Eureka Math Parent Tips

Fifth Grade Module 5

This document is being produced for the purpose of giving parents and students in Calcasieu Parish a better understanding of the math concepts being taught.

Addition and Multiplication with Volume and Area

Students will 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.

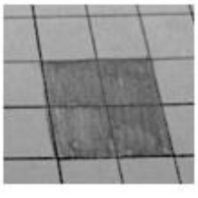
Louisiana Standards:

-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.
-Solve real world problems involving multiplication of fractions and mixed numbers.
-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.
-Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.
-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.
-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.
-Classify two-dimensional figures in a hierarchy based on properties.

Words to Know:

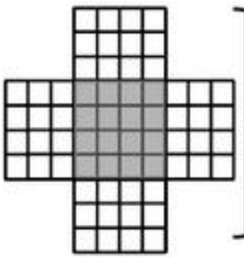
- Base
- Bisect
- Cubic units
- Height
- Hierarchy
- Unit Cube
- Volume of a Solid

Students begin with the Concepts of Volume through the use of Hands-On Manipulatives (Cubes).



On the Way to a Volume Formula

***Problem #1*: If this net were to be folded into a box or rectangular prism, how many cubes would fill it?**

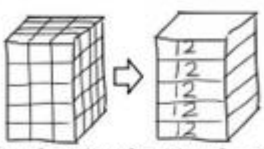


It would take 16 cubes to cover the shaded part which is the base or bottom layer. The flaps show that there are 3 layers. 16 x 3 = 48 So the volume of this box or rectangular prism is 48 cubic units or 48 u^3.

It would take 48 cubes to fill the box.

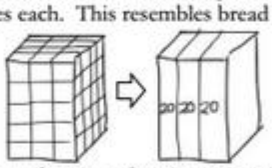
Thinking of the Rectangular Prism in Layers

Approach 1: We could think of drawing horizontal lines to show the 5 layers of 12 cubes each. This resembles layers of cake.



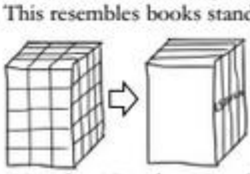
12 cm^3 + 12 cm^3 + 12 cm^3 + 12 cm^3 + 12 cm^3 = 60 cm^3
5 x 12 cubic centimeters = 60 cm^3

Approach 2: We could think of drawing vertical lines to show 3 layers of 20 cubes each. This resembles bread slices.



20 cm^3 + 20 cm^3 + 20 cm^3 = 60 cm^3
3 x 20 cubic centimeters = 60 cm^3

Approach 3: We could think of drawing both a horizontal and a vertical line to show the front and back layers. There are 4 layers of 15 cubes each. This resembles books standing up.



15 cm^3 + 15 cm^3 + 15 cm^3 + 15 cm^3 = 60 cm^3
4 x 15 cubic centimeters = 60 cm^3

No matter which approach is used, the volume is the same. Students use the layers that are easier for them to visualize.

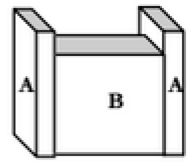
Students create the formula for Volume.

$$V = Area \times h = (l \times w) \times h$$

Where they use the area of their base and multiply by the amount of layers.

Calculating Volume of Non-Overlapping Prisms

Application Problem: A planting box pictured below is made of two sizes of rectangular prisms. One type of prism measures 2 inches by 5 inches by 12 inches. The other type measures 12 inches by 4 inches by 10 inches. What is the total volume of three such boxes?



Prism A	Prism B
Volume = (2 in x 5 in) x 12 in = 10 in^2 x 12 in = 120 in^3 There are two prisms 'A.' 120 in^3 x 2 = 240 in^3	Volume = (12 in x 4 in) x 10 in = 48 in^2 x 10 in = 480 in^3

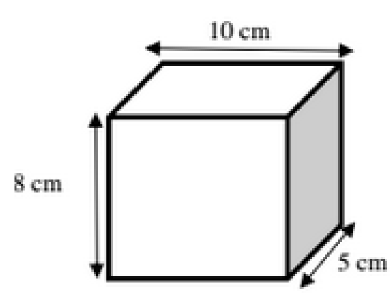
$$\begin{array}{r} 240\ in^3 \\ +480\ in^3 \\ \hline 720\ in^3 \end{array}$$

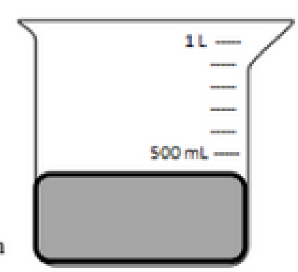
The total volume of the planting box is 720 cubic inches.

Liquid Volume

From an activity in Lesson 5, students will conclude that 1 cm^3 is equivalent to 1 mL. Milliliters are units of capacity which tell the amount of liquid a container will hold. There are 1,000 mL in a liter.

Problem: Find the volume of the prism and then shade the beaker to show how much liquid would fill the box.





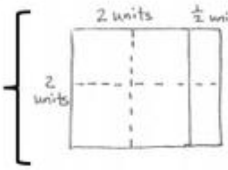
Volume = (8 cm x 5 cm) x 10 cm
= 40 cm^2 x 10 cm
= 400 cm^3

Since 1 cm^3 equals 1 mL, 400 cm^3 equals 400 mL.

Calculating Area (Topic C)

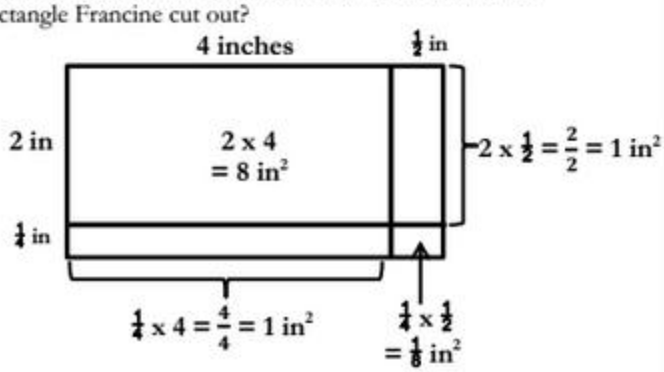
This topic begins with students using tiling to find the area of rectangles. **Tiling** is a strategy used to find area of rectangle by covering the entire figure with square units and fractional parts of square unit.

Example of tiling



Eventually students will just record partial products rather than draw individual tiles.

Example Problem: Francine cut a rectangle out of construction paper to complete her art project. The rectangle measured $4\frac{1}{2}$ inches x $2\frac{1}{4}$ inches. What is the area of the rectangle Francine cut out?



Add the partial products together to find the area.

$8 \text{ in}^2 + 1 \text{ in}^2 + 1 \text{ in}^2 + \frac{1}{8} \text{ in}^2 = 10\frac{1}{8} \text{ in}^2$

The area of the rectangle cut out is $10\frac{1}{8}$ square inches.

Algorithm using the distributive property:

$4\frac{1}{2} \times 2\frac{1}{4} = (4 + \frac{1}{2}) \times (2 + \frac{1}{4})$

$= (4 \times 2) + (4 \times \frac{1}{4}) + (\frac{1}{2} \times 2) + (\frac{1}{2} \times \frac{1}{4})$

$= 8 + 1 + 1 + \frac{1}{8}$

$= 10\frac{1}{8}$

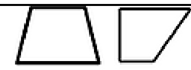
Algorithm without using the distributive property; mixed numbers are changed to improper fractions:

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

$= \frac{9}{2} \times \frac{9}{4} = \frac{81}{8} = 10\frac{1}{8}$

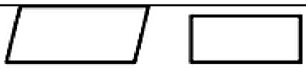
Defining Quadrilaterals Based on their Attributes

Trapezoid



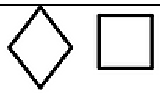
There are actually **two definitions** for a trapezoid:
1. A quadrilateral with **only one pair** of opposite sides parallel
2. A quadrilateral with **at least one pair** of opposite sides parallel

Parallelogram



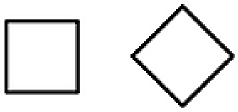
Attributes/Properties: a quadrilateral and opposite sides are parallel

Rhombus



Attributes/Properties: a quadrilateral, all sides are equal in length, and opposite sides are parallel

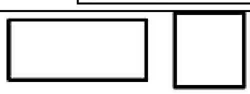
Square



Attributes/Properties: a quadrilateral, 4 right angles, 4 sides of equal length, and opposite sides are parallel

Since a square has 4 right angles, it can also be classified as a **rectangle.**
Since a square has 4 sides of equal length, it can also be classified as a **rhombus.**
The opposite sides are parallel so a square can also be classified as a **parallelogram.** If it is classified as a parallelogram then it is also classified as a **trapezoid.**

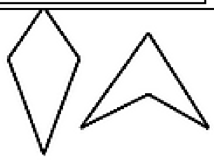
Rectangle



Attributes/Properties: a quadrilateral, 4 right angles, and opposite sides are parallel

Since opposite side are parallel, we can classify the rectangle as a parallelogram and a trapezoid.

Kite



Attributes/Properties: a quadrilateral and **adjacent** sides or sides next to each other are equal

How you can help at home…

- Draw different shapes. Divide them into different fractions.
- Find the volume of real-world objects in your home.
- Name two- and three- dimensional figures and find examples at home.
- Draw different polygons within a piece of triangle grid paper, or use combinations of triangles to create other polygons.
- Identify, describe, and different household objects as two-dimensional figures.
- Use a compass or a computer to draw geometric figures.