

Unit 1: Solid Geometry and Modeling

Practice Workbook. The same problems, in the same order, as the Practice sections of the online lessons.

Name _____ Period _____

Lesson 1.1 — Cross-Sections and Solids of Revolution

FLUENCY

1. Name the cross-section of a cube cut by a plane parallel to one face.

2. Name the cross-section of a cylinder cut by a plane through its axis.

3. Name the cross-section of a cone cut by a plane parallel to its base.

4. Name the cross-section of a square pyramid cut by a vertical plane through the apex and the midpoints of two opposite base edges.

5. What solid is formed by rotating a rectangle 360° about one of its sides?

6. What solid is formed by rotating a semicircle 360° about its diameter?

7. What is the greatest number of sides a plane section of a triangular prism can have? Explain.

8. Every plane section of a sphere is what shape, and where is the largest one?

APPLICATION

9. A log is modeled as a cylinder of radius 0.3 m and length 4 m. What cross-section would a sawmill measure to estimate its volume, what is its area, and what is the volume?

10. A 3 cm by 5 cm rectangle is rotated about its 5 cm side. Name the solid and find its volume.

11. A right triangle with legs 6 cm and 4 cm is rotated about the 6 cm leg. Name the solid and find its volume.

CHALLENGE

12. A cube has edge 4. Find the exact area of (a) the triangular cross-section through the three vertices adjacent to one corner and (b) the hexagonal cross-section through the midpoints of six edges.

REVIEW

13. In a right triangle, an acute angle is 32° and the adjacent leg is 38. Find the opposite leg. Round to the nearest tenth.

14. A 45° - 45° - 90° triangle has legs of length 5. Find the hypotenuse.

15. Triangle ABC is similar to triangle DEF . $AB = 12$ and the corresponding side $DE = 6$. If $BC = 20$, find EF , and the ratio of the triangles' areas.

Lesson 1.2 — Why the Volume Formulas Work

FLUENCY

1. Find the volume of a cylinder with radius 9 cm and height 3 cm. Give an exact answer and, if it involves π , a decimal to the nearest tenth.

2. Find the volume of a cylinder with radius 6 cm and height 8 cm. Give an exact answer and, if it involves π , a decimal to the nearest tenth.

3. Find the volume of a rectangular prism 9 cm by 15 cm by 20 cm. Give an exact answer and, if it involves π , a decimal to the nearest tenth.

4. Find the volume of a square pyramid with base edge 15 cm and height 11 cm. Give an exact answer and, if it involves π , a decimal to the nearest tenth.

5. Find the volume of a square pyramid with base edge 5 cm and height 10 cm. Give an exact answer and, if it involves π , a decimal to the nearest tenth.

6. Find the volume of a cylinder with radius 11 cm and height 11 cm. Give an exact answer and, if it involves π , a decimal to the nearest tenth.

7. Find the volume of a cylinder with radius 8 cm and height 19 cm. Give an exact answer and, if it involves π , a decimal to the nearest tenth.

8. Find the volume of a sphere with radius 4 cm. Give an exact answer and, if it involves π , a decimal to the nearest tenth.

9. A cube with edge 6 is cut into three congruent square pyramids that share a corner as their apex. Find the volume of one pyramid and check it with $V = \frac{1}{3}Bh$.

10. An upright cylinder and an oblique cylinder both have radius 4 and height 9. Compare their volumes and name the principle.

APPLICATION

11. A grain silo is a cylinder of radius 3 m and height 10 m topped by a hemisphere of the same radius. Find its volume.

12. An ice-cream cone is modeled as a cone of radius 2.5 cm and height 11 cm with a hemisphere of ice cream on top. Find the total volume to the nearest tenth.

13. A basketball has a diameter of about 24 cm. Find its volume to the nearest cubic centimeter.

14. A cone and a cylinder have the same radius and height. How many full cones of water fill the cylinder, and which argument explains it?

CHALLENGE

15. For a hemisphere of radius 5, and for a cylinder of radius 5 and height 5 with a cone removed (apex at the base center, base at the top), compare the cross-section areas at height 3 above the base. What does Cavalieri's principle then give for the hemisphere's volume?

REVIEW

16. In a right triangle, an acute angle is 37° and the hypotenuse is 30. Find the side adjacent to the angle. Round to the nearest tenth.

17. A 30° - 60° - 90° triangle has hypotenuse 20. Find both legs.

18. Triangle ABC is similar to triangle DEF . $AB = 18$ and the corresponding side $DE = 24$. If $BC = 9$, find EF , and the ratio of the triangles' areas.

Lesson 1.3 — Scaling Lengths, Areas and Volumes

FLUENCY

1. Triangle ABC is similar to triangle DEF . $AB = 8$ and the corresponding side $DE = 20$. If $BC = 8$, find EF , and the ratio of the triangles' areas.

2. Triangle ABC is similar to triangle DEF . $AB = 18$ and the corresponding side $DE = 9$. If $BC = 6$, find EF , and the ratio of the triangles' areas.

3. Triangle ABC is similar to triangle DEF . $AB = 9$ and the corresponding side $DE = 27$. If $BC = 11$, find EF , and the ratio of the triangles' areas.

4. Two similar solids have scale factor 3. By what factors do their surface areas and volumes differ?

5. A 1:50 model is 30 cm tall. How tall is the real object?

6. The same model has a floor area of 40 cm^2 . Find the real floor area in m^2 .

7. The model's volume is 600 cm^3 . Find the real volume in m^3 .

8. Two similar containers have volumes in the ratio $64 : 1$. Find the ratio of their heights and of their surface areas.

APPLICATION

9. A 14-inch pizza and a 10-inch pizza have the same thickness. How many times as much pizza is the larger one?

10. A statue is scaled up by a factor of 2.5. The original needed 3 L of paint and weighed 40 kg. Estimate the paint and weight for the copy (same material).

11. Compare surface area to volume for cubes with edge 1 cm and 10 cm. Use the result to explain why small animals lose heat faster.

CHALLENGE

12. A film shows a person scaled up 10 times. If the original weighs 60 kg and the cross-section of each thigh bone is 6 cm^2 , find the giant's weight and bone cross-section, and the load per cm^2 compared with the original.

REVIEW

13. In a right triangle, an acute angle is 50° and the adjacent leg is 26. Find the opposite leg. Round to the nearest tenth.

14. A 45° - 45° - 90° triangle has legs of length 11. Find the hypotenuse.

15. Triangle ABC is similar to triangle DEF . $AB = 16$ and the corresponding side $DE = 8$. If $BC = 12$, find EF , and the ratio of the triangles' areas.

Lesson 1.4 — Density and Design with Solids

FLUENCY

1. Find the volume of a square pyramid with base edge 4 cm and height 13 cm. Give an exact answer and, if it involves π , a decimal to the nearest tenth.

2. Find the volume of a cylinder with radius 7 cm and height 6 cm. Give an exact answer and, if it involves π , a decimal to the nearest tenth.

3. Find the volume of a square pyramid with base edge 10 cm and height 3 cm. Give an exact answer and, if it involves π , a decimal to the nearest tenth.

4. An iron ball (density 7.87 g/cm^3) has radius 3 cm. Find its mass to the nearest gram.

5. (*Illustrative.*) A town of 48,000 people covers 12.5 square miles. Find its population density.

6. A 250 cm^3 block has mass 675 g. Find its density and say which material in the lesson it matches.

APPLICATION

7. (*Illustrative forest survey.*) A circular plot of radius 10 m contains 23 trees. Estimate the tree density per hectare ($10,000 \text{ m}^2$).

8. A closed box with a square base must hold $1,000 \text{ cm}^3$. Compute the surface area for base edges 8, 10 and 12 cm and say which is least.

9. A solid aluminum cylinder (2.70 g/cm^3) of radius 2 cm must weigh 500 g. How tall must it be?

CHALLENGE

10. An *open-top* box with a square base must hold $1,000 \text{ cm}^3$. Build a table in a spreadsheet or Desmos and find the base edge that uses the least material, to the nearest tenth. How does it compare with the closed box?

REVIEW

11. In a right triangle, an acute angle is 16° and the adjacent leg is 9. Find the opposite leg. Round to the nearest tenth.

12. A 30° - 60° - 90° triangle has shorter leg 3. Find the longer leg and the hypotenuse.

13. Triangle ABC is similar to triangle DEF . $AB = 4$ and the corresponding side $DE = 12$. If $BC = 8$, find EF , and the ratio of the triangles' areas.

Unit 1 checkpoint

1. A plane cuts a cylinder parallel to its base. The cross-section is:
- A. A rectangle
 - B. A circle
 - C. An ellipse
 - D. A triangle

2. Rotating a right triangle about one leg produces a:
- A. Cylinder
 - B. Cone
 - C. Sphere
 - D. Pyramid
3. True or false: A cube can have a regular hexagonal cross-section.
4. A cylinder with radius 5 and height 4 has volume _____ π .
5. A cone with radius 3 and height 7 has volume _____ π .
6. A sphere with radius 6 has volume _____ π .
7. True or false: An oblique prism has a larger volume than an upright prism with the same base and height.
8. Why is the cone formula one-third of Bh ?
- A. Because cones are round
 - B. A cube splits into three congruent pyramids, and Cavalieri extends this to cones
 - C. Because $\pi \approx 3$
 - D. It is a definition
9. Two similar solids have scale factor 4. The volume ratio is:
- A. 4
 - B. 8
 - C. 16
 - D. 64
10. A 1:20 model has a surface area of 30 cm^2 . The real surface area is _____ cm^2 .
11. A 400 cm^3 block has mass 1,080 g. Its density is:
- A. 2.7 g/cm^3
 - B. 0.37 g/cm^3
 - C. 3.7 g/cm^3
 - D. 432 g/cm^3
12. True or false: For a closed cylinder holding a fixed volume, the least surface area occurs when the height equals the diameter.