

Cross Sections, Rotations and Geometric Modeling

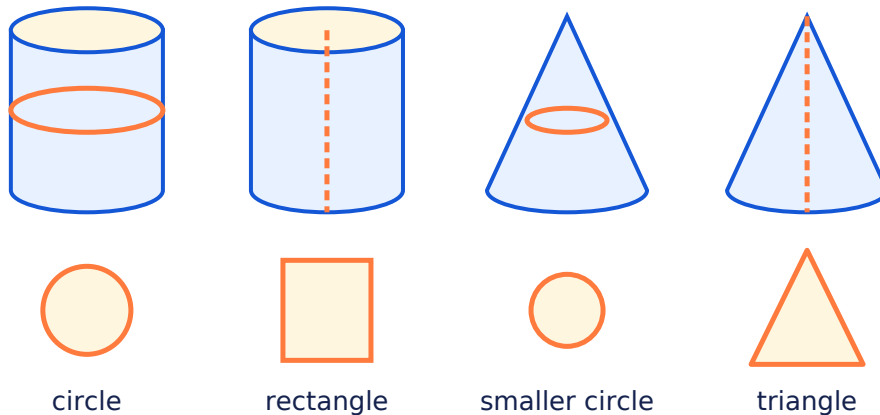
Grade 10 – Geometry math · Worksheet · Standards: G-GMD.B.4, G-MG.A.1, G-MG.A.2, G-MG.A.3

Name: _____ Date: _____ Class: _____

These problems cover cross sections of solids, solids made by rotation, and modeling with density and design constraints (G-GMD.B.4, G-MG.A.1, G-MG.A.2 and G-MG.A.3). Early problems name shapes; later problems model real objects. Towns, rooms, cans and tanks supply the contexts.

Standards: G-GMD.B.4, G-MG.A.1, G-MG.A.2, G-MG.A.3 · **Level:** Grade 10 Geometry

Problem 1 Name the Cross Section (easy)



Four familiar cuts.

Name the shape of each cross section. (a) A plane parallel to the base of a cylinder. (b) A plane through the axis of a cylinder. (c) A plane parallel to the base of a cone. (d) A plane through the apex of a cone perpendicular to its base. (e) A plane through the center of a sphere.

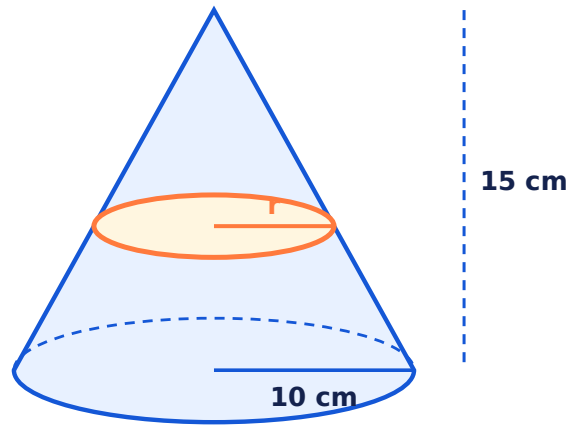
Problem 2 Slices of a Rectangular Box (easy)

A rectangular box measures 8 inches by 5 inches by 3 inches. Find the area of the cross section when a plane cuts parallel to (a) the 8 by 5 face and (b) the 5 by 3 face.

Problem 3 Slicing a Pyramid at Half Height (medium)

A rectangular pyramid has a base of 12 feet by 8 feet. A plane parallel to the base cuts the pyramid halfway between the base and the apex. Find the dimensions and area of the cross section.

Problem 4 Slicing a Cone (medium)



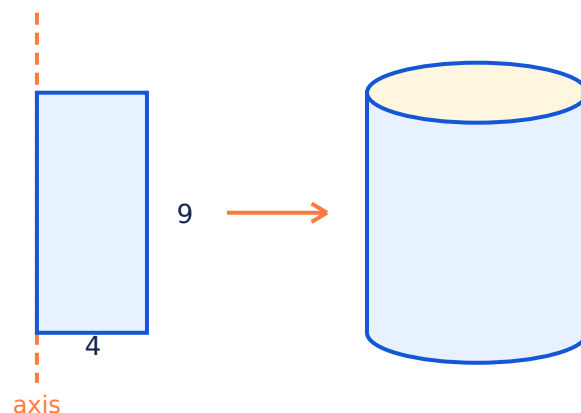
The plane is 9 cm from the apex.

A cone has radius 10 centimeters and height 15 centimeters. A plane parallel to the base is 9 centimeters from the apex. Find the radius and area of the circular cross section.

Problem 5 Slicing a Sphere (medium)

A sphere has radius 17 centimeters. A plane cuts it 8 centimeters from the center. Find the radius and the area of the cross-section circle.

Problem 6 Rectangle Rotated into a Cylinder (medium)

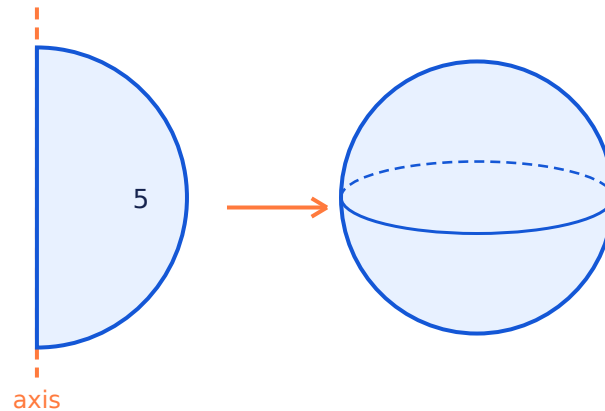


Rectangle turned about its 9-unit side.

A rectangle 4 feet wide and 9 feet tall is rotated about its 9-foot side. Name the solid and find its volume, exactly and to the nearest tenth.

Problem 7 Triangle Rotated Two Ways (hard)

A right triangle has legs 6 and 8. (a) Rotate it about the leg of length 8 and find the volume. (b) Rotate it about the leg of length 6 and find the volume. Compare.

Problem 8 Half Disk Rotated into a Sphere (hard)

Half disk turned about its diameter.

A half disk of radius 5 centimeters is rotated about its straight edge. Name the solid and find its volume to the nearest tenth.

Problem 9 Isosceles Triangle About Its Altitude (hard)

An isosceles triangle has base 10 inches and altitude 12 inches. It is rotated about its altitude. Name the solid and find its volume to the nearest tenth.

Problem 10 Population Density (medium)

A metropolitan area has 842,600 people living on 197 square miles. Find its population density to the nearest whole number of people per square mile.

Problem 11 Mass from Density (medium)

An aluminum rod is a cylinder with radius 3 centimeters and length 10 centimeters. Aluminum has density 2.7 grams per cubic centimeter. Find the mass of the rod to the nearest gram.

Problem 12 Heating a Room (medium)

A room is 18 feet long, 14 feet wide and 8 feet high. A rule of thumb says heating needs 22 BTUs per cubic foot. (a) How many BTUs does the room need? (b) A heater is rated at 40,000

BTUs. Is it enough?

Problem 13 Does the Soup Can Match Its Label? (medium)

A soup can has diameter 6.6 centimeters and height 10.2 centimeters, and its label claims 350 milliliters ($1 \text{ mL} = 1 \text{ cm}^3$). Model the can as a cylinder. Is the claim reasonable?

Problem 14 Volume of a Tree Trunk (hard)

A tree trunk is modeled as a cylinder 30 feet tall with a circumference of 94 inches. Find its radius in inches and its volume in cubic feet, to the nearest tenth.

Problem 15 Design a Can (hard)

A can must hold exactly 500 cubic centimeters and its height must equal twice its radius. Find the radius and height to the nearest tenth of a centimeter.

Problem 16 Which Town Is Denser? (medium)

Town A has 18,400 residents on 7.2 square miles. Town B has 31,500 residents on 13.5 square miles. Which town is denser, and by how many people per square mile? Round to the nearest whole number.

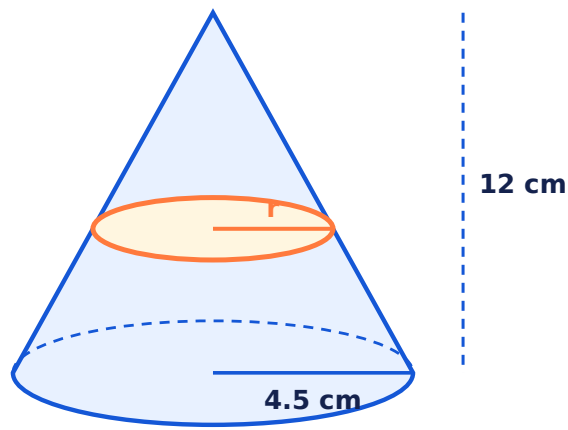
Problem 17 Tank Design (hard)

A cylindrical tank with radius 5 feet must hold at least 12,000 gallons. (1 cubic foot is about 7.48 gallons.) How tall must the tank be, to the nearest tenth of a foot?

Problem 18 Cans in a Box (hard)

Twelve cylindrical cans, each with diameter 6.4 centimeters and height 11 centimeters, are packed in 3 rows of 4 in a box. The box fits them exactly. What percent of the box volume do the cans fill? Round to the nearest tenth of a percent.

Problem 19 Water in a Conical Cup (hard)



Water surface 8 cm from the tip.

A conical paper cup has rim radius 4.5 centimeters and height 12 centimeters. Water fills it to a depth of 8 centimeters measured from the tip. Find the radius of the water surface, the volume of water, and the fraction of the cup that is full.

Problem 20 Shipping Tube Box (hard)

A cylindrical tube 36 inches long with diameter 4.5 inches is shipped in a box with a square base that just fits it (4.5 by 4.5 by 36 inches). Find the volume of the box, the volume of the tube, and the percent of the box that is empty. Round to the nearest tenth.