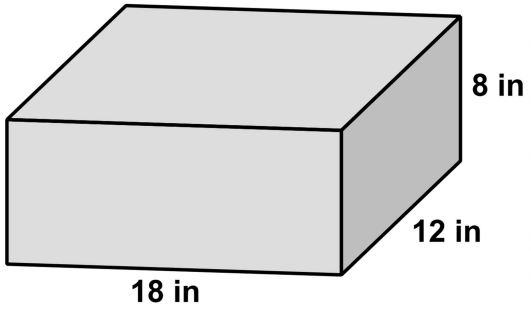
Name: _____ Date: _____

MODELING WITH VOLUME AND SURFACE AREA
N-GEN MATH® 6

Volume and surface area arise in the real-world all the time. We often need to know how much something will hold (volume) or how much it will take to cover something (surface area). In this lesson we will investigate real-world problems involving both.

***Exercise* #1:** A box is in the shape of a **right rectangular prism** made from cardboard has dimensions of 18 inches, by 12 inches, by 8 inches, as shown in the diagram.

(a) Find the volume of the box? Show your calculations and use appropriate units.

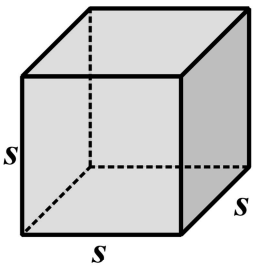


(b) Draw a net for the object below. Label all relevant dimensions.

(c) Find the **amount** of cardboard that is needed to make the box in square inches.

We often are presented with formulas for volume and surface area in geometry books. Let's find one such formula by modeling the surface area of a **cube** in the next exercise.

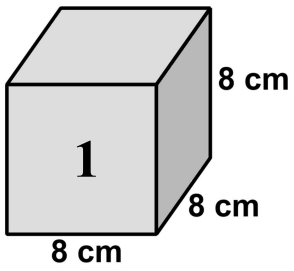
***Exercise* #2:** Consider the cube shown at the right. All the side lengths of the cube have been marked with the variable *s*.

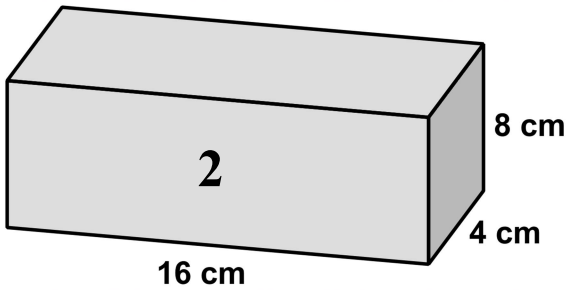


(a) The formula for the surface area of a cube is given by $SA = 6s^2$. Explain where this equation comes from.

(b) Using the formula above, find the surface area of a cube whose sides are all $\frac{2}{3}$ inches.

***Exercise* #3:** Two boxes used to hold sugar are shown below. One is a cube with side lengths that are 8 centimeters each. The other is a right rectangular prism (box) that is 16 cm by 4 centimeters by 8 centimeters.

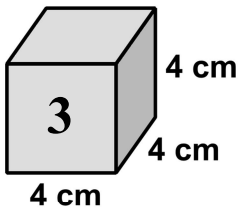




(a) Which box, if either, would hold more sugar? Show how you determined your answer.

(b) The boxes will be closed on all sides by pieces of wood. If the wood is painted, which box will require more paint? Explain how you decided.

(c) A third box is designed so that it is also a cube that has sides that are half of Solid 1's. Find the volume of Solid 3. Then find the ratio of the volume of Solid 1 to the volume of Solid 3. Explain why the ratio is **not** 2 to 1.



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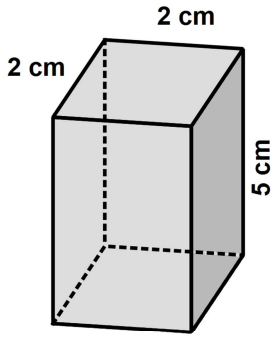
MODELING WITH VOLUME AND SURFACE AREA
N-GEN MATH® 6 HOMEWORK

USING YOUR MATH

1. Which of the following is the surface area, in square centimeters, of the right rectangular prism shown?

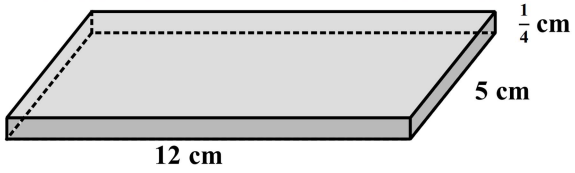


(1) 20 (3) 32

(2) 28 (4) 48

_____

2. A thin rectangular sheet is shown to the right. It is essentially a very short right rectangular prism, whose thickness is only $\frac{1}{4}$ centimeter. Which of the following is the volume of this rectangular sheet?



(1) 15 cm^3 (3) 45 cm^3

(2) 25 cm^3 (4) 60 cm^3

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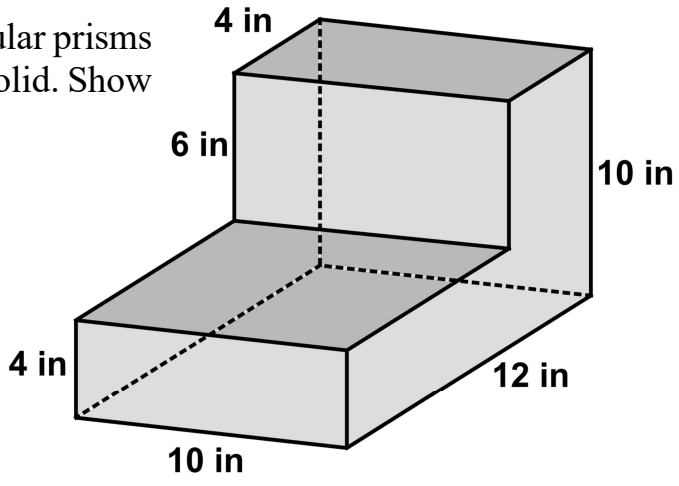
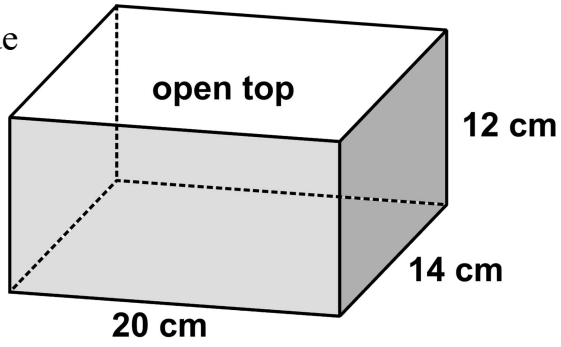
3. The following solid is made from right rectangular prisms joined together. Determine the volume of this solid. Show the work that leads to your answer.



4. A cardboard box in the shape of a right rectangular prism is being made. The box **does not have a top**. It has dimensions as shown below.

   (a) Draw a net for the surface of this box. Do not include the top. Label your net with relevant lengths.

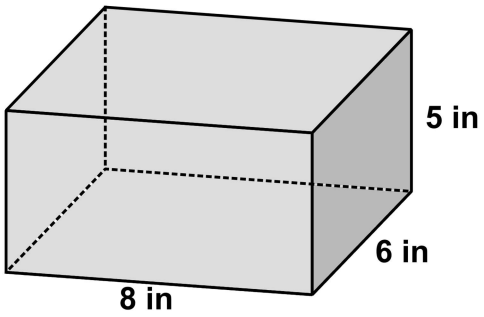


   (b) How many square inches of cardboard will be needed to make this box? Show the calculations you used to find your answer.

The part of a prism's surface area that is on the **lateral faces** is known as **lateral surface area**. This is the total surface area without the bases. Let's explore this in the final problem.

5. A rectangular solid is shown below.

   (a) Determine its lateral surface area. Show the calculations you use to find your answer.



   (b) What is the perimeter of one of the two bases?

   (c) What is the ratio of the lateral surface area in (a) to the perimeter you found in (b)? Express as a fraction in simplest form. What property of the box is this ratio equal to?