7.G.6 Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Resources:

Dan Meyer

1. Coffee Traveler
2. Popcorn Picker
3. Holes
4. Ticket to Ride

Fi.uu.nl

1. Houses with Height Numbers

Illustrative Mathematics Project

1. Illustrations

Math2.org

1. Areas, Volumes, Surface Areas

Mathematics Assessment Project (MAP)

1. E05: Fearless Frames
2. A04: Circle Pattern

NCTM Illuminations

1. Area Formulas
2. Burning Questions
3. Burning Questions
4. Creating A Firewise Defensible Space
5. Cubed Cans
6. Finding the Area of Irregular Figures
7. Side Length and Area of Similar Figures

Online Practice from IXL

1. Geometry: Area of rectangles and parallelograms (Seventh grade – P.18)
2. Geometry: Area of triangles and trapezoids (Seventh grade – P.19)
3. Geometry: Area and perimeter: word problems (Seventh grade – P.20)
4. Geometry: Nets of 3-dimensional figures (Seventh grade – P.27)
5. Geometry: Surface area (Seventh grade – P.28)
6. Geometry: Volume (Seventh grade – P.29)

Shodor

1. Triangle Area

Unpacking:

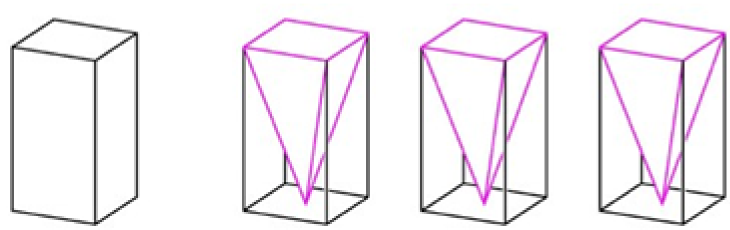
Students continue work from 5th and 6th grade to work with area, volume and surface area of two-dimensional and three-dimensional objects. (composite shapes) **Students will not work with cylinders**, as circles are not polygons. At this level, **students determine the dimensions of the figures given the area or volume**.

"Know the formula" does not mean memorization of the formula. To "know" means to have an understanding of ***why* the formula works and how the formula relates to the measure** (area and volume) and the figure. This understanding should be for *all* students.

Surface area formulas are not the expectation with this standard. Building on work with nets in the 6th grade, students should recognize that finding the area of each face of a three-dimensional figure and adding the areas will give the surface area. **No nets will be given at this level**; however, students could create nets to aid in surface area calculations.

Students understanding of volume can be supported by focusing on the area of base times the height to calculate volume.
Students solve for missing dimensions, given the area or volume.
Students determine the surface area and volume of pyramids.

Volume of Pyramids
Students recognize the volume relationship between pyramids and prisms with the same base area and height. Since it takes 3 pyramids to fill 1 prism, the volume of a pyramid is 1/3 the volume of a prism (see figure below).



To find the volume of a pyramid, find the area of the base, multiply by the height and then divide by three.

$$V = \frac{Bh}{3}$$

B = Area of the Base
h = height of the pyramid

Example 1:
A triangle has an area of 6 square feet. The height is four feet. What is the length of the base?

Solution:

2. Surface Area and Volume
3. Teach Engineering
4. Close Enough?
5. Trig River
6. Determining Densities
7. Volume of Prisms

One possible solution is to use the formula for the area of a triangle and substitute in the known values, then solve for the missing dimension. The length of the base would be 3 feet.

Example 2:
The surface area of a cube is 96 in2. What is the volume of the cube?

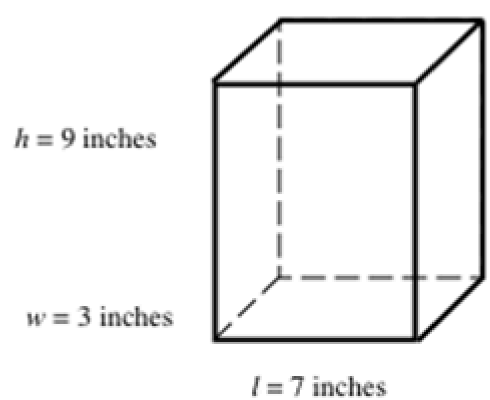
Solution:
The area of each face of the cube is equal. Dividing 96 by 6 gives an area of 16 in^2 for each face. Because each face is a square, the length of the edge would be 4 in. The volume could then be found by multiplying 4 x 4 x 4 or 64 in^3.

Example 3:
Huong covered the box to the right with sticky-backed decorating paper. The paper costs 3¢ per square inch. How much money will Huong need to spend on paper?

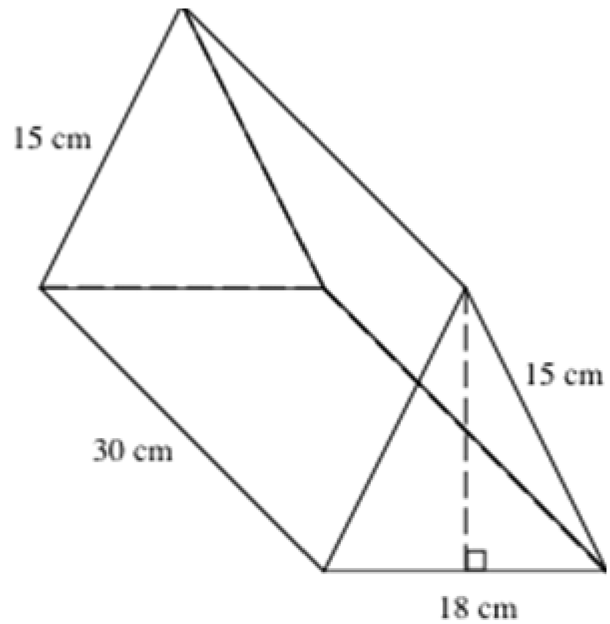
Solution:
The surface area can be found by using the dimensions of each face to find the area and multiplying by 2:

Front:	7 in. x 9 in.	=	63 in^2 x 2 = 126 in^2
Top:	3 in. x 7 in.	=	21 in^2 x 2 = 42 in^2
Side:	3 in. x 9 in.	=	27 in^2 x 2 = 54 in^2

The surface area is the sum of these areas, or 222 in^2.
If each square inch of paper cost \$0.03, the cost would be \$6.66.



Example 4:
Jennie purchased a box of crackers from the deli. The box is in the shape of a triangular prism (see diagram below). If the volume of the box is 3,240 cubic centimeters, what is the height of the triangular face of the box? How much packaging material was used to construct the cracker box? Explain how you got your answer.



Solution:

Volume can be calculated by multiplying the area of the base (triangle) by the height of the prism. Substitute given values and solve for the area of the triangle

$V = Bh$

$3{,}240 \text{ cm}^3 = B\,(30\text{cm})$

$\frac{3{,}240 \text{ cm}^3}{30 \text{ cm}} = \frac{B(30\text{cm})}{30 \text{ cm}}$

$108 \text{ cm}^2 = B$ (area of the triangle)

To find the height of the triangle, use the area formula for the triangle, substituting the known values in the formula and solving for height. The height of the triangle is 12 cm.

The problem also asks for the surface area of the package. Find the area of each face and add:

2 triangular bases: ½ (18 cm)(12 cm) = 108 cm^2 x 2 = 216 cm^2

2 rectangular faces: 15 cm x 30 cm = 450 cm^2 x 2 = 900 cm^2

1 rectangular face: 18 cm x 30 cm = 540 cm^2

Adding 216 cm^2 + 900 cm^2 + 540 cm^2 gives a total surface area of 1656 cm^2.