InsightMath

Exploring Volume and Multiplicative Relationships

Family Guide | Grade 5 | Unit 4

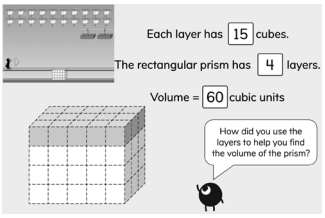
Your student is exploring how multiplication can help to discover, understand, and explain three-dimensional space and relationships between numbers.

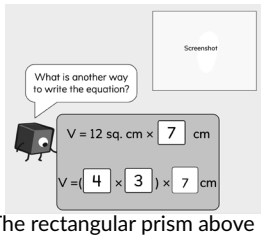
Key Math Ideas

Students come to grade 5 already knowing how to measure area by counting unit squares and using multiplication to find the area of rectangles. In this unit, they build on this knowledge as they explore three-dimensional space, learning how to understand and measure the volume of rectangular prisms. Their understanding of volume as something that can be measured develops into a foundation for exploring multiplication relationships between numbers, which they express using parentheses in mathematical expressions. These multiplication relationships include exploring prime numbers (a number that has exactly 2 factors: 1 and itself) and composite numbers (a number that has more than 2 factors), as well as prime factors (a factor that is a prime number). At the end of the unit, students expand their exploration of measurement to converting measurements with customary units.

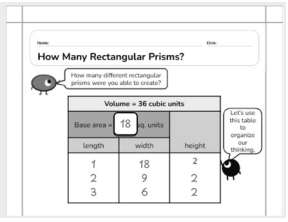
→ In the first half of the unit, your student will learn to

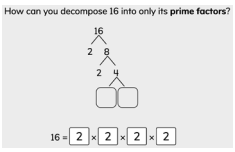
- determine the number of cubic units needed to fill a rectangular prism by decomposing it (taking it apart) into layers;
- use multiplication to determine volume, including the formulas for volume (such $V = A \times h$ and $V = l \times w \times h$);
- describe, compare, and write about volume situations using volume language such as cubic unit, base, face, dimension, and volume measurements;
- find one dimension of a rectangular prism given the other two dimensions and the volume;
- identify possible dimensions of a rectangular prism given the volume and the third dimension;
- use factors and multiples to find missing a dimension and make connections to prime and composite numbers;
- express a whole number between 2–50 as the product of its prime factors.





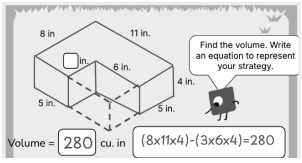
The rectangular prism above is found using the formula $V = A \times h$ ($V = 12 \times 7$) and $V = l \times w \times h$ ($V = 4 \times 3 \times 7$)

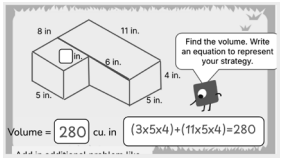




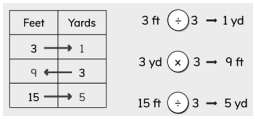
→ In the second half of the unit, your student will learn to

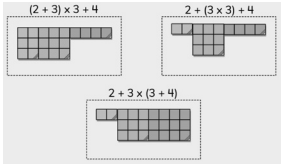
- find the volume of solid figures by decomposing or composing them into rectangular prisms;
- write equations with parentheses and describe how they match the situation or visual model;
- describe the effects of changing the position of parentheses within an expression;
- compare two expressions without computing the totals;
- convert customary units (feet, pounds, gallons) using multiplication and division;
- solve multistep real-world problems involving converting area and volume measurements.





In the examples above, the volume of the figure is found by composing (left) and decomposing (right).





The example to the left shows how changing the position of parentheses in the expression changes the model.

Helpful Hint

Sometimes students want to select the tallest object as having the greatest volume, without fully considering the dimensions of width and depth. Show them containers in the shape of rectangular prisms where the tallest does not have the greatest volume. Have them first estimate the order by volume and then have them measure the actual volume and compare.

Tips for Supporting Your Student at Home

Questions to Ask Your Student

→ In the first half of the unit:

- What does volume measure?
- What do you need to know to find the volume of a rectangular prism?
- How can you find the volume of a rectangular prism?
- What strategy can you use to find dimensions of a rectangular prism?
- How do you find a number's prime factors?

→ In the second half of the unit:

- How does the position of parentheses in an expression change the meaning of the expression?
- How do you find the volume of a solid figure made up of rectangular prisms?
- How do you convert customary units using multiplication and division?
- What strategies can you use to solve word problems that involve converting area and volume?

If...	Try...
your student is not sure whether they should multiply or divide to convert measurements . . .	asking if they are converting from a smaller unit (like inches) to a larger unit (like feet) or from a larger unit to a smaller unit. Support them to recognize that they will need more of a smaller unit, so when converting to a smaller unit they need to multiply. Similarly, they will need less of a larger unit, so when converting to a larger unit they need to divide.

Student Strengths Spotlight

I ask my classmates to clarify their reasoning.	Students engage in discussions about different sets of dimensions for a given volume of a rectangular prism, which provides opportunities to better understand each other's reasoning and expand their own understanding.
I determine what tools and strategies might help me solve this problem.	Students use unit cubes to explore volume of rectangular prisms, discovering it as a way to measure 3-D shapes.
I consider how precise I need to be when solving problems.	Students recognize that precision is an essential part of measurement, both measuring rectangular prisms with cubic units and converting between measurements.
I use math to represent real-life situations, and I create contexts to match the given math.	Students see rectangular prisms all around them in the real world. Having the strategies to measure and describe them helps them to become well-rounded mathematicians.

Try This Together!

- **Volume Around Us!** Support your student to see how much space the rectangular prisms at home, such as cereal boxes or board game boxes, take up. Ask your student how they can find the volume. Support your student to recognize that they need to know the dimensions of the rectangular prism. Have your student measure the dimensions if needed, rounding to the nearest whole number. Have them find the approximate volume of the rectangular prism using the dimensions and explain their strategy.
- **Flexible Box Sizes.** Pose the situation to your student: "I need a box that holds 24 cubic inches. What could the dimensions be?" Ask your students to find as many sets of dimensions as possible. Try this with volumes that have many sets of dimensions (like 36 cubic inches) and volumes with just one set of dimensions (like 21 cubic inches).\
- **Measurements in the Kitchen.** Go through your pantry or fridge and ask your student to look at the labels to see what units of measurement items are packaged in. If you have a pint of ice cream, how much ice cream in cups or gallons? If the yogurt container is 32 ounces, how many pounds is that?