Dear Family,

The next Unit in your child's mathematics class this year is ***Filling and Wrapping: Three-Dimensional Measurement***. Its focus is volume (filling) and surface area (wrapping) of objects such as prisms, cylinders, cones, and spheres. In addition, students will understand, find, and use area and circumference of circles. They will also extend their understanding of similarity and scale factors to three-dimensional figures.

Unit Goals

Students develop strategies for measuring surface area and volume. Their strategies are discussed and used to formulate rules for finding the surface areas and volumes of prisms and cylinders. Students also investigate other solids—including cones and spheres—to develop volume relationships.

In this Unit, students will revisit and extend ideas from previous Units. For example, students will build on what they learned in *Stretching and Shrinking* to study the connection of how changing the scale of a box affects its surface area and volume.

Homework and Conversations About The Mathematics

In your child's notebook, you can find worked-out examples, notes on the mathematics of the Unit, and descriptions of the vocabulary words.

You can help with homework and encourage sound mathematical habits as your child studies this Unit by asking questions such as:

- *What quantities are involved in the problem?*
- *Which measure of an object is involved—volume or surface area?*
- *What method should I use to determine this measure?*
- *What strategies or formulas might help?*

You can help your child with his or her work for this Unit in several ways:

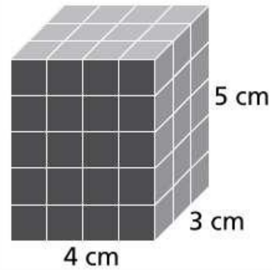
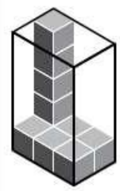
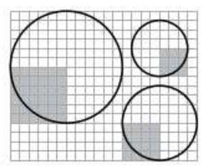
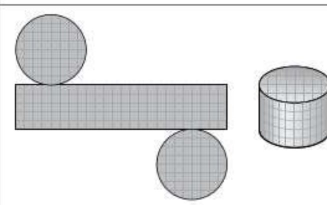
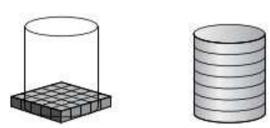
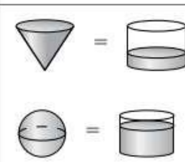
- *Talk with your child about the size and shape of boxes in your home, and ask why they may be shaped as they are.*
- *Ask your child about the different strategies the class has explored for finding the surface areas and volumes of various shapes.*
- *Look at your child's mathematics notebook. You may want to review the section where your child is recording definitions for new words that he or she is encountering in the Unit.*
- *Have your child pick a question that was interesting to him or her and explain it to you.*

Common Core State Standards

While all of the Standards for Mathematical Practice are developed and used by students throughout the curriculum, particular attention is paid to reasoning abstractly and quantitatively as students develop meaning and algorithms for volume and surface area. *Filling and Wrapping* focuses on the Geometry domain.

A few important mathematical ideas that your child will learn in *Filling and Wrapping* are given on the next page.

As always, if you have any questions or concerns about this Unit or your child's progress in the class, please feel free to call. We are interested in your child and want this year's mathematics experiences to be enjoyable and to promote a firm understanding of mathematics.

Important Concepts	Examples
Surface Area of Rectangular Prisms Surface area is the sum of the areas of the faces. Surface Area = (area of the front × 2) + (area of the side × 2) + (area of the top × 2) or Surface Area = (area of the front + area of the side + area of the top) × 2 = $(w \times h + w \times \ell + \ell \times h) \times 2$.	 There are three sets of two congruent faces: 4 cm by 3 cm (area is 12 cm^2); 4 cm by 5 cm (area is 20 cm^2); 3 cm by 5 cm (area is 15 cm^2). Surface area = 94 cm^2
Volume of Rectangular Prisms The volume (the total number of unit cubes) of a rectangular prism is the area of its base (the number of unit cubes in the first layer) multiplied by its height (the total number of layers). Volume = Area of the base × height = $Bh = \ell wh$	 3 × 2 = 6 cubes on the base 5 layers of cubes (height); Volume = 6 × 5 = 30 cubic units
Volume of Prisms The same layering strategy is used to generalize the method for finding the volume of any prism. The volume of any prism is the area of its base multiplied by its height. Volume = Area of the base × height = Bh	 Rectangular Prism · Triangular Prism · Hexagonal Prism
Area of Circles Students begin by finding the number of "radius squares" with side lengths that are equal to the radius, that cover the circle. It is a little more than 3, or pi.	 The area of a circle is pi × a "radius square" or pi × radius × radius $= \pi \times r \times r$ $= \pi r^2$
Perimeter of Circles (Circumference) Students count the number of diameter lengths needed to surround the circle. It is a little more than 3, or pi.	The circumference of a circle is pi × diameter, or πd.
Surface Area of Cylinders By folding a flat pattern to form a cylinder, students discover that the surface area of the cylinder is the area of the rectangle that forms the lateral surface ($2\pi rh$) plus the areas of the two circular ends ($2\pi r^2$). Surface Area = $2\pi r^2 + 2\pi rh$	 Use 3.14 for π. $r = 4 \quad h = 5$ $2\pi \cdot 4^2 + 2\pi \cdot 4(5)$ $\approx 100.48 + 125.6$ $= 226.08$ square units
Volume of Cylinders The volume of a cylinder is the number of unit cubes in one layer (the area of the circular base, πr^2) multiplied by the number of layers (the height h) needed to fill the cylinder. Volume = $Bh = \pi r^2 h$	 Estimate the number of unit cubes in one layer. · Multiply by the number of layers. Area of base $B = \pi r^2$ $\approx 3.14 \times 2.5^2$ $= 19.625$ square units $V = Bh$ $= 19.625 \times 7$ $= 137.375$ cubic units
Volumes of Cones and Spheres If a cylinder, a cone, and a sphere all have the same radius and the same height (the height being equal to two radii), then it takes 3 cones to fill the cylinder, and $1\frac{1}{2}$ spheres to fill the cylinder. $\text{Volume}_{cone} = \frac{1}{3} \cdot \text{Volume}_{cylinder} = \frac{1}{3}\pi r^2 h$ $\text{Volume}_{sphere} = \frac{2}{3} \cdot \text{Volume}_{cylinder} = \frac{2}{3}\pi r^2 h$	 $\text{Volume}_{cylinder} = 628\ cm^3$ $\text{Volume}_{cone} \approx 209\ cm^3$ $\text{Volume}_{sphere} \approx 419\ cm^3$