Math Tips for Parents

Grade 5 • Unit 6

Addition and Multiplication with Volume and Surface Area

In Unit 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 unit bridges the Grade 4 work on area with the Grade 6 work on volume and area to come.

Grade Level Standards

5.G.3, 5.G.4, 5.MD.3, 5.MD.4, 5.MD.5, 5.NF.4

Target Goals

- Classifies 2D figures into categories based on their products.
- Recognizes, measures, and solves problems involving volume.
- Multiplies and divides fractions.

Key Vocabulary

- 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

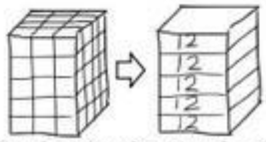
How you can help at home:

- 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.
- Keep practicing those multiplication and division facts, especially as problems become more complex.

Models and Representations

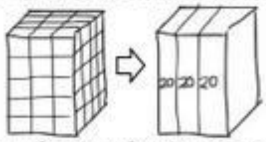
Thinking of the Rectangular Prism in Layers

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



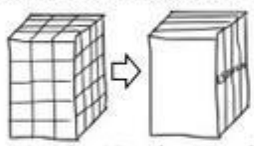
$12\text{ cm}^3 + 12\text{ cm}^3 + 12\text{ cm}^3 + 12\text{ cm}^3 + 12\text{ cm}^3 = 60\text{ cm}^3$
5×12 cubic centimeters $= 60\text{ cm}^3$

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



$20\text{ cm}^3 + 20\text{ cm}^3 + 20\text{ cm}^3 = 60\text{ cm}^3$
3×20 cubic centimeters $= 60\text{ cm}^3$

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.



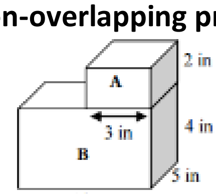
$15\text{ cm}^3 + 15\text{ cm}^3 + 15\text{ cm}^3 + 15\text{ cm}^3 = 60\text{ cm}^3$
4×15 cubic centimeters $= 60\text{ cm}^3$

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

V = *Area* x *h* = (*l* x *w*) x *h*

Total volume of a solid figure compose of two non-overlapping prisms

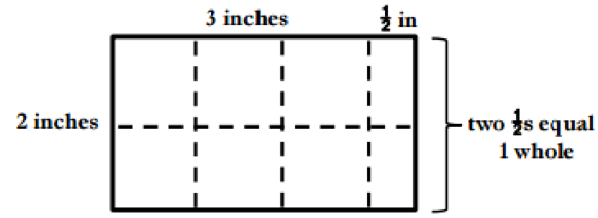


Prism A	Prism B
Length – 3 inches Width – 5 inches Height – 2 inches Volume = 3 in x (5 in x 2 in) = 3 in x 10 in² = 30 in³	Length – 6 inches Width – 5 inches Height – 4 inches Volume = (6 in x 5 in) x 4 in = 30 in² x 4 in = 120 in³

Total volume = $30\text{ in}^3 + 120\text{ in}^3$
$= 150\text{ in}^3$

Area with Fractions

Students extend their knowledge of area to include fractions. Students start by using tiling to find area. Tiling is a strategy used to find area by covering the entire figure with square units and fractional parts of square units.

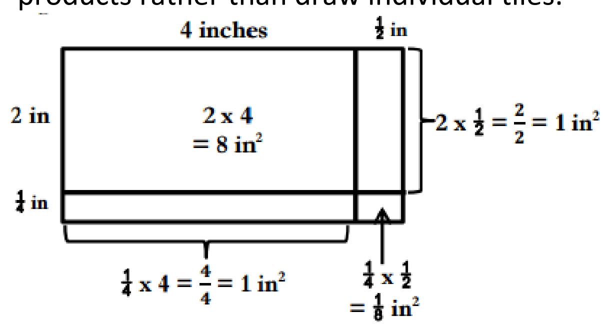


The area of one tile is 7 square inches. Since there are 6 tiles, the area of the whole mosaic is 42 square inches or 42 in² (6 x 7).

Algorithm using the distributive property:

$3\frac{1}{2} \times 2 = (3 + \frac{1}{2}) \times 2$
$= (3 \times 2) + (\frac{1}{2} \times 2)$
$= 6 + 1$
$= 7$

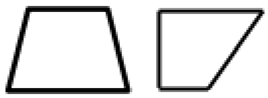
Eventually students will just record partial products rather than draw individual tiles.



Add the partial products together to find the area.
$8\text{ in}^2 + 1\text{ in}^2 + 1\text{ in}^2 + \frac{1}{8}\text{ in}^2 = 10\frac{1}{8}\text{ in}^2$

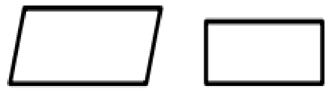
Defining Quadrilaterals Based on their Attributes

Trapezoid



A quadrilateral with **at least one** pair of opposite sides parallel

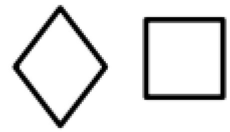
Parallelogram



A quadrilateral and opposite sides are parallel

Since a parallelogram has two pairs of parallel sides then it has at least one pair of parallel sides. Therefore, all parallelograms are also classified as trapezoids.

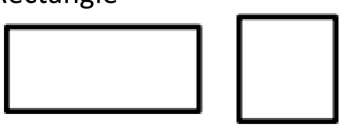
Rhombus



A quadrilateral, all sides are equal in length, and opposite sides are parallel

A rhombus can also be classified as a parallelogram and all parallelograms are also classified as a trapezoid.

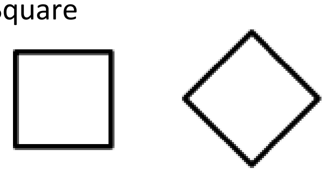
Rectangle



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.

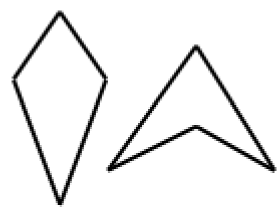
Square



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.

Kite



A quadrilateral and adjacent sides or sides next to each other are equal