Unit 1 Plans: Investigating Volume of Solid Figures

AKS:

5MA.D.8 examine properties of polygons (e.g., triangles, quadrilaterals including kites, trapezoids, rectangles, squares, rhombuses, other parallelograms, pentagons, hexagons, octagons) and rectangular prisms; classify polygons by their properties; discover volume of right rectangular prisms.

8.c investigate volume of right rectangular prisms by packing them with unit cubes without gaps or overlaps; determine the total volume to solve problems (5.GSR.8.3)

8.d discover and explain how the volume of a right rectangular prism can be found by multiplying the area of the base times the height to solve authentic, mathematical problems (5.GSR.8.4)

5MA.A.5 write, interpret, and evaluate numerical expressions within real-life problems.

5.a write, interpret, and evaluate simple (up to two operations) numerical expressions involving whole numbers with or without grouping symbols to represent actual situations (5.NR.5.1a)

Vocabulary: 5th Grade Math Word Wall; County Resource

Additional Practice: Boddle (free for teachers)

Day	Lesson
Day 1: August 2	**Activating Strategy:** Set up Math Journal Establishing Norms: We are mathematicians Go through powerpoint with the class. Discuss what qualities make a good mathematician and what qualities they possess. Connect to My Math Autobiography.
I CAN reflect on what I know about math and set goals for myself.	**Lesson:** NONE
	Small Group: NONE
	Group Work: My Math Autobiography
Day 2: August 3	**Activating Strategy:** Establishing Norms: Teamwork & Math Talk Before beginning UTSY, talk with students about the importance of teamwork, talking through problems, and being respectful when working in groups. Discuss how they can handle talks when they disagree and how they can work through those disagreements. Why is it important to be respectful to one another when working in groups?
I CAN reflect on what I know about math and set goals for myself. **I CAN** review concepts I learned in 4th grade.	**Lesson:** NONE
	Small Group: NONE
	Group Work: • Complete My Math Autobiography if not finished • Unlock the School Year - Students will work in pairs to solve challenges to review 4th grade math standards. As students complete a challenge, they should check in with you to verify their answers BEFORE moving their game piece on the game board.

Day 3: August 4	**Activating Strategy:** Establishing Norms: Mistakes are valuable Highlight the fact that we ALL make mistakes (including us as teachers). How can mistakes help us learn? How should we handle ourselves if someone makes a mistake in class?
I CAN review concepts I learned in 4th grade.	**Lesson:** NONE
	Small Group: NONE
	Group Work: ● Unlock the School Year - Students will work in pairs to solve challenges to review 4th grade math standards. As students complete a challenge, they should check in with you to verify their answers BEFORE moving their game piece on the game board. (Powerpoint for game pieces)
Day 4: August 7	**Activating Strategy:** Distribute workbooks. Explain each station thoroughly before students begin. Answer questions on procedures
Volume - 5MA.D.8.c Concrete **I CAN** investigate volume of rectangular prisms by packing them with unit cubes.	**Lesson/ Group Work:** Volume Inquiry: Day 1 (Student Workbook; Spanish) Students will work in small groups. Set a timer for each station and have small groups rotate through. ● Station 1: Teacher will build 6 rectangular prisms of varying sizes from snap cubes. Place them on a flat surface and label them A-F. In small groups, students will count cubes and reason how many cubes were used to create each prism. Students MAY NOT take the prisms apart. Be sure to explain that the prisms are solid figures, not hollow. If students finish early, challenge them to find the volume of the shape created if they stack 2 prisms together. Have them record their thinking in a blank section next to the "Count It" chart. ● Station 2: Provide students with a bucket of snap cubes. Using their recording packets, students will create prisms with the specified numbers of cubes, no more and no less. They will record L, W, and H. You may need to explain that height is the number of layers. Be sure to also explain that each prism cannot be hollow and they should NOT rotate the prism to record the dimensions. ● Station 3: Create "packages" of 48 snap cubes (in ziplocs or small baskets, for example). Students will use the 48 cubes to create as many prisms as possible. You may need to encourage students, they like to make one and say they can't figure out any more. ● Station 4: Provide students with empty boxes of varying sizes and a bucket of unit cubes. Students will need to select a box, describe the box and estimate how many cubes will fill the box FIRST. Students will then try to determine the actual volume of the box. Explain to students that, while the instructions say to "fill the box," they may not have enough to fill the entire box. Challenge them to figure out how they can determine the actual number of cubes WITHOUT filling the box.
Day 5: August 8	**Activating Strategy:** Explain each station thoroughly before students begin. Answer questions on procedures.
Volume - 5MA.D.8.c Concrete/ Representational **I CAN** investigate volume of	**Lesson/ Group Work:** Volume Inquiry: Day 2 (Student Workbook; Spanish) Students will work in small groups. Decide whether you want students to work in the same groups or new groups. Set a timer for each station and have small

rectangular prisms by packing them with unit cubes.	groups rotate through. • Station 1: Using the cards, student groups will decide how many cubes were used to make the prisms pictured. Remind students that all prisms are solid figures, not hollow. (Cards are page 12) • Station 2: Using the cards, student groups will decide how many MORE cubes are needed to make the shapes pictured a complete rectangular prism. Remind students that all prisms are solid figures, not hollow. (Cards are page 13) • Station 3: Students will reason through the Base x Height formula for volume using prisms pictured on the cards. They will need to count the unit cubes on the base and the height (number of layers). Students will need to use this information to determine the volume. Some will use repeated addition while some will make the connection of Base x Height. (Cards are page 14) • Station 4: Students will use the counting method to determine the volume of the prisms pictured on each card. Remind students prisms are solid figures, not hollow, and they cannot see all the cubes used (hidden cubes). (Cards are page 15) • Station 5: Students will compare the two boxes pictured. One is neatly stacked, while the other has cubes just dumped in. Students will estimate the volume of the box based on the images and which "method" will hold more cubes. Encourage students to thoroughly explain their thinking on WHY they chose the box they did. (Card on page 16)
Day 6: August 9	**Activating Strategy:** Explain each station thoroughly before students begin. Answer questions on procedures.
Volume - 5MA.D.8.c Concrete/ Representational **I CAN** investigate volume of rectangular prisms by packing them with unit cubes.	**Lesson/ Group Work:** Volume Inquiry: Day 3 (Student Workbook; Spanish) Students will work in small groups. Decide whether you want students to work in the same groups or new groups. Set a timer for each station and have small groups rotate through. • Station 1: (pages 4-18) Students will use the descriptions on the card and snap cubes to build the prism. Students can use any method they would like to determine volume (counting is most obvious while they build, LxWxH using dimensions) • Station 2: Provide the group with a large box (student supplies box?) and ONLY 36 snap cubes. Before they begin, students need to estimate how many snap cubes will fill the box. Then, working in a group, they need to devise a plan to determine the volume of the box. Their plan needs to be written down before they begin. Students will then carry out their experiment. • Station 3: Students will choose one of the nets provided and build the rectangular prism. They will estimate how many centimeter cubes will fit into their prism. Encourage students to form a plan for estimating rather than guessing an arbitrary number. Students will then fill their prism with centimeter cubes to determine the actual volume.
Day 7: August 10	**Activating Strategy:** Volume Activating Strategy: Slide 1
Volume - 5MA.D.8.d Numerical Exp - 5MA.A.5.a Representational/ Abstract	**Lesson/Group Work:** Student Notes: pg. 1-3 (start with strategy 4) Slides: Volume Lesson slides 1-35

I CAN investigate volume of rectangular prisms by packing them with unit cubes.	**Strategy 4: Counting Cubes** ● Review what students learned during their volume inquiry: what kind of connections did they make? What strategies did they come up with to determine volume? ● Introduce the difference between 2D and 3D figure. What do students notice - 3D has height (the third dimension), 2D does not. Volume is the amount of stuff in something (how much can fit inside the prism). ● Introduce there are many ways to determine volume, the first being counting cubes. Remind students there are hidden cubes (no floating cubes). Continue through powerpoint and allow students to complete notes & practice. **Strategy 1: Counting Layers** ● NOTE: Not the same as B X H. This is more of a repeated addition method. This checks for understanding that each layer is the same in a rectangular prism. Students should find the cubes in one layer and see that each layer is the same.
	Small Group: ● Small Group Instructional Moves (8.c & 8.d) ● Counting Cubes/Layers: Using the pictured prisms, have students count the cubes together to determine volume. ○ Remind students there are no floating cubes and they must count the "hidden cubes." ○ Allow to practice with elbow partner, then one independently before releasing from small group. ● Base x Height: (Use any page) have students identify the base layer (can be top or bottom). Ask students how to find area. What does the area tell us? (how big the base layer is) ○ Students will rebuild the base layer and work with partners to determine how many layers they need to add. How many total layers do you have? How can you use what you know about area of the base and the number of layers to find volume? ● Small Group Resources based in iReady
	Practice/Formative: Practice: Volume Introduction Boom Cards - assigned in Google Classroom (Hide 4 cards to equal 20)
Day 8: August 11	**Activating Strategy:** Volume Activating Strategy: Slide 2
Volume - 5MA.D.8.d Numerical Exp - 5MA.A.5.a Representational/ Abstract **I CAN** discover how the volume of a right rectangular prism can be found by multiplying the area of the base times the height	**Lesson/Group Work:** Student Notes: page 2-3 Slides: Volume Lesson slides 42-50 **Strategy 2: Area of Base x Height** ● Review what area is from 4th grade standards - tie to the first layer of a prism ● Review what volume is - how is volume different from area? 2D vs 3D figure, has to have height. **Task Based Learning:** Build a Base activity ● Need: snap cubes, worksheet for each student ● In small groups, students will build the base of the given prism. Students will fill

	in the chart based on the prism they have. Next, students will follow the instructions on how to modify the prism and record the new volume based on the changes they have made.
	Small Group: ● Small Group Instructional Moves (8.c & 8.d) ● Base x Height: page 3 - have students identify the base layer (can be top or bottom). Ask students how to find area. What does the area tell us? (how big the base layer is) ○ Students will rebuild the base layer and work with partners to determine how many layers they need to add. How many total layers do you have? How can you use what you know about area of the base and the number of layers to find volume? ● Small Group Resources based in iReady
	Practice/Formative: Volume Sort (pages 3 & 4)
Day 9: August 14	**Activating Strategy:** Volume Activating Strategy: Slide 3
Volume - 5MA.D.8.d Numerical Exp - 5MA.A.5.a Representational/ Abstract **I CAN** discover how the volume of a right rectangular prism can be found by multiplying the area of the base times the height	**Lesson/Group Work:** Student Notes: page 2-3 Slides: Volume Lesson slides 49-55 **Strategy 3: Length x Width x Height** ● Review what area is from 4th grade standards Area of Base x Height **Task Based Learning:** based on county B x H lesson ● Need: scratch paper or white boards, chart paper (folded in half), markers, snap cubes ● Part 1: In small groups, students will solve the problem "Kara received a sandbox for her birthday that she placed in her backyard. The area of the sandbox measures 24 square feet. Her Dad is ordering sand for the box and wants to fill it with sand that measures 3 feet high. What will be the volume of the sand in the sandbox?" Students will use snap cubes to build the base of the sandbox first, and then the rest of the prism to solve for the volume. Students will neatly draw the sand box and explain their thinking on their chart paper ● Part 2: Students will come up with other options for their sandbox and record their thinking on the bottom half of the chart paper. ● Display work in the halls
	Small Group: ● Small Group Instructional Moves (8.c & 8.d) ● Base x Height: page 3 - have students identify the base layer (can be top or bottom). Ask students how to find area. What does the area tell us? (how big the base layer is) ○ Students will rebuild the base layer and work with partners to determine how many layers they need to add. How many total layers do you have? How can you use what you know about area of the base and the number of layers to find volume? ● L x W x H: page 10 - with crayons, have students highlight length in one color,

	width in another, and height in a third. Students will use these colors to create their volume equations. Remind students: how many measurements do you use for volume?
	Practice/Formative: Formative: Quick Check
Day 10: August 15	**Activating Strategy:** Volume Activating Strategy: Slide 4
iReady Diagnostic - Reading Volume - 5MA.D.8.d Numerical Exp - 5MA.A.5.a Representational/ Abstract **I CAN** explain how the volume of a right rectangular prism can be found by multiplying the area of the base times the height **I CAN** write and evaluate simple numerical expressions with grouping symbols	**Lesson/Group Work:** Relate area of base to (LxW) x H {using grouping symbols with one operation} ● County Activity ○ Slides ○ Student Notes ● Make a big deal about finding the area of the base. Students should understand when we use the Area of Base x Height formula, finding the area is the FIRST step. Students should be able to identify length and width versus height. ○ Since we need to find the area first, it needs to be "special." How can we make something special? We can set it apart as being it's own step, so we'll use parentheses. ● Complete the task with students in their notes. Allow students to work through the example in their small groups. **Task Based Learning:** Base 10 Challenge (page 11) ● Need: Baskets of base 10 blocks equal to the greatest amount needed for each piece; worksheet for each student ● Students will work in small groups to create regular rectangular prisms from the base-10 blocks and record their findings on their sheet ● Note: there could be multiple ways to create the prism with the base 10 blocks, but the volume will always be the same
	Small Group: ● Small Group Instructional Moves (8.c & 8.d) ● Base x Height: page 3 - have students identify the base layer (can be top or bottom). Ask students how to find area. What does the area tell us? (how big the base layer is) ○ Students will rebuild the base layer and work with partners to determine how many layers they need to add. How many total layers do you have? How can you use what you know about area of the base and the number of layers to find volume? ● L x W x H: page 10 - with crayons, have students highlight length in one color, width in another, and height in a third. Students will use these colors to create their volume equations. Remind students: how many measurements do you use for volume?
	Practice/Formative: Volume Daily Grade in Edulastic
Day 11: August 16	**Activating Strategy:** Volume Activating Strategy: Slide 5

Volume - 5MA.D.8.d Numerical Exp - 5MA.A.5.a Representational/ Abstract **I CAN** explain how the volume of a right rectangular prism can be found by multiplying the area of the base times the height (incomplete model)	**Lesson/Group Work:** Slides: Volume Lesson slides 64-67 **Applying BxH with Incomplete Model** • BEFORE STARTING SLIDES: Review vocabulary - 2D figure, 3D figure, area vs volume, height, unit cube • We've been using unit cubes to determine volume. We have also had full and complete rectangular prisms. Do you think you could determine the volume of a rectangular prism if it was NOT completely filled with unit cubes? • Complete slides with students **Independent or Group:** Practice: Base x Height Task Cards (print or digital option)
	Small Group: • Small Group Instructional Moves (8.c & 8.d) • Base x Height: page 3 - have students identify the base layer (can be top or bottom). Ask students how to find area. What does the area tell us? (how big the base layer is) ○ Students will rebuild the base layer and work with partners to determine how many layers they need to add. How many total layers do you have? How can you use what you know about area of the base and the number of layers to find volume? • L x W x H: page 10 - with crayons, have students highlight length in one color, width in another, and height in a third. Students will use these colors to create their volume equations. Remind students: how many measurements do you use for volume?
	Practice/Formative: Practice: Base x Height Task Cards (print or digital option) Alternate Practice: Volume of a Prism practice page (page 5) Formative: Quick Check (Page 43)
Day 12: August 17	**Activating Strategy:** Volume Activating Strategy: Slide 6
iReady Diagnostic - Math Volume - 5MA.D.8.d Concrete/ Representational **I CAN** explain how the volume of a right rectangular prism can be found by multiplying the area of the base times the height **I CAN** write and evaluate simple numerical expressions with grouping symbols	**Lesson:** Slides: Student Notes: pages 15-16 **Real World Problem Solving** **Partner Work:** Volume Match Students will work with a partner to create the prisms listed in the word problems on the problem cards, They will then match the prisms with the answer cards. Differentiation: some students may need physical snap cubes to use. You could alternatively use this digital prism builder. Some students may be able to create numerical expressions without the need to build. • Continue to have students use grouping symbols to write numerical expressions
	Small Group: • Small Group Instructional Moves (8.c & 8.d)

	• Base x Height: page 3 - have students identify the base layer (can be top or bottom). Ask students how to find area. What does the area tell us? (how big the base layer is) ○ Students will rebuild the base layer and work with partners to determine how many layers they need to add. How many total layers do you have? How can you use what you know about area of the base and the number of layers to find volume? • L x W x H: page 10 - with crayons, have students highlight length in one color, width in another, and height in a third. Students will use these colors to create their volume equations. Remind students: how many measurements do you use for volume?
	Practice/Formative: Practice: Volume of a Prism - Incomplete Model Formative: Packing Unit Cubes or Quick Check (Page 43)
Day 13: August 18	**Activating Strategy:** Volume Activating Strategy: Slide 7
Volume - 5MA.D.8.d Concrete/ Representational **I CAN** explain how the volume of a right rectangular prism can be found by multiplying the area of the base times the height **I CAN** write and evaluate simple numerical expressions with grouping symbols	**Lesson/Group Work:** Slides: Student Notes: page 4-5 **Volume models without unit cubes** • Review the 4 ways students have learned to calculate volume: 1) counting cubes, 2) counting layers, 3) Base x Height, 4) L X W x H • Review writing numerical expression for Base x Height • Play NumbeRocks video • We will not always have unit cubes with us or drawn for us to solve for our volume, so the counting method may not always be the best option to solve for volume. But using our volume formulas works the same way, with or without unit cubes. • Complete notes with students and allow students to work through example with elbow partners.
	Small Group: • Small Group Instructional Moves (8.c & 8.d) • Base x Height: page 3 - have students identify the base layer (can be top or bottom). Ask students how to find area. What does the area tell us? (how big the base layer is) ○ Students will rebuild the base layer and work with partners to determine how many layers they need to add. How many total layers do you have? How can you use what you know about area of the base and the number of layers to find volume? • L x W x H: page 10 - with crayons, have students highlight length in one color, width in another, and height in a third. Students will use these colors to create their volume equations. Remind students: how many measurements do you use for volume?
	Practice/Formative: Practice: Volume of Rectangular Prism Slides (Answer Key)

<table>
<tr><td>Day 14: August 21</td><td>Activating Strategy: Volume Activating Strategy: Slide 8</td></tr>
<tr><td rowspan="3">Volume - 5MA.D.8.d
Numerical Exp - 5MA.A.5.a
Representational/ Abstract
I CAN explain how the volume of a right rectangular prism can be found by multiplying the area of the base times the height
I CAN write and evaluate simple numerical expressions with grouping symbols</td><td>Lesson/Group Work:
Volume models without unit cubes (focus on cubes - what makes a cube special)
Partner Practice: Roll You Own Prism (page 69 with a partner)</td></tr>
<tr><td>Small Group:
Small Group Instructional Moves (8.c & 8.d)
Base x Height: page 3 - have students identify the base layer (can be top or bottom). Ask students how to find area. What does the area tell us? (how big the base layer is)
Students will rebuild the base layer and work with partners to determine how many layers they need to add. How many total layers do you have? How can you use what you know about area of the base and the number of layers to find volume?
L x W x H: page 10 - with crayons, have students highlight length in one color, width in another, and height in a third. Students will use these colors to create their volume equations. Remind students: how many measurements do you use for volume?</td></tr>
<tr><td>Practice/Formative:
Practice: Volume of Rectangular Prism Boom Cards</td></tr>
<tr><td>Day 15: August 22</td><td>Activating Strategy: Volume Activating Strategy: Slide 9</td></tr>
<tr><td rowspan="3">Volume - 5MA.D.8.d
Numerical Exp - 5MA.A.5.a
Representational/ Abstract
I CAN explain how the volume of a right rectangular prism can be found by multiplying the area of the base times the height
I CAN write and evaluate simple numerical expressions with grouping symbols</td><td>Lesson/Group Work:
Slides: slides 70-75
Missing Dimension
BEFORE starting slides, review multiplication vocabulary: factors, product. What is a factor? If we know the product and ONE of the factors, is there any way to find the other factor?
Work through the problems on the slide. Remind students that multiplication and division are related, inverse operations. You may need to provide multiplication charts to students who struggle with multiplication facts.
Independent/Partner Practice: Solving Problems with Volume</td></tr>
<tr><td>Small Group:</td></tr>
<tr><td>Practice/Formative:
Volume Daily Grade 2 in Edulastic
(This Google Form has problems that would be good for incomplete models)</td></tr>
<tr><td>Day 16: August 23</td><td>Activating Strategy: Missing Dimension Slide 10</td></tr>
<tr><td rowspan="2">Volume - 5MA.D.8.d
Numerical Exp - 5MA.A.5.a
Abstract
I CAN explain how the volume of a right rectangular prism can be found by</td><td>Lesson:</td></tr>
<tr><td>Small Group:
Small Group Instructional Moves (8.c & 8.d)
Base x Height: page 3 - have students identify the base layer (can be top or bottom). Ask students how to find area. What does the area tell us? (how big the base layer is)</td></tr>
</table>

multiplying the area of the base times the height **I CAN** write and evaluate simple numerical expressions with grouping symbols	○ Students will rebuild the base layer and work with partners to determine how many layers they need to add. How many total layers do you have? How can you use what you know about area of the base and the number of layers to find volume? • L x W x H: page 10 - with crayons, have students highlight length in one color, width in another, and height in a third. Students will use these colors to create their volume equations. Remind students: how many measurements do you use for volume?
	Practice/Formative: Formative: Justified True or False Statement
Day 17: August 24	**Activating Strategy:** Volume Activating Strategy: slide 11
Volume - 5MA.D.8.d Numerical Exp - 5MA.A.5.a Abstract **I CAN** explain how the volume of a right rectangular prism can be found by multiplying the area of the base times the height **I CAN** write and evaluate simple numerical expressions with grouping symbols	**Lesson: Real World Problem Solving** **Tasked Based Learning:** Treats Galore; Treat Options • Need: Chart paper; different color markers for each student in group; directions and treat options for each group; make snap cubes available or digital prism builder • Have students write their name on the chart paper in their color marker. • In small groups, students will work to decide the dimensions of the truck (with given volume) and decide what treats will fit inside the trunk. Remind students that the total volume of the treats they pick cannot go over the volume of the trunk (it's illegal to drive with your trunk flapping open). The boxes also need to fit in a way that match the dimensions they have chosen. • Students will record their thinking in their color marker so understanding can be checked.
	Small Group: NONE (provide guidance to small groups as they work)
	Practice/Formative: Extra Practice: Volume Problem Solving Graphic Organizer
Day 18: August 25	**Activating Strategy:** Volume Activating Strategy: Slide 12
Volume - 5MA.D.8.d Numerical Exp - 5MA.A.5.a TEST REVIEW	**Lesson: TEST REVIEW**
	Small Group:
	Practice/Formative: Volume Task Cards/ Think Sheet (pages 26-32) Volume Game with Task Cards Quizizz Review Game
Day 19: August 28	**Activating Strategy:** Volume Activating Strategy: Slide 13
Volume - 5MA.D.8.d Numerical Exp - 5MA.A.5.a TEST REVIEW	**Lesson: TEST REVIEW**
	Small Group:
	Practice/Formative: Volume Task Cards/ Think Sheet (pages 26-32)

	Volume Game with Task Cards Quizizz Review Game
Day 20: August 29	**UNIT 1 TEST** (Have printed recording sheets ready)

LINKED RESOURCES:

- First Days
  - My Math Autobiography
  - Unlock the School Year
  - Unlock the School Year Answer Key
- Volume Inquiry
  - Student Workbook (Cards pages 12-16)
  - Spanish Student Workbook