North Penn School District

Elementary Math Parent Letter

Grade 6

Unit 4 – Chapter 11: Surface Area and Volume

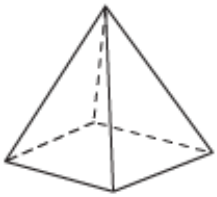
Examples for each lesson:

Lesson 11.1

Three-Dimensional Figures and Nets

Solid figures have three dimensions—length, width, and height. They can be named by the shapes of their bases, the number of bases, and the shapes of their lateral faces.

Identify and draw a net for the solid figure.

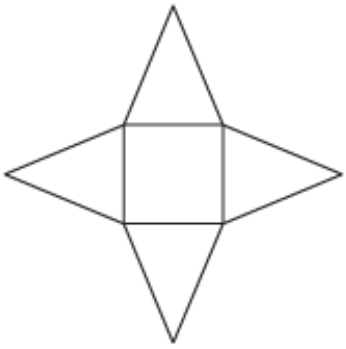


Step 1 Describe the base of the figure.
The base is a square.

Step 2 Describe the lateral surfaces.
The lateral surfaces are triangles.

So, the figure is a square pyramid.

Step 3 Name the shapes to be used in the net. Then make a sketch. Draw a square for the base, and four triangles for the lateral faces.

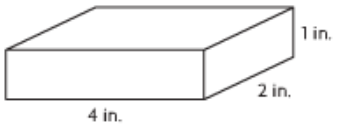


Lesson 11.2

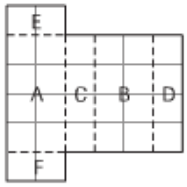
Explore Surface Area Using Nets

The net of a solid figure shows you all of the faces or surfaces of the figure. A net can help you find the **surface area** of a figure.

Find the surface area of the rectangular prism.



Step 1 Make a net of the rectangular prism. The prism has 6 rectangular faces, so the net has 6 rectangles.



Step 2 Find the area of each face of the prism.

First Way: Count the grid squares on each rectangle to find its area.

Second Way: Calculate the area of each rectangle by multiplying *length* × *width*.

A: 8 squares	$4 \times 2 = 8$
B: 8 squares	$4 \times 2 = 8$
C: 4 squares	$4 \times 1 = 4$
D: 4 squares	$4 \times 1 = 4$
E: 2 squares	$2 \times 1 = 2$
F: 2 squares	$2 \times 1 = 2$

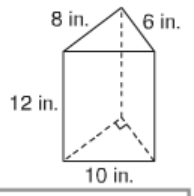
Step 3 Add the areas of all the rectangular faces. 28 squares 28 square inches

So, the surface area of the rectangular prism is 28 square inches ($in.^2$).

Lesson 11.3

Algebra • Surface Area of Prisms

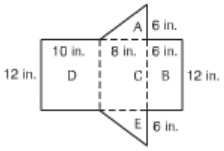
You can find the surface area of a figure by adding the lateral surface area to the sum of the areas of the bases.



Use a net to find the surface area.

Step 1 Draw a net.

Note any faces that have equal areas.



Step 2 Both triangular bases have the same area.

Base A: $A = \frac{1}{2}bh = \frac{1}{2} \times 6 \times 8 = 24$ in.^{2}

Base E: $A = 24$ in.^{2}

Step 3 Find the areas of the rectangular faces.

Face B: $A = lw = 6 \times 12 = 72$ in.^{2}

Face C: $A = lw = 8 \times 12 = 96$ in.^{2}

Face D: $A = lw = 10 \times 12 = 120$ in.^{2}

Step 4 Add the areas: A + B + C + D + E

$24 + 72 + 96 + 120 + 24 = 336$ in.^{2}

So, the surface area of the triangular prism is 336 square inches (in.^{2}).

More information on this strategy is available on Animated Math Model #34.

Lesson 11.4

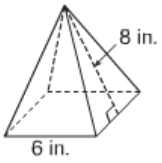
Algebra • Surface Area of Pyramids

To find the surface area of a pyramid, add the area of the base to the **lateral area**. The lateral area is the combined area of the triangular faces.

Find the surface area of the square pyramid.

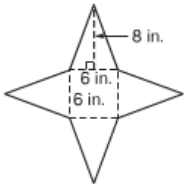
Step 1 The base is a square with side length of 6 in. Use the formula $A = s^2$ to find the area. Substitute 6 for the variable s.

$A = 6^2 = 36$ in.^{2}



Step 2 The lateral faces are four triangles with base of 6 in. and height of 8 in. Find the area of one triangular lateral face using the formula $A = \frac{1}{2}bh$. Substitute 6 for b and 8 for h.

$A = \frac{1}{2}(6)(8) = 24$ in.^{2}



Step 3 Multiply by 4 to find the total lateral area. $L = 24 \times 4 = 96$ in.^{2}

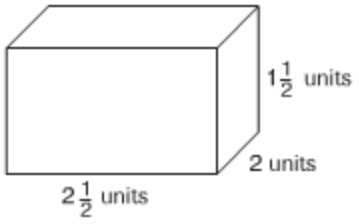
Step 4 Add the area of the base and the lateral area. $S = 36$ in.$^2 + 96$ in.$^2 = 132$ in.^{2}

So, the surface area of the square pyramid is 132 square inches (in.^{2}).

Lesson 11.5

Fractions and Volume

Find the volume of a rectangular prism that is $2\frac{1}{2}$ units long, 2 units wide, and $1\frac{1}{2}$ units high.

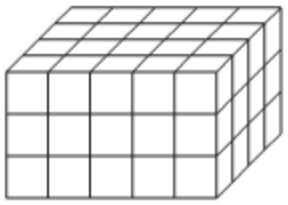


Step 1 Stack cubes with $\frac{1}{2}$-unit side length to form a rectangular prism.

Length: 5 cubes $= \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2\frac{1}{2}$ units

Width: 4 cubes $= \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2$ units

Height: 3 cubes $= \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 1\frac{1}{2}$ units



Step 2 Count the total number of cubes.

60 cubes

Step 3 It takes 8 cubes with $\frac{1}{2}$-unit side lengths to make 1 unit cube. So, each smaller cube has $\frac{1}{8}$ the volume of a unit cube.

Divide 60 by 8 to find how many unit cubes it would take to form the prism. Write the remainder as a fraction and simplify.

$60 \div 8 = 7$ R4 $\qquad 7\frac{4}{8} = 7\frac{1}{2}$

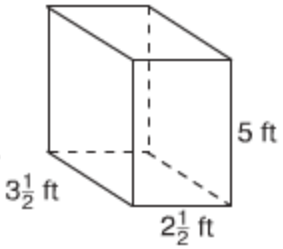
So, the volume of the prism is $7\frac{1}{2}$ cubic units.

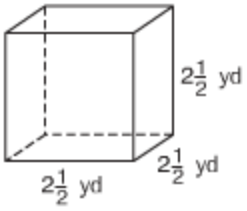
Lesson 11.6

Algebra • Volume of Rectangular Prisms

You can find the volume of a prism by using the formula $V = Bh$. V stands for volume, B stands for the area of the base, and h stands for the height.

For a rectangular prism, any face can be the base, since all faces are rectangles.





Find the volume of the rectangular prism.

Step 1 Find the area of the base. The base is $2\frac{1}{2}$ ft by $3\frac{1}{2}$ ft.

$A = l \times w$

$A = 2\frac{1}{2}\text{ ft} \times 3\frac{1}{2}\text{ ft} = 8\frac{3}{4}\text{ ft}^2$

Step 2 Multiply the area of the base by the height.

$V = Bh$

$V = 8\frac{3}{4}\text{ ft}^2 \times 5\text{ ft} = 43\frac{3}{4}\text{ ft}^3$

So, the volume of the rectangular prism is $43\frac{3}{4}$ ft^3.

Find the volume of the cube.

Step 1 Because the length, width, and height are all equal, you can use a special formula.

$V = Bh = l \times w \times h$

$V = s^3$

Step 2 Substitute $2\frac{1}{2}$ for s.

$V = s^3 = \left(2\frac{1}{2}\right)^3 = \left(\frac{5}{2}\right)^3$

$V = \frac{5}{2}\text{ yd} \times \frac{5}{2}\text{ yd} \times \frac{5}{2}\text{ yd} = \frac{125}{8}\text{ yd}^3$

$= 15\frac{5}{8}\text{ yd}^3$

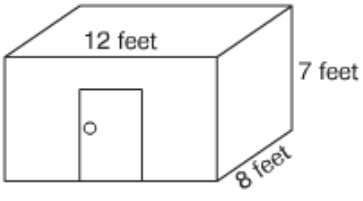
So, the volume of the cube is $15\frac{5}{8}$ yd^3.

More information on this strategy is available on Animated Math Model #35.

Lesson 11.7

Problem Solving • Geometric Measurements

Leslie stores gardening supplies in this shed shaped like a rectangular prism. What is the area of the ground covered by the shed?



Read the Problem	Solve the Problem
What do I need to find? I need to find _____ _____ _____.	Choose the measure—area, surface area, or volume—that gives the area of the ground covered by the barrel. Explain. _____ _____ _____ _____.
What information do I need to use? I need to use _____ _____.	Choose an appropriate formula. _____
How will I use the information? First, I will decide _____ _____. Then I will choose a _____ I can use to calculate this measure. Finally, I will _____ _____ _____.	Replace the variables l and w in the area formula with their values in the dimensions of the shed. l = _____ ft w = _____ ft Evaluate the formula. A = _____ × _____ = _____ ft²

Vocabulary

Lateral area – the sum of the areas of all the lateral faces or surfaces of a three-dimensional figure

Net – a two-dimensional pattern that can be folded to make a three-dimensional shape

Solid figure – a three-dimensional figure

Surface area – the sum of the areas of all of the faces or surfaces of a solid figure

Volume -- a measure of the amount of space a solid figure occupies

Area – the number of square units needed to cover a flat surface

Base (of a solid figure) – a flat surface of a solid figure by which the figure is measured or classified

Polygon – a closed plane figure formed by three or more line segments that intersect only at endpoints

Prism – a solid figure that has two congruent, polygon-shaped bases and other faces that are all parallelograms

Pyramid – a solid figure with a polygon-shaped base and other faces that are all triangles and that meet at a common vertex