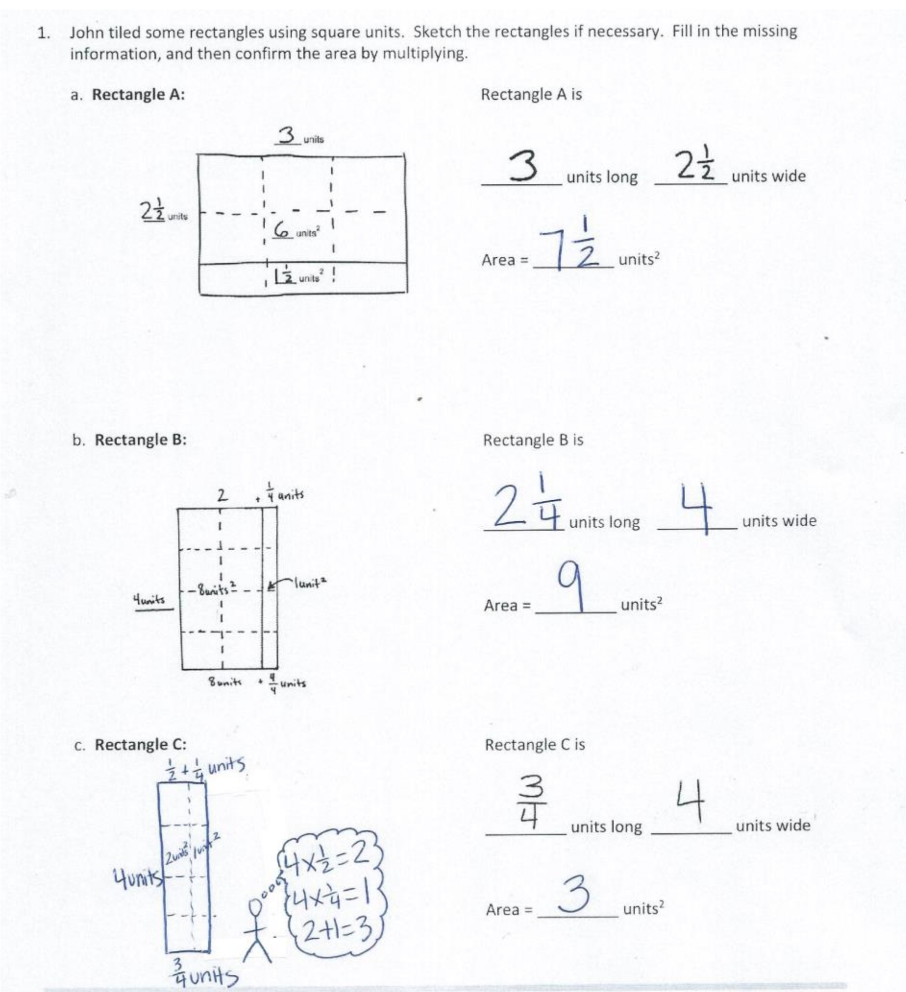
   c. Rectangle $\frac{3}{4}$ units by 4 units is drawn and tiled; 3

   Rectangle 2 units by $1\frac{3}{4}$ units is drawn and tiled; $3\frac{1}{2}$

2. $109\frac{1}{2}$ in^2

3. $42\frac{3}{4}$ ft^2

Homework Sample



1. John tiled some rectangles using square units. Sketch the rectangles if necessary. Fill in the missing information, and then confirm the area by multiplying.

a. **Rectangle A:**

Rectangle A is

3 units long $2\frac{1}{2}$ units wide

Area = $7\frac{1}{2}$ units^2

b. **Rectangle B:**

Rectangle B is

$2\frac{1}{4}$ units long 4 units wide

Area = 9 units^2

c. **Rectangle C:**

Rectangle C is

$\frac{3}{4}$ units long 4 units wide

Area = 3 units^2

Lesson 11

Objective: Find the area of rectangles with mixed-by-mixed and fraction-by-fraction side lengths by tiling, record by drawing, and relate to fraction multiplication.

Homework Key

1. a. $2\frac{3}{4}$; $1\frac{1}{2}$; $4\frac{1}{8}$

   b. Rectangle $2\frac{1}{2}$ by $\frac{3}{4}$ units drawn and tiled; $1\frac{7}{8}$

   c. Rectangle $3\frac{1}{3}$ by $2\frac{1}{2}$ units drawn and tiled; $8\frac{1}{3}$

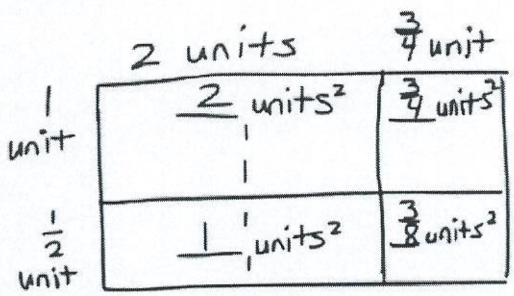
   d. Rectangle $3\frac{1}{2}$ by $2\frac{1}{4}$ units drawn and tiled; $7\frac{7}{8}$

2. $39\frac{1}{16}$ in^2

Homework Sample

1. Kristen tiled the following rectangles using square units. Sketch the rectangles, and find the areas. Then, confirm the area by multiplying. Rectangle A has been sketched for you.

   a. **Rectangle A:**



Rectangle A is $2\frac{3}{4}$ units long × $1\frac{1}{2}$ units wide

Area = $4\frac{1}{8}$ units^2

$$A = 2 + 1 + \frac{3}{4} + \frac{3}{8}$$
$$= 3 + \frac{6}{8} + \frac{3}{8}$$
$$= 3 + \frac{9}{8} = 4\frac{1}{8}$$

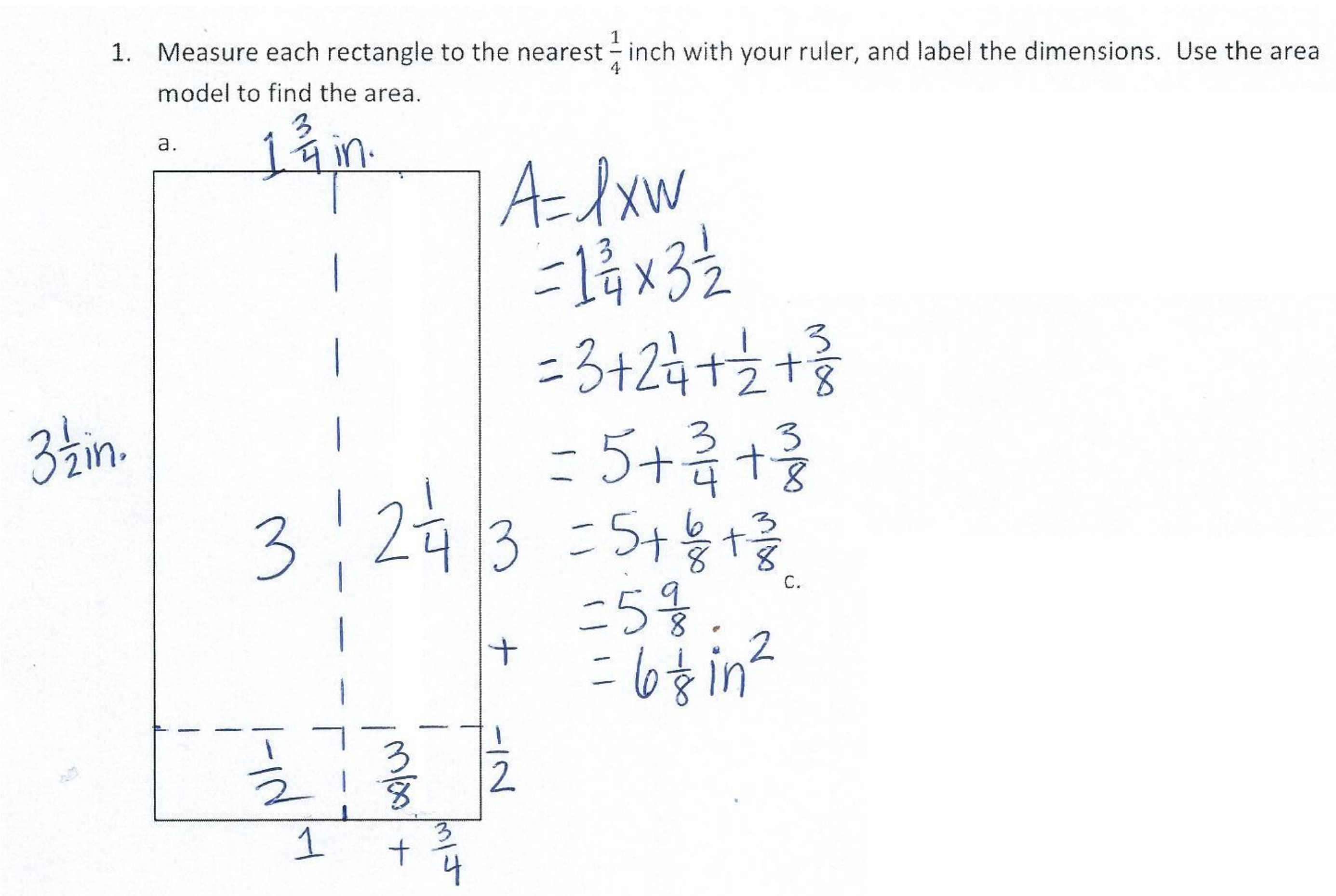
Lesson 12

Objective: Measure to find the area of rectangles with fractional side lengths.

Homework Key

1. a. Rectangle labeled; $6\frac{1}{8}$ in²
   b. Rectangle labeled; $1\frac{11}{16}$ in²
   c. Rectangle labeled; $5\frac{1}{16}$ in²
   d. Rectangle labeled; $4\frac{1}{8}$ in²
   e. Rectangle labeled; $\frac{7}{8}$ in²
2. a. Area model drawn; $\frac{9}{16}$ yd²
   b. Area model drawn; $3\frac{1}{8}$ ft²
3. No; answers will vary.
4. a. $6\frac{1}{4}$ ft²
   b. 266 ft²

Homework Sample



1. Measure each rectangle to the nearest $\frac{1}{4}$ inch with your ruler, and label the dimensions. Use the area model to find the area.

a.

Lesson 13

Objective: Multiply mixed number factors, and relate to the distributive property and the area model.

Homework Key

1. a. 16 cm^2

   b. $21\frac{3}{5}\text{ ft}^2$

   c. $26\frac{1}{15}\text{ in}^2$

   d. $4\frac{5}{7}\text{ m}^2$

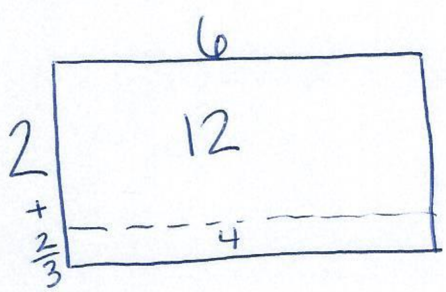
2. $77\frac{11}{32}\text{ in}^2$

3. $374\frac{21}{80}\text{ ft}^2$

Homework Sample

1. Find the area of the following rectangles. Draw an area model if it helps you.

   a. $\frac{8}{3}\text{ cm} \times \frac{24}{4}\text{ cm}$



$A = l \times w$
$= 2\frac{2}{3} \times 6$
$= 12 + 4$
$= 16\text{cm}^2$

Lesson 14 - 15

Objective: Solve real world problems involving area of figures with fractional side lengths using visual models and/or equations.

Homework Key (14)

1. 180 ft^2

   $161\frac{2}{3} \text{ ft}^2$

2. $307\frac{1}{16} \text{ in}^2$

3. $383\frac{9}{10} \text{ ft}^2$

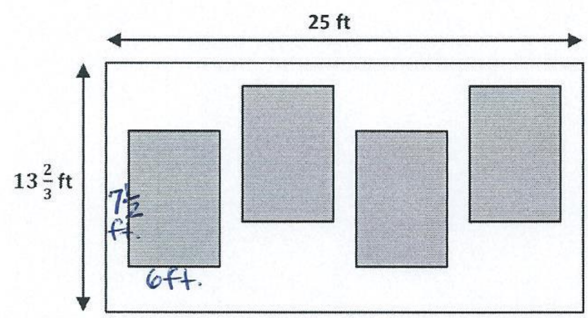
4. $2{,}075\frac{7}{10} \text{ ft}^2$

   5 bags for the highest setting;

   7 bags for the lowest

Homework Sample

1. Mr. Albano wants to paint menus on the wall of his café in chalkboard paint. The gray area below shows where the rectangular menus will be. Each menu will measure 6-ft wide and $7\frac{1}{2}$-ft tall.



- How many square feet of menu space will Mr. Albano have? 4 menu areas

$A = l \times w$
$= 7\frac{1}{2} \times 6$
$= 42 + 3$
$= 45 \text{ ft}^2$

$45 \text{ ft}^2 \times 4$
180 ft^2

$45 \times 4 = 180$

Mr. Albano will have 180 ft^2 of menu space.

- What is the area of wall space that is not covered by chalkboard paint?

$A = 13\frac{2}{3} \times 25$
$= (13 \times 25) + (\frac{2}{3} \times 25)$
$= 325 + 16\frac{2}{3}$
$= 341\frac{2}{3} \text{ ft}^2$

$341\frac{2}{3} - 180$
$161\frac{2}{3} \text{ ft}^2$

$341\frac{2}{3} - 180 = 161\frac{2}{3}$

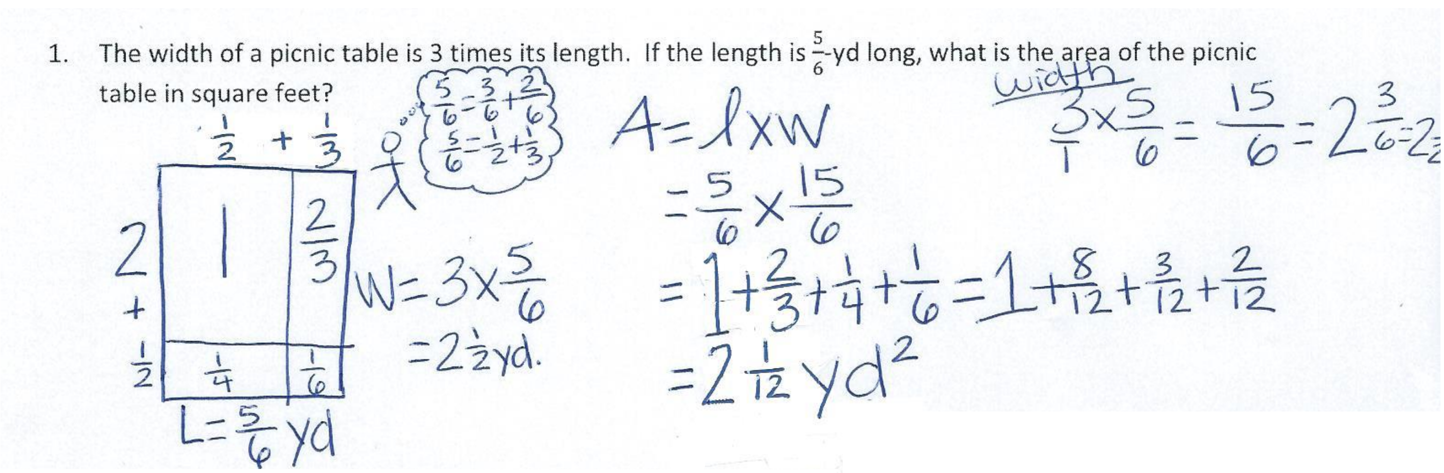
The area of wall space not covered by chalkboard paint is $161\frac{2}{3} \text{ ft}^2$.

Lesson 15

Homework Key

1. $18\frac{3}{4}$ ft^2
2. $1{,}642\frac{9}{16}$ ft^2
3. $375\frac{3}{4}$ in^2

Homework Sample



1. The width of a picnic table is 3 times its length. If the length is $\frac{5}{6}$-yd long, what is the area of the picnic table in square feet?

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

$\frac{5}{6} = \frac{3}{6} + \frac{2}{6}$

$\frac{5}{6} = \frac{1}{2} + \frac{1}{3}$

$2 + \frac{1}{2}$

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

$\frac{1}{4} \quad \frac{1}{6}$

$L = \frac{5}{6}$ yd

$W = 3 \times \frac{5}{6}$

$= 2\frac{1}{2}$ yd.

$A = l \times w$

$= \frac{5}{6} \times \frac{15}{6}$

$= 1 + \frac{2}{3} + \frac{1}{4} + \frac{1}{6} = 1 + \frac{8}{12} + \frac{3}{12} + \frac{2}{12}$

$= 2\frac{1}{12}$ yd^2

width

$\frac{3}{1} \times \frac{5}{6} = \frac{15}{6} = 2\frac{3}{6} = 2\frac{1}{2}$

Grade 5 Module 5 Topic D

Drawing, Analysis, and Classification of Two-Dimensional Shapes

Focus Standards:

5.G.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 are rectangles, so all squares have four right angles.*
5.G.4	Classify two-dimensional figures in a hierarchy based on properties.

Instructional Days Recommended: 6

In Topic D, students draw two-dimensional shapes to analyze their attributes, and then use those attributes to classify them. Familiar figures, such as parallelograms, rhombuses, squares, and trapezoids, were defined in earlier grades; by Grade 4, students gained an understanding of shapes beyond the intuitive level. Grade 5 extends this understanding through an in-depth analysis of the properties and defining attributes of quadrilaterals.

Grade 4's work with the protractor is applied in this topic to construct various quadrilaterals. Using measurement tools illuminates the attributes used to define and recognize each quadrilateral (**5.G.3**). Students see, for example, that the same process they used to construct a parallelogram will also produce a rectangle when all angles are constructed to measure 90°. Students then analyze defining attributes and create a hierarchical classification of quadrilaterals (**5.G.4**).

**The sample homework responses contained in this manual are intended to provide insight into the skills expected of students and instructional strategies used in Eureka Math.*

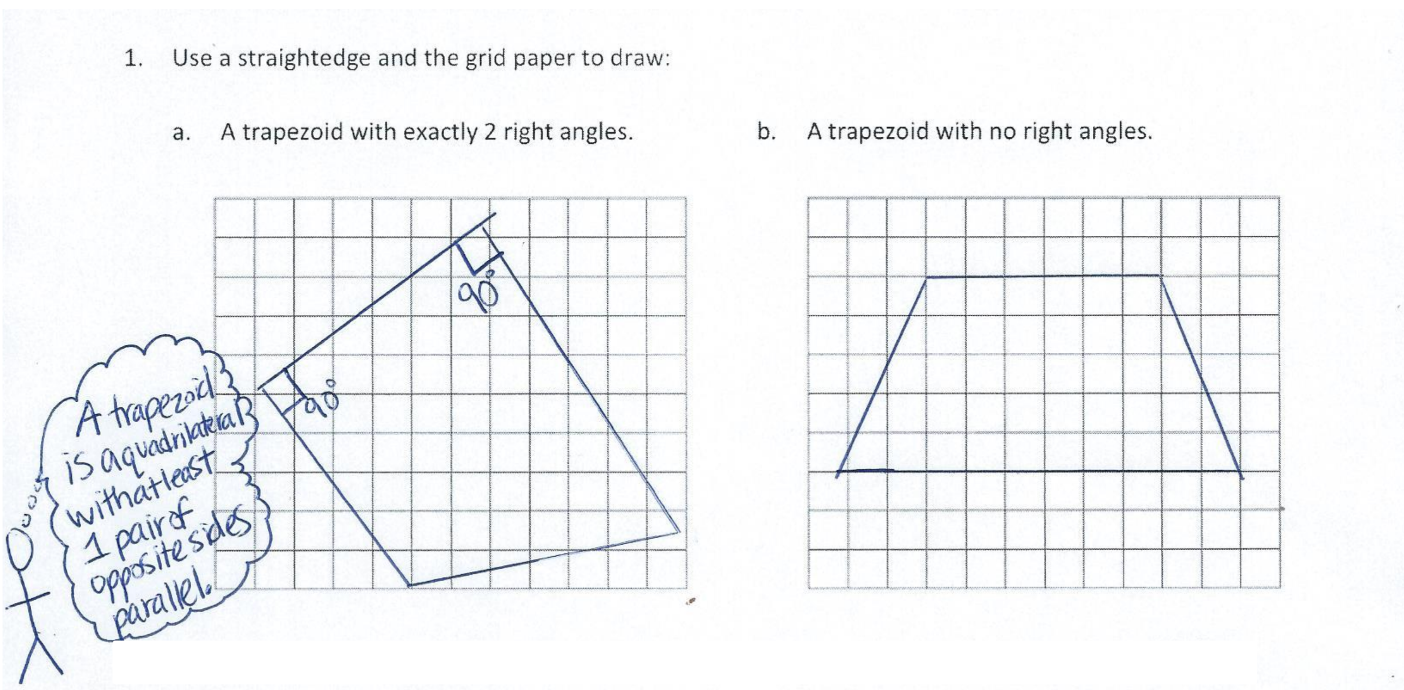
Lesson 16

Objective: Draw trapezoids to clarify their attributes, and define trapezoids based on those attributes.

Homework Key

1. a. Drawings will vary.
   b. Drawings will vary.
2. a. Shapes in the wrong groups circled; explanations will vary.
   b. Explanations will vary.
3. Trapezoid will vary.
   a. Answers will vary.

Homework Sample



Lesson 17

Objective: Draw parallelograms to clarify their attributes, and define parallelograms based on those attributes.

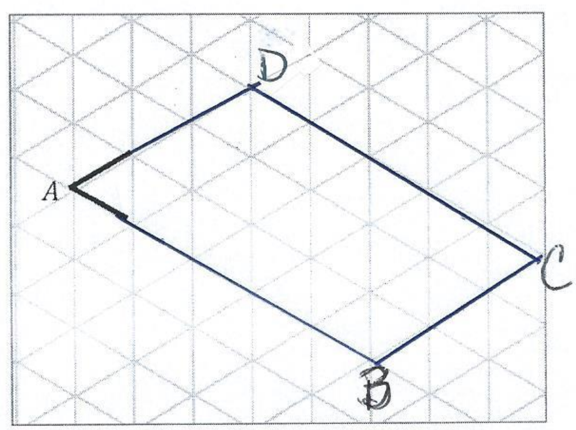
Homework Key

1. a. Parallelograms will vary.
   b. 120°; 60°; 120°
2. a. 6 cm; 3 cm
   b. 67°; 113°; 67°
3. 4; 4; 3; 6
4. Answers will vary.
5. Answers will vary.

Homework Sample

1. $\angle A$ measures 60°.

   a. Extend the rays of $\angle A$, and draw parallelogram $ABCD$ on the grid paper.

   b. What are the measures of $\angle B$, $\angle C$, and $\angle D$?

   $\angle B = 120°$
   $\angle C = 60°$
   $\angle D = 120°$

   (Answers may vary based on labels - B, C, D.)

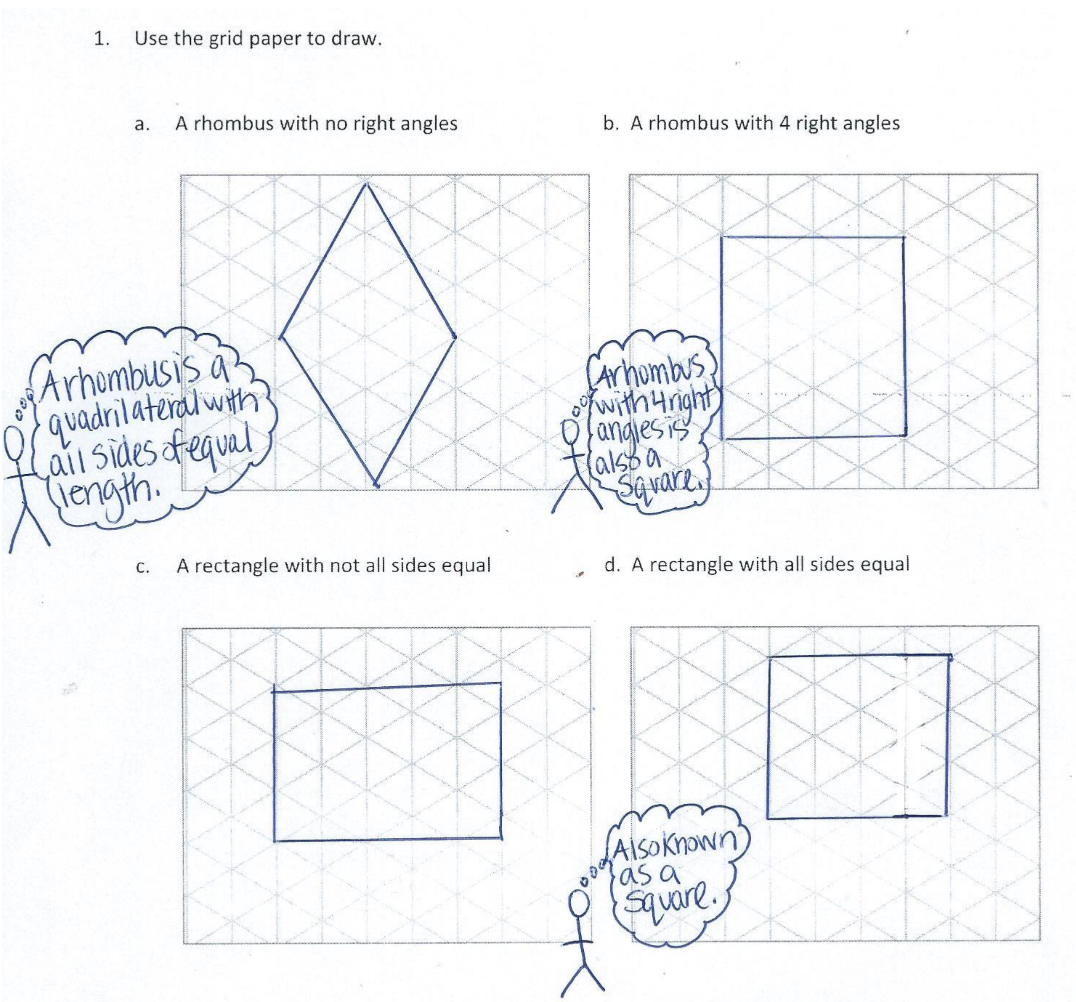
Lesson 18

Objective: Draw rectangles and rhombuses to clarify their attributes, and define rectangles and rhombuses based on those attributes.

Homework Key

1. a. Rhombuses will vary.
   b. Rectangles will vary.
   c. Rectangles will vary.
   d. Rectangles will vary.
2. 54.25 cm or $54\frac{1}{4}$ cm
3. Answers will vary.
4. Answers will vary.

Homework Sample



Lesson 19

Objective: Draw kites and squares to clarify their attributes, and define kites and squares based on those attributes.

Homework Key

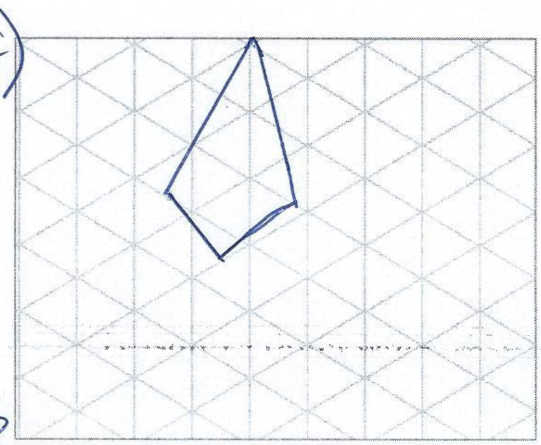
1. a. Kites will vary.
   b. Quadrilateral that has two pairs of equal adjacent sides
   c. Both pairs of sides are equal, or when it is a rhombus
2. It has right angles.
3. Squares will vary.
4. Explanations will vary.

Homework Sample

1. a. Draw a kite that is not a parallelogram on the grid paper.

   b. List all the properties of a kite.

   2 adjacent sides equal (2 sets of)
   4 sided shape (quadrilateral)



   c. When can a parallelogram also be a kite?

   A Kite is a quadrilateral in which 2 consecutive sides have equal length, the remaining two sides have equal length.

   A square & rhombus have sides of equal length that are next to each other, so they can also be a kite.

Lesson 20

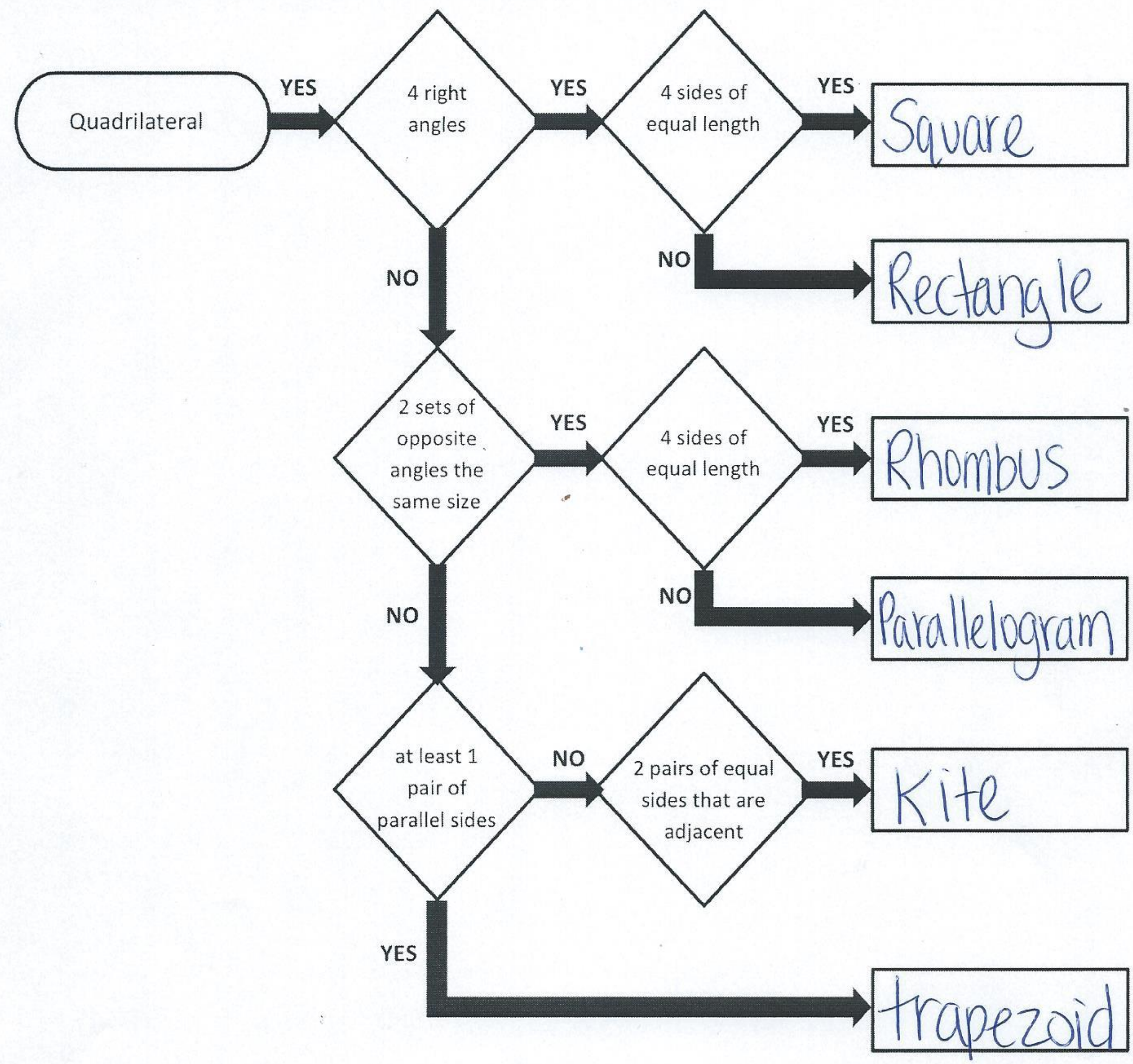
Objective: Classify two-dimensional figures in a hierarchy based on properties.

Homework Key

1. Square; rectangle; rhombus; parallelogram; kite; trapezoid
2. 9.9; 9.9; 28; 90; 90

Homework Sample

1. Follow the flow chart, and put the name of the figure in the boxes.



Lesson 21

Objective: Draw and identify varied two-dimensional figures from given attributes.

Homework Key

1. a. Always
   b. Sometimes
   c. Always
   d. Always
   e. Always
   f. Sometimes
   g. Sometimes
   h. Drawings will vary.

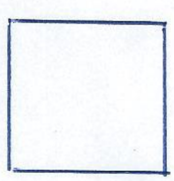
2. a. Explanations will vary.
   b. Explanations will vary.

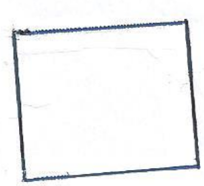
Homework Sample

1. Answer the questions by checking the box.

	Sometimes	Always
a. Is a square a rectangle?		X
b. Is a rectangle a kite?	X	
c. Is a rectangle a parallelogram?		X
d. Is a square a trapezoid?		X
e. Is a parallelogram a trapezoid?		X
f. Is a trapezoid a parallelogram?	X	
g. Is a kite a parallelogram?	X	

h. For each statement that you answered with *sometimes*, draw and label an example that justifies your answer.

B.


F.


G.