

Geometry · Cross Sections, Solids of Rotation and Geometric Modeling · Worksheet

Common Core G-GMD.B.4, G-MG.A.1, G-MG.A.2, G-MG.A.3 · mathovore.fr

Name: _____ Date: ____/____/____ Score: _____

These problems practice standards G-GMD.B.4 and G-MG.A.1 to A.3: cross sections of solids, solids made by rotation, modeling objects with shapes, density, and design with constraints.

The 24 problems move from naming slices to rotation volumes and density, then to design questions about fences, cans, boxes and banners. Draw a sketch whenever it helps.

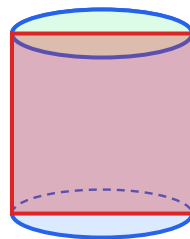
GeometryCommon Core: G-GMD.B.4 · G-MG.A.1 · G-MG.A.2 · G-MG.A.3

Problem 1: Slicing a cube

A plane cuts a cube parallel to its base. Name the shape of the cross section. If the cube has an edge of 6 cm, find the area of the cross section.

Problem 2: Rectangle from a cylinder

A cylinder has a radius of 4 cm and a height of 10 cm. A plane passes through its axis perpendicular to the bases. Describe the cross section and find its area.

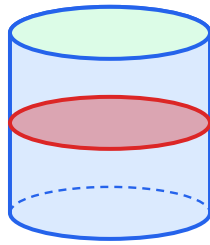


$$r = 4 \text{ cm}, h = 10 \text{ cm}$$

A cut through the axis.

Problem 3: Circle from a cylinder

A plane cuts a cylinder with a radius of 5 cm parallel to its bases. Name the cross section and find its area and circumference in terms of π .

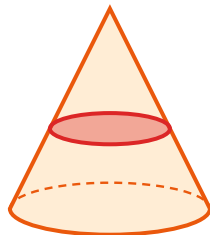


$$r = 5 \text{ cm}$$

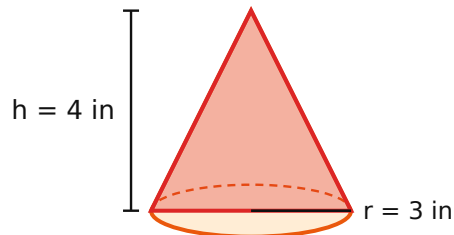
A cut parallel to the bases.

Problem 4: Cutting a cone

A cone has a radius of 3 in and a height of 4 in. (a) What shape is the cross section when a plane cuts parallel to the base? (b) What shape is it when the plane passes through the apex and the center of the base? (c) Find the area of the shape in part (b).



(a) parallel to the base

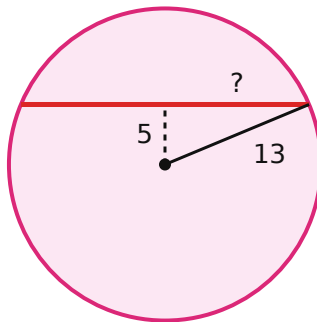


(b) through the apex

Two cuts of a cone.

Problem 5: Slicing a sphere

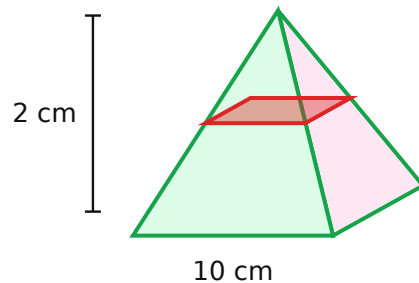
A sphere has a radius of 13 in. A plane cuts it at a distance of 5 in from the center. Find the radius and area of the circular cross section.



The slice is a circle.

Problem 6: Slicing a pyramid

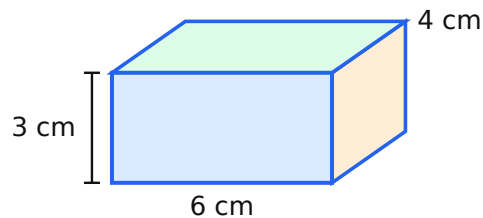
A square pyramid has a base side of 10 cm and a height of 12 cm. A plane parallel to the base cuts the pyramid halfway up. Find the side length and area of the cross section.



A cut halfway up.

Problem 7: Slices of a prism

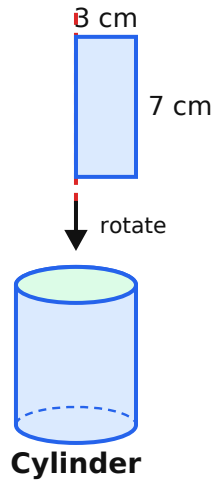
A rectangular prism measures 6 cm by 4 cm by 3 cm. Find the area of the cross section for a cut parallel to each pair of faces.



A rectangular prism.

Problem 8: Rotating a rectangle

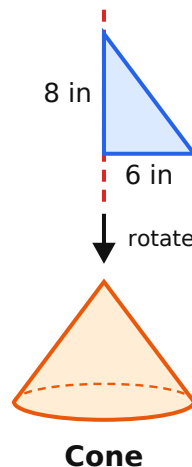
A rectangle 3 cm wide and 7 cm tall is rotated about its 7 cm side. Name the solid, give its radius and height, and find its volume in terms of π .



Rotate the shape about the dashed axis.

Problem 9: Rotating a right triangle

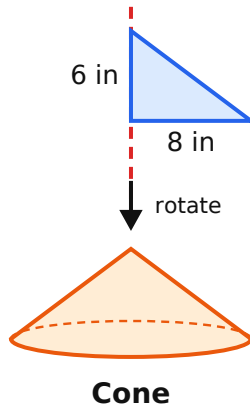
A right triangle with legs 6 in and 8 in is rotated about the 8 in leg. Name the solid, find its slant height, and find its volume in terms of π .



Rotate the shape about the dashed axis.

Problem 10: Rotating about the other leg

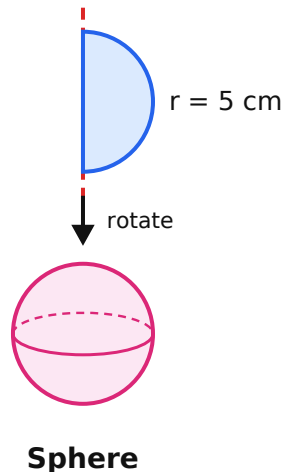
The same right triangle with legs 6 in and 8 in is now rotated about the 6 in leg. Find the volume of the new cone in terms of π , and tell how much more it holds than the cone in the previous problem.



Rotate the shape about the dashed axis.

Problem 11: Rotating a semicircle

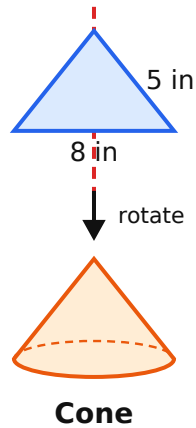
A semicircle with a radius of 5 cm is rotated about its diameter. Name the solid and find its volume in terms of π and to the nearest hundredth.



Rotate the shape about the dashed axis.

Problem 12: Rotating a triangle about its altitude

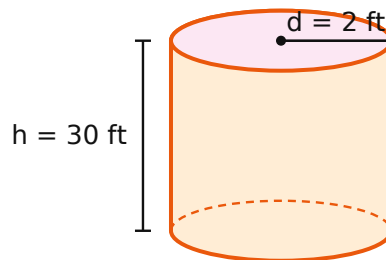
An isosceles triangle has a base of 8 in and a height of 5 in. It is rotated about its altitude. Name the solid and find its volume in terms of π and to the nearest hundredth.



Rotate the shape about the dashed axis.

Problem 13: Modeling a tree trunk

Priya models a tree trunk as a cylinder with a diameter of 2 ft and a height of 30 ft. Estimate its volume to the nearest hundredth.



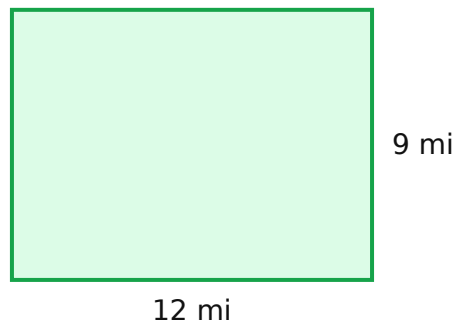
A tree trunk modeled as a cylinder.

Problem 14: Population density

A city has 45,000 people living in 30 mi^2 . Find the population density.

Problem 15: Density of a county

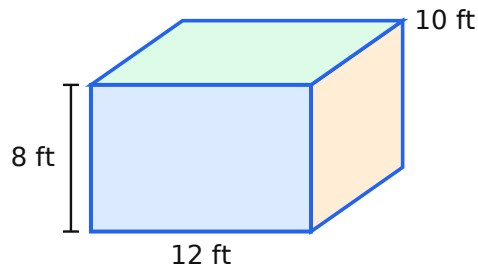
A rectangular county measures 12 mi by 9 mi and has 54,000 residents. Find its area and its population density.



A rectangular county.

Problem 16: Heating a room

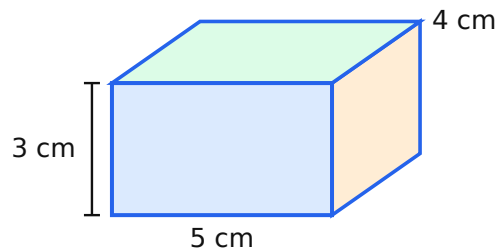
A furnace must supply 6 BTUs of heat for every cubic foot of a room. Ethan's room is 12 ft by 10 ft with an 8 ft ceiling. How many BTUs are needed?



The room.

Problem 17: Density of a metal block

A metal block measures 5 cm by 4 cm by 3 cm and has a mass of 162 g. Find its density in grams per cubic centimeter.



A metal block.

Problem 18: Comparing towns

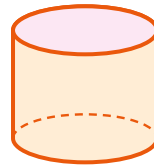
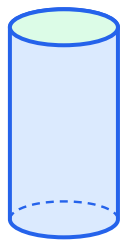
Town A has 9,600 residents on 12 mi^2 . Town B has 7,350 residents on 7 mi^2 . Which town is more densely populated, and by how many people per square mile?

Problem 19: Fencing a pen

Liam has 48 ft of fence for a rectangular dog pen and wants the largest area. Using whole-number side lengths, which dimensions should he use? How much more area is that than an 8 ft by 16 ft pen?

Problem 20: Two soup cans

A company compares two closed cans that each hold $72\pi \text{ cm}^3$. Can A has a radius of 3 cm and a height of 8 cm. Can B has a radius of 4 cm and a height of 4.5 cm. Verify the volumes, then find the total surface area of each. Which can needs less metal?



Can A: $r = 3 \text{ cm}$, $h = 8 \text{ cm}$ Can B: $r = 4 \text{ cm}$, $h = 4.5 \text{ cm}$

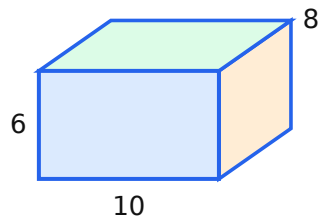
Two cans that each hold $72\pi \text{ cm}^3$.

Problem 21: Sizing a water tank

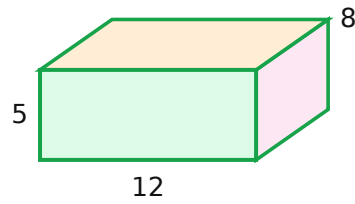
A cylindrical tank has a radius of 3 ft and must hold at least 1,000 gallons. Use $1 \text{ ft}^3 \approx 7.5$ gallons. What is the least height, to the nearest tenth of a foot, that works?

Problem 22: Choosing a shipping box

Maya can ship an item in Box 1 (10 in by 8 in by 6 in) or Box 2 (12 in by 8 in by 5 in). Cardboard costs \$0.02 per square inch. Show that the volumes are equal, then find which box is cheaper to make and by how much.



Box 1: $10 \times 8 \times 6$ in

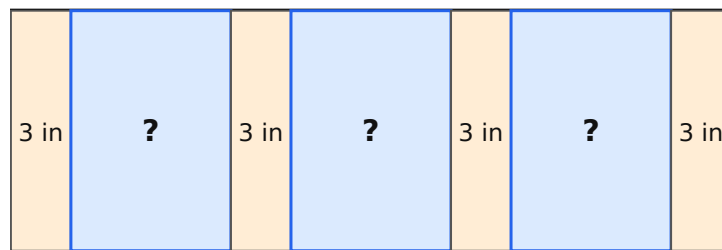


Box 2: $12 \times 8 \times 5$ in

Box 1 and Box 2.

Problem 23: Banner grid

A banner is 36 in wide. A designer leaves a 3 in margin on each side and uses three equal columns separated by two gutters, each 3 in wide. Find the width of one column.



Banner width: 36 in

Grid for a 36-inch banner.

Problem 24: Crowded field

A concert field measures 120 yd by 80 yd and holds 14,400 people. (a) Find the density in people per square yard. (b) Safety rules allow at most 2 people per square yard. How many more people may be admitted?