LESSON MAKER PRO

Build to Fit

Test box designs against real limits

HIGH SCHOOL · MM.D3D.A.9

MM.D3D.A.9 "Use the Mathematical Modeling Cycle to solve real-world problems involving the design of three-dimensional objects."

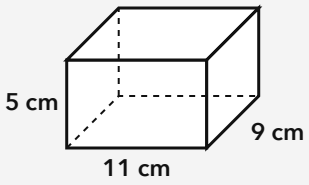
NAME _____ **DATE** _____

MODEL, CALCULATE, CHECK

Model a box as a rectangular prism. Its capacity is V = lwh. For an open-top box, the material area is A = lw + 2lh + 2wh. Compare your result with the design limit, then check whether your model accounts for details such as seams.

WORKED EXAMPLE

Find the capacity and material area of the open-top box shown. Ignore seams.



1. Capacity: V = 11 × 9 × 5 = 495 cm^3.
2. Material: A = (11 × 9) + 2(11 × 5) + 2(9 × 5).
3. A = 99 + 110 + 90 = 299 cm^2.

Answer: Capacity: 495 cm^3; material area: 299 cm^2.

PRACTICE 4 problems

1 A storage box is 4 cm by 6 cm by 10 cm. Find its capacity.

ANSWER _____

2 An open-top tray is 8 cm by 4 cm by 6 cm. Find its material area. Ignore seams.

ANSWER _____

3 A 10 cm by 6 cm by 4 cm box needs to hold 250 cm^3. Give its capacity and decide if it is large enough.

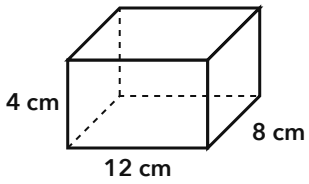
ANSWER _____

4 An open-top box has a 12 cm by 4 cm base and a height of 6 cm. Is 250 cm^2 of material enough? Give the area needed and your decision. Ignore seams.

ANSWER _____

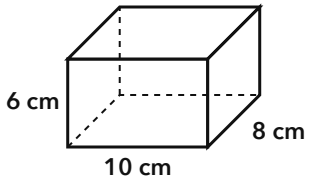
APPLY IT Show your work

1 Your club needs an open-top merch box that holds at least 350 cm^3. Does the box shown work? Give its capacity and explain.



ANSWER _____

2 A gaming booth has 300 cm^2 of cardboard for the open-top prize bin shown. Is that enough? Give the area needed and explain. Ignore seams.



ANSWER _____

CHALLENGE One step up

An open-top snack bin needs at least 300 cm^3 of capacity. Its base is 10 cm by 6 cm, and you have 270 cm^2 of cardboard. Find every whole-number height, in centimeters, that meets both limits. Ignore seams. Show how you checked both limits.

WORK SPACE AND ANSWER

Build to Fit

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A storage box is 4 cm by 6 cm by 10 cm. Find its capacity.	**240 cm^3**
2	An open-top tray is 8 cm by 4 cm by 6 cm. Find its material area. Ignore seams.	**176 cm^2**
3	A 10 cm by 6 cm by 4 cm box needs to hold 250 cm^3. Give its capacity and decide if it is large enough.	**240 cm^3; no, it is not large enough.**
4	An open-top box has a 12 cm by 4 cm base and a height of 6 cm. Is 250 cm^2 of material enough? Give the area needed and your decision. Ignore seams.	**240 cm^2; yes, the material is enough.**

PART 2 · APPLY IT

1. **Yes. Its capacity is 384 cm^3, which exceeds 350 cm^3.** Multiply the three dimensions: 12 × 8 × 4 = 384 cm^3. Compare 384 with the required 350.
2. **Yes. The bin needs 296 cm^2, leaving 4 cm^2.** Find the base and four sides: 10 × 8 + 2(10 × 6) + 2(8 × 6) = 296 cm^2. This is less than the available 300 cm^2.

CHALLENGE

The heights are 5 cm and 6 cm. Capacity is 60h, so h must be at least 5. Material area is 60 + 32h, so h can be no more than 6 as a whole number. At h = 5, capacity is 300 cm^3 and area is 220 cm^2; at h = 6, capacity is 360 cm^3 and area is 252 cm^2.

Accept equivalent calculations with correct units. Area calculations exclude a lid and ignore seams as directed.