Name_____ Class_____ Date_____

5-4

Solving Surface Area Problems

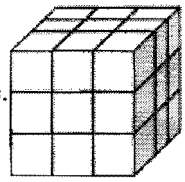
COMMON CORE

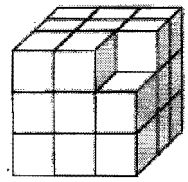
Essential question: *How do you find the surface area of a figure made of prisms?*

CC.7.G.6

1 EXPLORE Comparing the Surface Area of Two Figures

Using centimeter cubes, build the two figures shown.





A Find the surface area of the 3-by-3-by-3 cube.

54 cm^2

B Now find the surface area of the cube with one missing corner.

54 cm^2

C Which figure has a greater surface area: the 3-by-3-by-3 cube, or the same cube with one of the corners missing?

They are the same.

REFLECT

1a. How did you find the surface area of the figures?

Sample answer: I counted the faces of the centimeter cubes that were showing.

1b. Why does it make sense that the surface areas are equal?

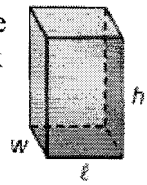
Sample answer: The number of centimeter-cube faces that show is the same for both figures.

1c. What If? If four cubes are taken, one from each corner of the top layer, would this change the surface area?

Sample answer: No, the number of centimeter-cube faces that show would still be the same.

One way to find the surface area of a figure is to make a net, open it up, find the areas of the shapes, and add them together. Another way to find the surface area is to use a formula.

Consider a rectangular prism with length, l, width, w, and height, h. The top and bottom faces have the same area, $A = l \ w$. The front and back faces have the same area, $A = l \ h$.
The left and right faces have the same area, $A = w \ h$.

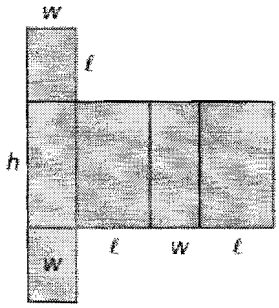


To find the surface area, add the areas of the top, bottom, front, back,

left, and right faces.

$S = lw + lw + lh + lh + wh + wh$

top bottom front back left right



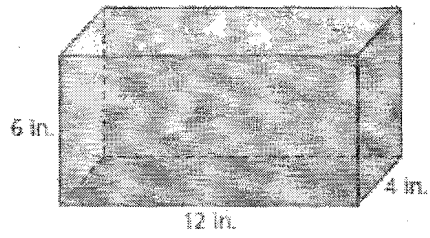
Combine like terms to find the formula for surface area of a rectangular prism.

$S = 2lw + 2lh + 2wh$

2 EXAMPLE Finding the Surface Area of a Rectangular Prism

Felix is making a jewelry box out of balsa wood as a present for his sister. He wants the jewelry box to be 12 inches long, 4 inches wide, and 6 inches tall. How much balsa wood does Felix need?

Step 1: Sketch and label the prism.



Step 2: Find how much balsa wood Felix needs to make his box.

- Use the formula for surface area of a rectangular prism.

  $S = 2lw + 2lh + 2wh$

- Substitute for the length, width, and height.

  $S = 2(12 \cdot 4) + 2(12 \cdot 6) + 2(4 \cdot 6)$

- Simplify each term.

  $S = 96 + 144 + 48$

- Add.

  $S = 288$

Felix needs 288 in^2 of balsa wood for his jewelry box.

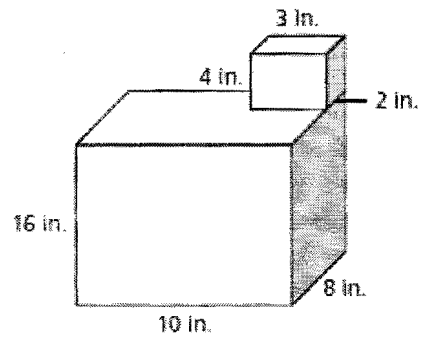
REFLECT

2. Adapt the formula for the surface area of a rectangular prism for a cube. What is the formula for the surface area of a cube?

$S = 6lw$

3 EXAMPLE Finding the Surface Area of a Composite Solid

Matthew builds a model of a simple flat-roofed house with a chimney on top. He wants to paint both the house and chimney with red paint. How many square inches will he paint?



A Find the surface area of the chimney.

$S = 2lw + 2lh + 2wh$

$S = 2(3 \cdot 2) + 2(3 \cdot 4) + 2(2 \cdot 4)$

$S = 12 + 24 + 16$

$S = 52$

The surface area of the chimney is 52 square inches.

B Find the surface area of the house. Do not include the bottom of the house.

$S = lw + 2lh + 2wh$

$S = (10 \cdot 8) + 2(10 \cdot 16) + 2(8 \cdot 16)$

$S = 80 + 320 + 256$

$S = 656$

The surface area of the house is 656 square inches.

C Add the surface areas of the chimney and the house.

$S = 52 + 656 = 708$

D Part of the chimney and house overlap. The overlapping area has a length of 3 inches and a width of 2 inches, or an area of 6 square inches. Subtract two times that area.

$S = 708 - 2(6) = 696$

Matthew will paint 696 square inches.

REFLECT

3a. Explain why you subtract the overlap area two times.

Sample answer: You have to subtract it from the surface area of both the chimney and the house, or two times.

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3b. Matthew decides to add an extension to the right side of the house that is 12 inches tall, 6 inches long, and 4 inches wide. If he repaints the model blue, not including the bottom, how many square inches will