LESSON MAKER PRO

Scale Up Solids

Use similarity to find lengths, areas, and volumes.

HIGH SCHOOL · G.3D.1.2

G.3D.1.2 "Use ratios derived from similar three-dimensional figures to make conjectures, generalize, and to solve for unknown values such as angles, side lengths, perimeter, and circumference of a face, area of a face, and volume."

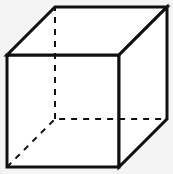
NAME _____ DATE _____

THE BIG IDEA

For similar solids, a length scale factor of k changes lengths and face perimeters by k, face areas by k^2, and volumes by k^3. Corresponding angles stay equal.

WORKED EXAMPLE

The cube shown has an edge length of 7 cm. A similar cube has an edge length of 21 cm. Find the larger cube's volume.

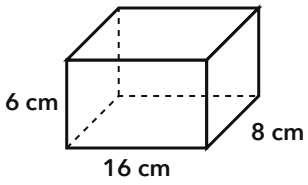


1. Length scale factor: 21/7 = 3.
2. Shown cube's volume: $7^3 = 343$ cm^3.
3. Larger cube's volume: $343 \times 3^3 = 9261$ cm^3.

Answer: 9261 cm^3

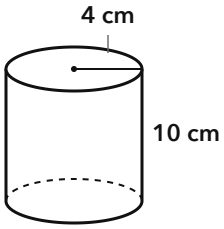
PRACTICE 6 problems

1 A similar rectangular prism has a length of 24 cm. What is its height?



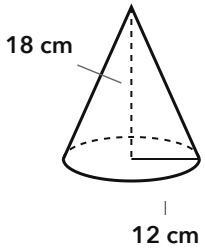
ANSWER _____

2 A similar cylinder has a radius of 12 cm. Find the circumference of its circular base in terms of π.



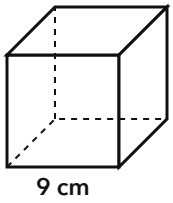
ANSWER _____

3 A similar cone has a height of 6 cm. Find the area of its circular base in terms of π.



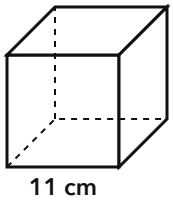
ANSWER _____

4 A similar cube has an edge length of 18 cm. Find its volume.



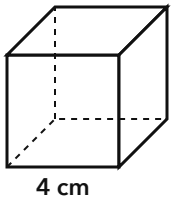
ANSWER _____

5 A similar cube has an edge length of 33 cm. Find the perimeter of one square face of the larger cube.



ANSWER _____

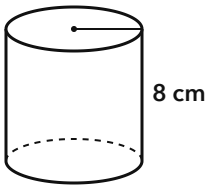
6 A similar cube has a volume of 1728 cm^3. Find its edge length.



ANSWER _____

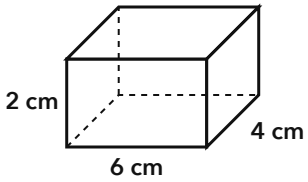
APPLY IT Show your work

1 The cylinder shown is a 3D-printed game token. A similar token is 12 cm tall. A design covers 32 cm^2 of the smaller token's curved surface. What area will the matching design cover on the larger token?



ANSWER _____

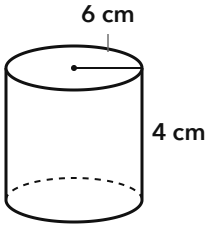
2 A merch box is made in a larger, similar size with a length of 18 cm. How much can the larger box hold?



ANSWER _____

CHALLENGE One step up

The cylinder shown is a candle mold. A similar mold has a circular base area of 81π cm^2. Find the larger mold's height and volume. In one sentence, explain why you cannot use the base-area ratio alone to scale the volume.



WORK SPACE AND ANSWER

ANSWER KEY # Scale Up Solids

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A similar rectangular prism has a length of 24 cm. What is its height?	**9 cm**
2	A similar cylinder has a radius of 12 cm. Find the circumference of its circular base in terms of π.	**24π cm**
3	A similar cone has a height of 6 cm. Find the area of its circular base in terms of π.	**16π cm^2**
4	A similar cube has an edge length of 18 cm. Find its volume.	**5832 cm^3**
5	A similar cube has an edge length of 33 cm. Find the perimeter of one square face of the larger cube.	**132 cm**
6	A similar cube has a volume of 1728 cm^3. Find its edge length.	**12 cm**

PART 2 · APPLY IT

1. **72 cm^2** The length scale factor is 12/8 = 3/2. Multiply 32 by $(3/2)^2$ to get 72 cm^2.
2. **1296 cm^3** The shown box holds 6 × 4 × 2 = 48 cm^3. The length scale factor is 18/6 = 3, so the larger box holds 48 × 3^3 = 1296 cm^3.

CHALLENGE

The larger mold is 6 cm tall and has a volume of 486π cm^3. The base-area ratio is 9/4, but volume also scales with height, so the volume ratio is 27/8.

Accept equivalent exact forms such as 24 × π cm. For the challenge, accept a clear explanation that the larger mold's height changes as well as its base area.