

Rectangular Prisms: Units of Measure

Grades: 4-6

Standards: MG 4.1.4, MG 5.1.3, MG 6.1.3

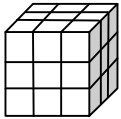
Objectives: Compare linear, planar, and spatial units. Find the volume of rectangular prisms.

Warm Up and Debrief

Create a three-column chart for note taking.

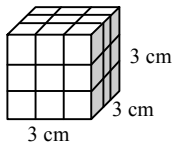
Label each column: Volume, Surface Area, and Perimeter of the Net.

Use linker cubes to construct a 3 unit \times 3 unit \times 3 unit cube. Let each linker cube represent a cube with a side of 1 cm.



Sketch the cube, label each dimension, and record the number of cubes used to build the shape in the first column.

Volume



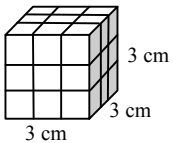
$$V = 27 \text{ cm}^3$$

Surface Area

Perimeter of the Net

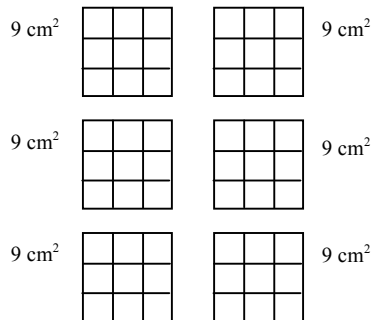
Record each face in the second column. Find the area of each face, add, and record the sum.

Volume



$$V = 27 \text{ cm}^3$$

Surface Area



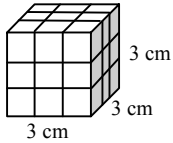
$$SA = 9 \text{ cm}^2 + 9 \text{ cm}^2 + 9 \text{ cm}^2 + 9 \text{ cm}^2 + 9 \text{ cm}^2 + 9 \text{ cm}^2$$

$$SA = 54 \text{ cm}^2$$

Perimeter of the Net

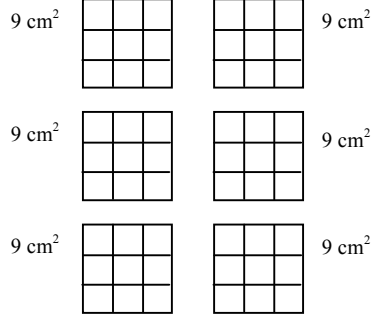
Sketch the net of the cube in the third column. Outline the perimeter with a highlighter, and record its measure.

Volume



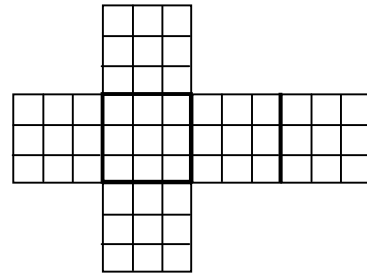
$V = 27 \text{ cm}^3$

Surface Area



$SA = 9 \text{ cm}^2 + 9 \text{ cm}^2 + 9 \text{ cm}^2 + 9 \text{ cm}^2 + 9 \text{ cm}^2 + 9 \text{ cm}^2$
 $SA = 54 \text{ cm}^2$

Perimeter of the Net



$P = 42 \text{ cm}$

Discuss how the three types of measure differ and what is it that they are measuring.

Perimeter is a linear measurement.

It is measuring one dimension, the length around the shape, in units.

Area is a planar measurement.

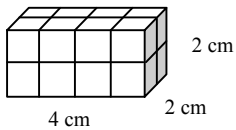
It is measuring in two dimensions, the area in a plane bounded by the shape, in square units.

Volume is a spatial measurement.

It is measuring in three dimensions, the amount of space defined by the solid figure, in cubic units.

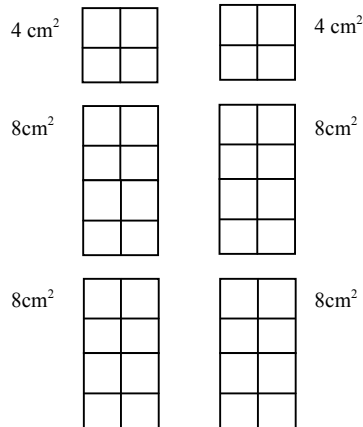
You Try #1: construct and record the measurements for a **2 cm × 4 cm × 2 cm** rectangular prism.

Volume



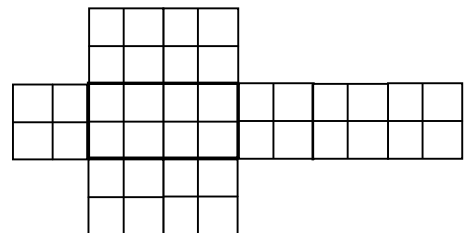
$V = 16 \text{ cm}^3$

Surface Area



$SA = 4 \text{ cm}^2 + 4 \text{ cm}^2 + 8 \text{ cm}^2 + 8 \text{ cm}^2 + 8 \text{ cm}^2 + 8 \text{ cm}^2$
 $SA = 40 \text{ cm}^2$

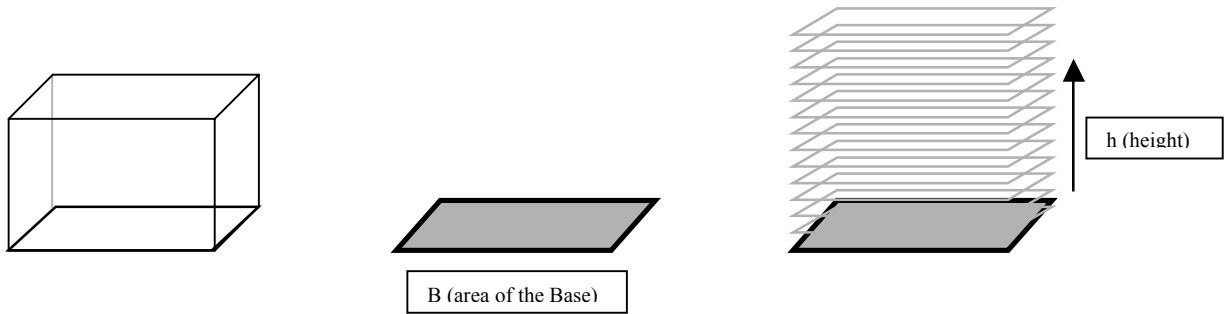
Perimeter of the Net



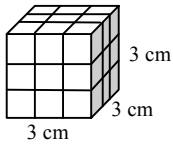
$P = 36 \text{ cm}$

Rectangular Prisms: Units of Measure

Introduce/review the formula $V=Bh$. Use a deck of cards to illustrate the concept. Use the formula to check the first two examples in your notes.



Students may ask, “Why not just multiply length, width, and height?” That will work for rectangular prisms, but not all prisms. $V=Bh$ works for all prisms.

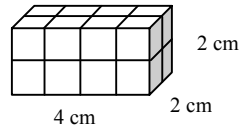


$$V = Bh$$

$$V = (3\text{cm} \times 3\text{cm}) \times 3\text{cm}$$

$$V = 9\text{cm}^2 \times 3\text{cm}$$

$$V = 27\text{cm}^3$$



$$V = Bh$$

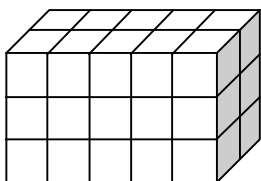
$$V = (4\text{cm} \times 2\text{cm}) \times 2\text{cm}$$

$$V = 8\text{cm}^2 \times 2\text{cm}$$

$$V = 16\text{cm}^3$$

You Try #2: construct a $2\text{ cm} \times 5\text{ cm} \times 3\text{ cm}$ rectangular prism. Record as before and solve for volume using $V=Bh$.

Volume



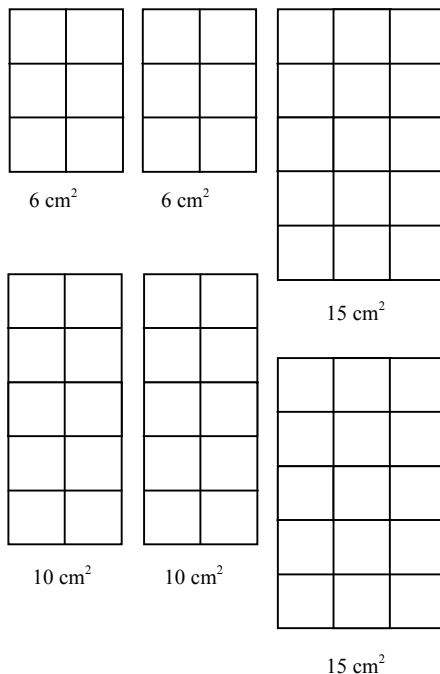
$$V = Bh$$

$$V = (2\text{cm} \times 5\text{cm}) \times 3\text{cm}$$

$$V = 10\text{cm}^2 \times 3\text{cm}$$

$$V = 30\text{cm}^3$$

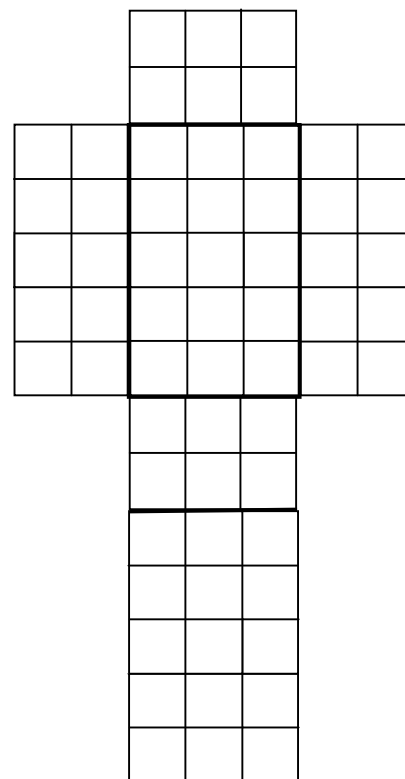
Surface Area



$$SA = 6\text{ cm}^2 + 6\text{ cm}^2 + 10\text{ cm}^2 + 10\text{ cm}^2 + 15\text{ cm}^2 + 15\text{ cm}^2$$

$$SA = 62\text{ cm}^2$$

Perimeter of the Net



$$P = 42\text{ cm}$$

EXTENSIONS:

1. Explore how the perimeter of the net changes based on how the net is structured. Seek to maximize and minimize the perimeter of the net.
2. Choose a specific volume. Explore and chart the various rectangular prisms that share the volume. Compare how the surface area changes.
3. Introduce the formula for the surface area of prisms.
4. Explore triangular prisms using the volume and surface area formulas.

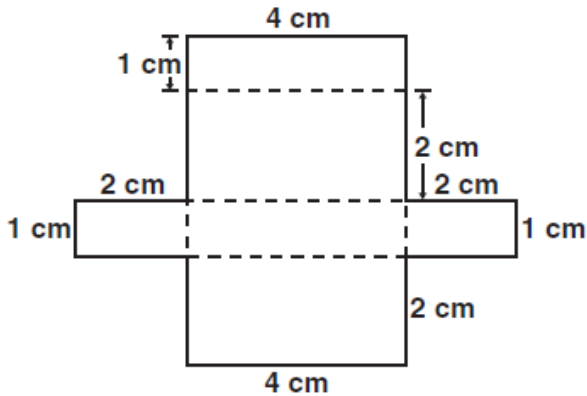
$$SA_{\text{prism}} = PH + 2B$$

Show how these nets can be deconstructed into 3 parts: 2 congruent bases, and 1 large rectangle formed by the side faces of the prism. The height of this large rectangle is the height of the prism; the base of this large rectangle is the perimeter of the prism's Base.

Warm-Up

CST/CAHSEE: Grade 5 MG 1.2

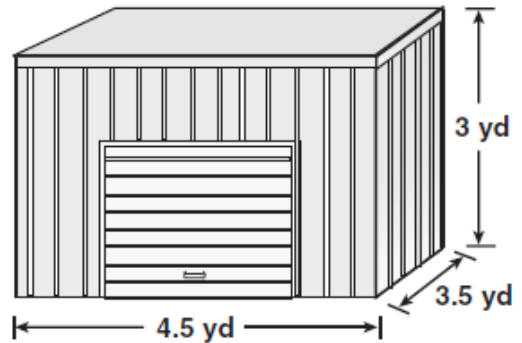
73 What is the surface area of the box formed by the pattern below?



*What is the perimeter of this net?

Review: Grade 5 MG 1.3

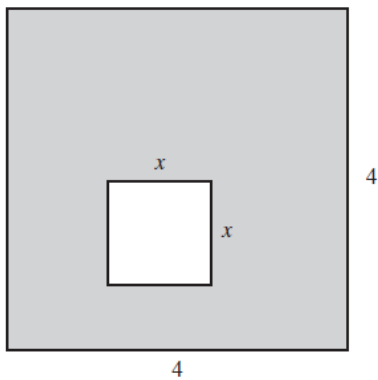
77 What is the volume, in cubic yards, of the storage unit below?



*Draw the net for this rectangular prism.

Current: Grade 6 AF 3.1

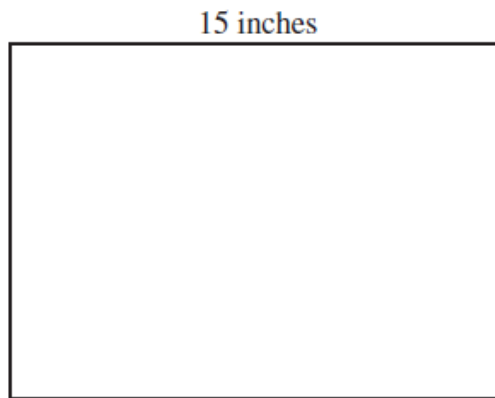
Write an expression describing the shaded region of the square.



*Make a function table to test x when it has values greater than 0 but less than 4.

Other: Grade 6 AF 3.2

The rectangle shown below has length 15 inches and perimeter P inches.



How could you find the height of this rectangle if you knew its perimeter?

If the area is 185 in^2 , what is P ?