LESSON MAKER PRO

Size Up Designs

Use scale factors to plan three-dimensional models.

HIGH SCHOOL · MM.D3D.A

MM.D3D.A "Two- and three-dimensional representations, coordinates systems, geometric transformations, and scale models are useful tools in planning, designing, and constructing solutions to real-world problems."

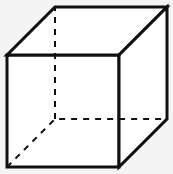
NAME _____ DATE _____

SCALING A SOLID

For similar solids, a scale factor multiplies every length by the same number. Surface area is multiplied by the scale factor squared, while volume is multiplied by the scale factor cubed. Use the dimensions on a solid to find its starting measurement before scaling.

WORKED EXAMPLE

The cube shown is enlarged by a scale factor of 3. What is the enlarged cube's volume?

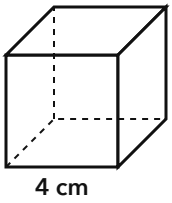


1. Original volume: $7 \times 7 \times 7 = 343$ cm^3.
2. Volume multiplier: $3 \times 3 \times 3 = 27$.
3. Enlarged volume: $343 \times 27 = 9{,}261$ cm^3.

Answer: 9,261 cm^3

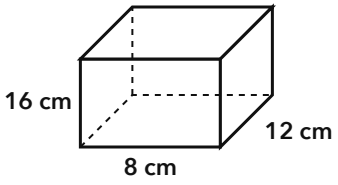
PRACTICE 6 problems

1 Enlarge the cube shown by a scale factor of 2. What is its new volume?



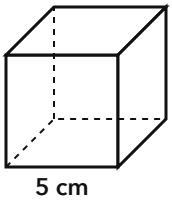
ANSWER _____

2 Reduce the rectangular prism shown by a scale factor of 1/2. What is its new volume?



ANSWER _____

3 The cube shown is a scale model at 1/4 of its intended size. What are the intended cube's edge length and volume?



ANSWER _____

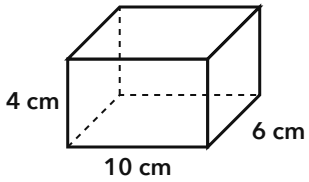
4 A solid has a volume of 48 cm^3. Every length is doubled. What is its new volume?

ANSWER _____

5 A larger version of a solid has a volume of 1,000 cm^3. The original volume is 8 cm^3. What scale factor was applied to its lengths?

ANSWER _____

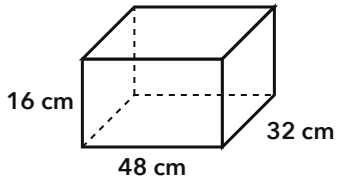
6 Make a model of the rectangular prism shown at 1/2 scale. What is the model's volume?



ANSWER _____

APPLY IT Show your work

1 A student is building a 1/4-scale model of the storage box shown for a stage design. What volume will the model occupy?



ANSWER _____

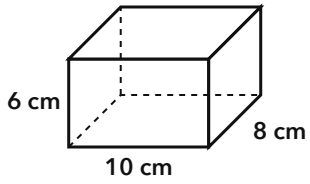
2 A designer 3D-prints a solid miniature game piece using 16 cm^3 of plastic. A larger version keeps the same shape but makes every length 5 times as large. How much plastic will the larger piece use?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A designer doubles every length of the rectangular display case shown. Find its new surface area and volume. Explain why they change by different factors.



WORK SPACE AND ANSWER

Size Up Designs

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Enlarge the cube shown by a scale factor of 2. What is its new volume?	**512 cm^3**
2	Reduce the rectangular prism shown by a scale factor of 1/2. What is its new volume?	**192 cm^3**
3	The cube shown is a scale model at 1/4 of its intended size. What are the intended cube's edge length and volume?	**Edge length: 20 cm. Volume: 8,000 cm^3.**
4	A solid has a volume of 48 cm^3. Every length is doubled. What is its new volume?	**384 cm^3**
5	A larger version of a solid has a volume of 1,000 cm^3. The original volume is 8 cm^3. What scale factor was applied to its lengths?	**5**
6	Make a model of the rectangular prism shown at 1/2 scale. What is the model's volume?	**30 cm^3**

PART 2 · APPLY IT

1. **384 cm^3** The model's dimensions are 12 cm, 8 cm, and 4 cm. Its volume is 12 × 8 × 4 = 384 cm^3.
2. **2,000 cm^3** Volume is multiplied by 5 × 5 × 5 = 125. The larger piece uses 16 × 125 = 2,000 cm^3 of plastic.

CHALLENGE

New surface area: 1,504 cm^2. New volume: 3,840 cm^3. Doubling lengths multiplies surface area by 2 × 2 = 4 and volume by 2 × 2 × 2 = 8.

Accept calculations using either scaled dimensions or the appropriate scale-factor multiplier. In the challenge, the original surface area is 376 cm^2 and the original volume is 480 cm^3.