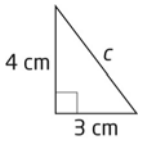
8.1 Apply the Pythagorean Theorem

***Principles of Mathematics 9*, pages 418–425**

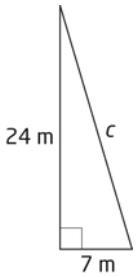
A

1. Calculate the length of the hypotenuse in each triangle. Round your answers to the nearest tenth of a unit, when necessary.

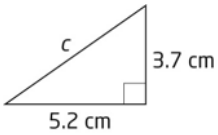
a)



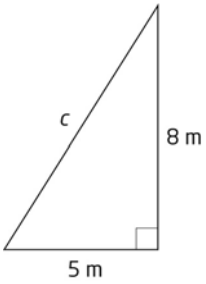
b)



c)

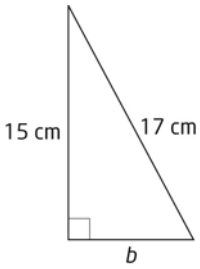


d)

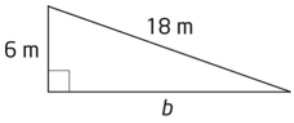


2. Calculate the length of the unknown side in each triangle. Round your answers to the nearest tenth of a unit, when necessary.

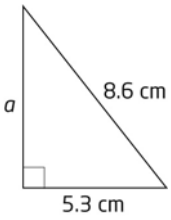
a)



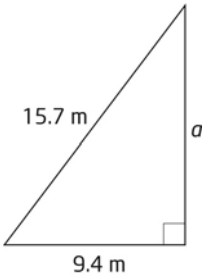
b)



c)



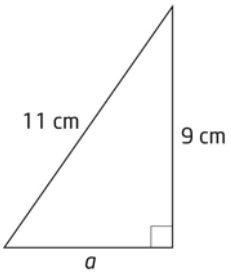
d)



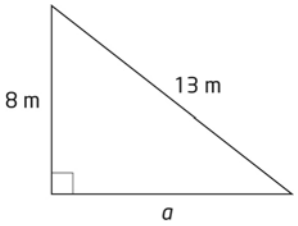
B

3. Determine the area of each right triangle. Round your answers to the nearest square unit, when necessary.

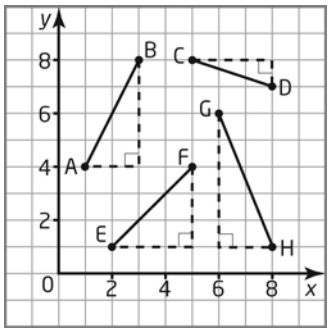
a)



b)



4. Calculate the length of each line segment. Round your answers to the nearest tenth of a unit, when necessary.



a) AB

b) CD

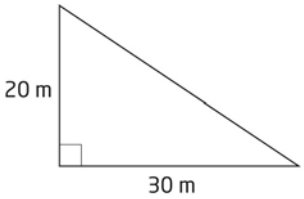
c) EF

d) GH

5. What is the length of the diagonal of a plasma TV screen that measures 127 cm by 107 cm? Round your answer to the nearest centimetre.

6. In a major league baseball game, a baseball diamond is a square with sides that measure about 27 m. How far does the first base player have to throw the ball to get a runner out a third base? Round your answer to the nearest metre.

7. **a)** What length of fencing is needed to surround this triangular section of land, to the nearest metre?

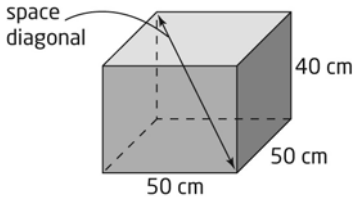


b) What is the area of the triangular section of land?

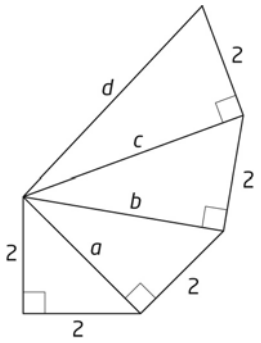
c) Explain the steps you took to solve this problem.

C

8. A cardboard box measures 50 cm by 50 cm by 40 cm. Calculate the length of the space diagonal, to the nearest centimetre.



9. A spiral is formed with right triangles as shown in the diagram.



a) Calculate the length of the hypotenuse of each triangle, leaving your answers in square root form. Describe the pattern that results.

b) Write an expression for the total area of the spiral shown.

c) Describe how the expression for the total area would change if the pattern continued.

10. a) Complete the following chart of Pythagorean Triples.

Length Side, *a*	Length Side, *b*	Hypotenuse
3	4	5
5	12	
7		25
9		

b) Describe any patterns that you can find in the table.

8.2 Perimeter and Area of Composite Figures

***Principles of Mathematics 9*, pages 426–435**

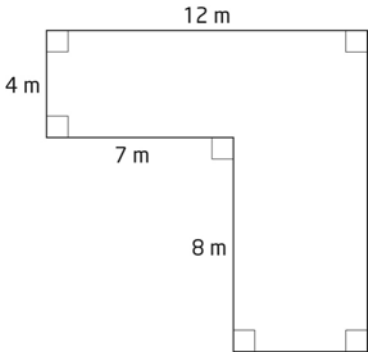
A

1. For each composite figure,

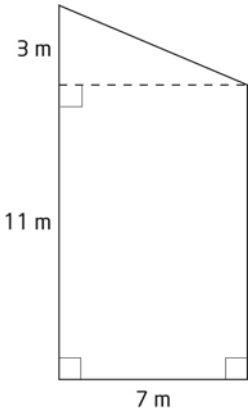
- solve for any unknown lengths
- determine the perimeter

Round your answers to the nearest tenth of a unit, when necessary.

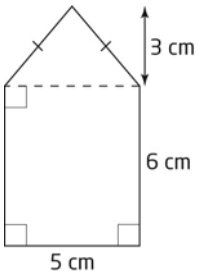
a)



b)



c)

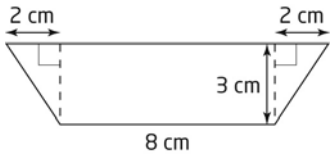


2. For each composite figure,

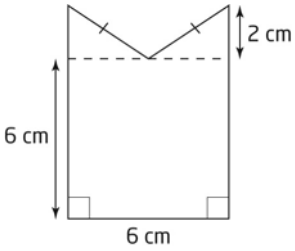
- solve for any unknown lengths
- determine the perimeter

Round your answers to the nearest tenth of a unit, when necessary.

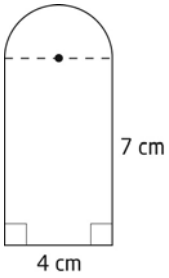
a)



b)



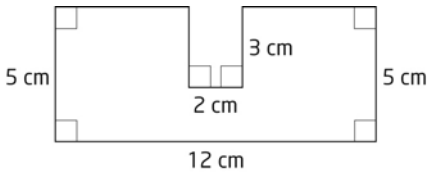
c)



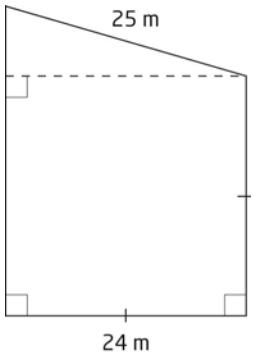
B

3. Calculate the area of each composite figure. Round your answers to the nearest square unit, when necessary.

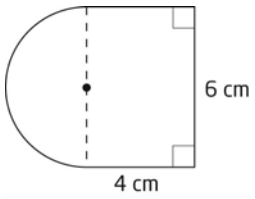
a)



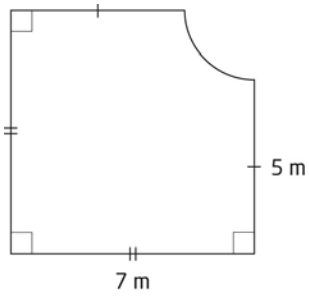
b)



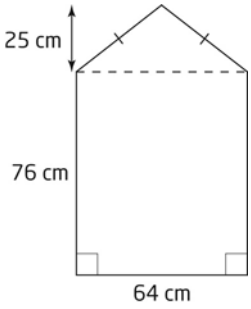
c)



d)



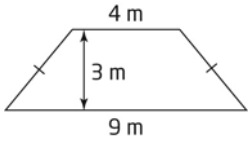
4. **a)** What length of moulding is needed to surround this window, to the nearest metre?



b) What is the area of the window?

c) Explain the steps you took to solve this problem.

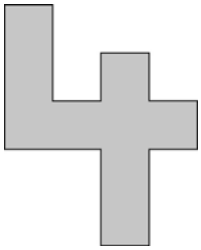
5. Michael is designing a garden railway for his parents' back yard.



a) What length of fencing is needed to surround the garden railway, to the nearest tenth of a metre?

b) What is the area of the garden railway?

6. Stella has designed a number for her art project. Use a ruler to make the appropriate measurements and calculate the area of the number, to the nearest hundred square millimetres.



7. **Use Technology** Use *The Geometer's Sketchpad*® to create a composite figure made up of at least four different shapes.

a) Estimate the perimeter and area of the figure you created.

b) Determine the area using the measurement feature of *The Geometer's Sketchpad*®. Was your estimate reasonable?

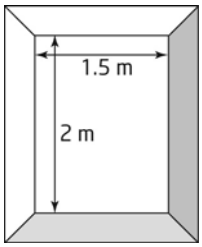
8. The area of a square patio is 8 m^2.

a) Find the length of one of its sides, to the nearest tenth of a metre.

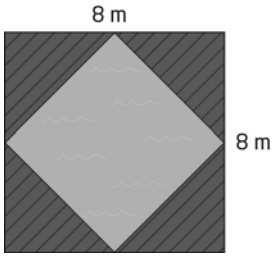
b) Find the perimeter of the patio, to the nearest metre.

C

9. Junjie is working as a framer. He is framing a rectangular picture that measures 2 m by 1.5 m. The frame is 5 cm wide and is made up of four trapezoids. Find the total area of the frame, in square centimetres.



10. Sheila is designing a square swimming pool to fit inside a square yard with side length 8 m so that there is a triangular deck at each corner.

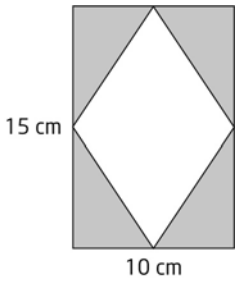


a) Find the area of Sheila's swimming pool.

b) How does the area of the swimming pool compare to the area of the triangular deck areas?

c) Sheila's design is an example of a square inscribed within a square. The vertices of the inside square touch the sides of the outside square but do not intersect. Will your answer in part b) always be true when a square is inscribed within a square? Explain.

11. The midpoints of the sides of a rectangle that measures 15 cm by 10 cm are joined. Determine the area of the shaded region.



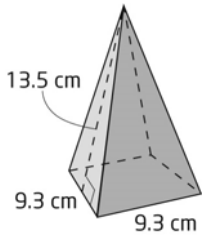
8.3 Surface Area and Volume of Prisms and Pyramids

***Principles of Mathematics 9*, pages 436–443**

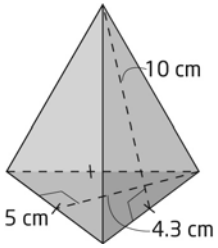
A

1. Determine the surface area of each object. Round to the nearest tenth of a square unit, when necessary.

a)

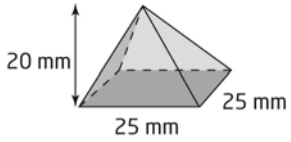


b)

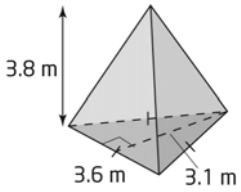


2. Determine the volume of each object. Round to the nearest cubic unit, when necessary.

a)



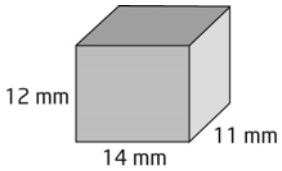
b)



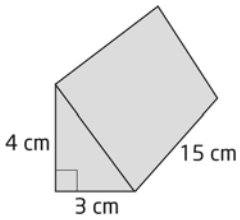
B

3. Determine the surface area of each object.

a)

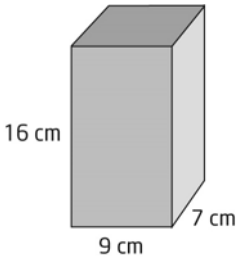


b)

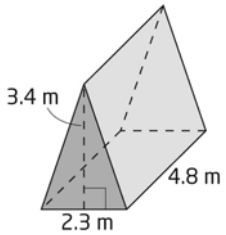


4. Determine the volume of each object. Round to the nearest cubic unit, when necessary.

a)



b)



5. A rectangular prism has length 4 m, width 3 m, and height 5 m.

a) Determine the surface area of the prism.

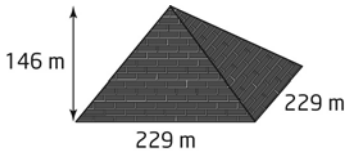
b) Determine the volume of the prism.

6. A box of crackers has a volume of 5000 cm^3. If its length is 25 cm and its width is 8 cm, what is its height?

7. The Great Pyramid of Giza is the only surviving wonder of the Seven Wonders of the Ancient World. When the Great Pyramid of Giza was built its square base had side lengths of 229 m and its height was 146 m.

a) Determine the volume of this famous pyramid, to the nearest cubic metre.

b) Determine its surface area, to the nearest square metre.



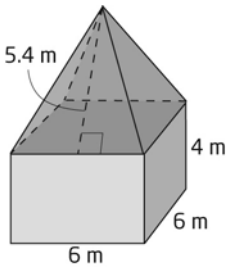
8. A juice container is a right prism with a base area of 140 cm^2. The height of the container is 35 cm.

a) Find the volume of the juice container.

b) How many litres of juice will the container hold?

C

9. Phil has built a garden shed in the shape shown.

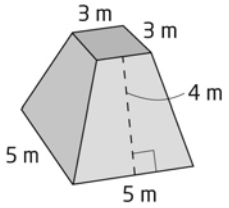


a) Calculate the volume of the shed, to the nearest cubic metre.

b) Phil plans to paint the outside of the shed, including the roof but not the floor. One can of paint covers 16 m^2. How many cans of paint will Phil need?

c) If one can of paint costs $19.95, what is the total cost, including 6% GST and 8% PST?

10. The curator of a museum recently purchased the frustum of a pyramid shown. He plans to use the frustum to display ancient artifacts. The frustum is the part remaining from a pyramid after the top portion has been removed by making a cut parallel to the base of the pyramid.



a) Determine the surface area of the frustum.

b) Calculate the total cost of painting the frustum with paint that costs $\$9.50/m^2$ including GST and PST. It is not necessary to paint the bottom of the frustum.

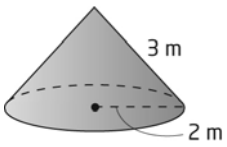
8.4 Surface Area of a Cone

***Principles of Mathematics 9*, pages 444–450**

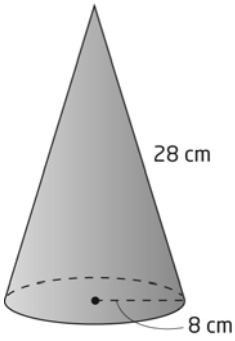
A

1. Calculate the surface area of each cone. Round to the nearest square unit.

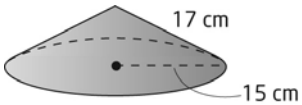
a)



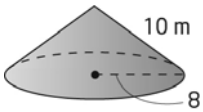
b)



c)

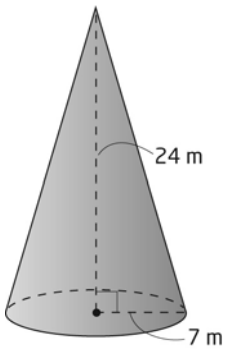


d)



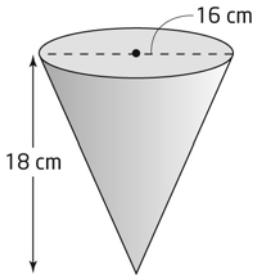
2. **a)** Find the slant height of the cone.

b) Calculate the surface area of the cone. Round to the nearest square metre.



B

3. A funnel is shaped like a cone.



a) How much aluminum, to the nearest square centimetre, is needed to make the funnel?

b) What assumptions have you made?

4. One cone has base radius 5 cm and height 7 cm. Another cone has a base radius of 7 cm and height 5 cm.

a) Do the cones have the same slant height?

b) Do the cones have the same surface area? If not, predict which cone has the greater surface area. Explain your reasoning.

c) Determine the surface area of each cone to check your prediction. Round your answer to the nearest tenth of a centimetre. Were you correct?

5. The lateral area of a cone with radius 5 cm is 120 cm^2.

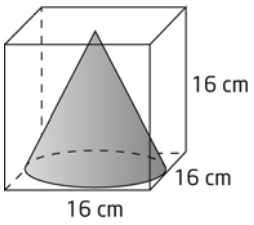
a) Determine the slant height of the cone, to the nearest centimetre.

b) Determine the height of the cone, to the nearest centimetre.

6. The height of a cone is tripled. Does this tripe the surface area? Justify your answer.

7. The radius of a cone is tripled. Does this triple the surface area? Justify your answer.

8. A cube-shaped box has sides 16 cm in length.

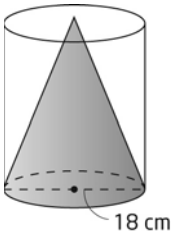


a) What are the dimensions of the largest cone that fits inside this box?

b) What is the slant height of this cone? Round your answer to the nearest centimetre.

c) What is the surface area of this cone, to the nearest square centimetre?

9. A cone just fits inside a cylinder. The volume of the cylinder is 5600 cm^3. The diameter of the cylinder is 18 cm.



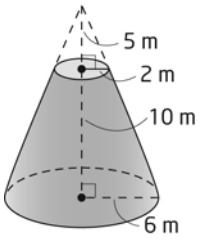
a) What are the dimensions of this cone? Round your answers to the nearest centimetre.

b) What is the slant height of this cone? Round your answer to the nearest centimetre.

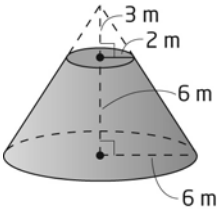
c) What is the surface area of this cone, to the nearest square centimetre?

C

10. The frustum of a cone is the part that remains after the top portion has been removed by making a cut parallel to the base. Calculate the surface area of this frustum, to the nearest square metre.



11. Calculate the surface area of this frustum, to the nearest square metre.



12. Create a problem involving the surface area of a cone. Solve the problem. Exchange with a classmate.

13. Suppose the cube in question 8 has side lengths of y.

a) Write expressions for the dimensions of the largest cone that fits inside this box.

b) What is a formula for the surface area of this cone?

14. a) Find an expression for the radius of a cone in terms of its lateral area and its slant height.

b) If the lateral area of a cone is 120 cm^2 and its slant height is 13 cm, determine its radius, to the nearest tenth of a centimetre.

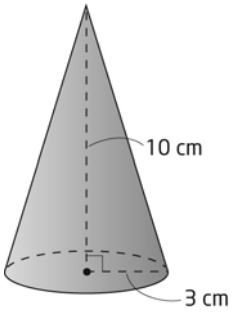
8.5 Volume of a Cone

***Principles of Mathematics 9*, pages 451–456**

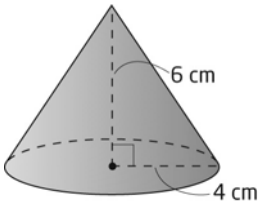
A

1. Determine the volume of each cone. Round your answer to the nearest cubic unit, when necessary.

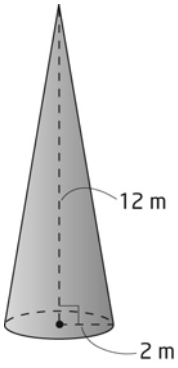
a)



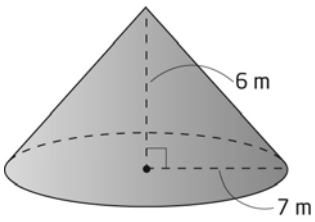
b)



c)

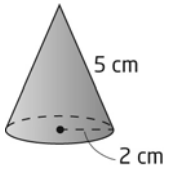


d)

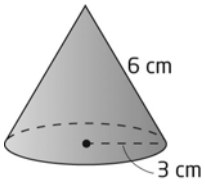


2. Determine the volume of each cone. Round your answer to the nearest cubic unit, when necessary.

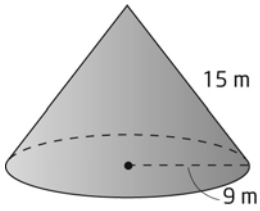
a)



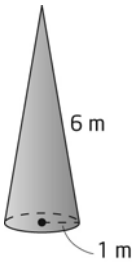
b)



c)

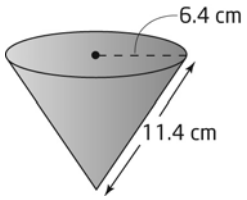


d)



B

3. Giacomo has a water cup in the shape of a cone. The water cup has a radius of 6.4 cm and a slant height of 11.4 cm. How much water can the paper cup hold, to the nearest tenth of a cubic centimetre?



4. Sophia has constructed a cone-shaped funnel from paper. The funnel has a volume of 62 cm^3 and a radius of 4 cm. What is the height of the paper cup? Round your answer to the nearest centimetre.

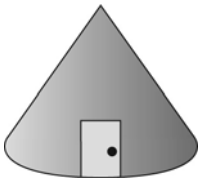
5. Nadia has constructed a sand pile in the shape of a cone. The sand pile has a volume of 80 cm^3 and a height of 10 cm. What is the radius of the sand pile? Round your answer to the nearest centimetre.

6. A cone just fits inside a cylinder with volume 600 cm^3. What is the volume of the cone?

7. Create a problem involving the volume of a cone. Solve it. Exchange your problem with a classmate.

8. A cone has a volume of 80 cm^3. What is the volume of a cylinder that just holds the cone?

9. A cone-shaped storage unit holds 300 m^3 of salt. The unit has a base radius of 7 m. Round your answers to the nearest metre, if necessary.

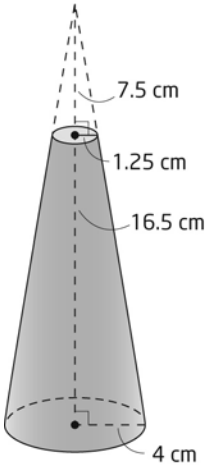


a) Estimate the height of the storage unit.

b) Calculate the height.

c) How close was your estimate?

10. A candle is in the shape of a frustum. Calculate the volume of the candle to the nearest tenth of a cubic centimetre.



C

11. A cone has a height of 6 cm and a base radius of 5 cm. Another cone has a height of 5 cm and a base radius of 6 cm.

a) Predict which cone has the greater volume. Explain your prediction.

b) Calculate the volume of each cone to the nearest cubic centimetre. Was your prediction correct?

12. a) Express the height of a cone in terms of its volume and its radius.

b) If a cone holds 1.5 L and its radius is 15 cm, what is its height? Round your answer to the nearest tenth of a centimetre.

13. a) Express the radius of a cone in terms of its volume and its height.

b) If a cone holds 2 L and its height is 16 cm, what is its radius? Round your answer to the nearest tenth of a centimetre.

14. A cone-shaped glass holds 500 mL of water. If the height of the glass is 10 cm, determine the radius of the glass, rounded to the nearest tenth of a centimetre.

15. A cone-shaped sand pile has a volume of approximately 300 m^3. If the radius of the sand pile is 6 m, determine the height of the sand pile, rounded to the nearest tenth of a metre.

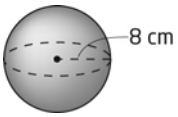
8.6 Surface Area of a Sphere

***Principles of Mathematics 9*, pages 457–461**

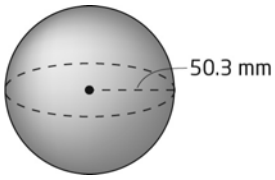
A

1. Determine the surface area of each sphere. Round your answer to the nearest square unit.

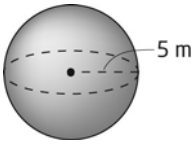
a)



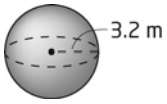
b)



c)



d)



2. A sphere has a surface area of 47.5 cm^2. Find its radius. Round your answer to one decimal place.

3. A sphere has a surface area of 65.8 cm^2. Find its diameter. Round your answer to one decimal place.

B

4. A soccer ball has a diameter of 25.4 cm.

a) How much synthetic leather is required to cover this ball? Round your answer to the nearest tenth of a square centimetre.

b) If the synthetic leather costs \$25/m^2, what does it cost to cover the soccer ball?

5. A volleyball has a diameter of 26.4 cm.

a) How much leather is required to cover this ball? Round your answer to the nearest tenth of a square centimetre.

b) If the leather costs \$32/m^2, what does it cost to cover the soccer ball?

6. Martie has a globe of the earth in her house. The diameter of the globe is 28 cm.

a) Calculate the surface area of the globe. Round your answer to the nearest square centimetre.

b) If the paper material to cover the surface area of the globe costs \$2/m^2, what does it cost to cover the globe?

7. The world's largest rotating globe, excluding the Earth itself, is Eartha, located within the headquarters of the Delorme mapping corporation in Yarmouth, Maine. The globe has a diameter of 12.5 m. Calculate the surface area of Eartha. Round your answer to the nearest square metre.

8. Asteroids are rocky and metallic objects that orbit the sun but are too small to be considered planets. They are known as minor planets. The diameter of Ceres, the largest asteroid, is approximately 1000 km. Calculate its surface area, to the nearest square kilometre.

9. Joe is creating a Snow Globe. The ball has a diameter of 20 cm and will be covered with glass. Calculate the surface area of the Snow Globe, to the nearest square centimetre.

10. The radius of a sphere is 12 cm.

a) Predict how much the surface area increases if the radius increases by 3 cm.

b) Calculate the change in the surface area, to the nearest square centimetre.

c) How accurate was your prediction?

C

11. Use Technology

a) Write the formula to calculate the surface area of a sphere in terms of the diameter, d.

b) Use a graphing calculator to graph the surface area of a sphere versus its diameter by entering the surface area formula.

c) Describe the relationship.

d) Use the TRACE feature to determine

- the surface area of a sphere with diameter 8.5 cm, to the nearest square centimetre
- the diameter of a sphere with surface area 60 cm^2, to the nearest tenth of a centimetre

12. Use Technology Refer to question 11.

a) Determine an algebraic expression for the diameter of a sphere in terms of its surface area.

b) Use your expression from part a) and a graphing calculator to graph the relationship between the diameter and the surface area.

c) Describe the relationship.

d) Use the graphing calculator to find the diameter of a sphere with surface area 600 cm^2. Round to the nearest tenth of a centimetre.

13. A spherical balloon is blown up from a diameter of 15 cm to a diameter of

60 cm. By what factor has its surface area increased? Explain your reasoning.

14. Which has the greater surface area: a sphere of radius 8 cm or a cube with edges of length 16 cm?

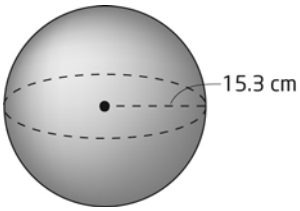
8.7 Volume of a Sphere

***Principles of Mathematics 9*, pages 462–469**

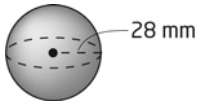
A

1. Calculate the volume of each sphere. Round your answers to the nearest cubic unit.

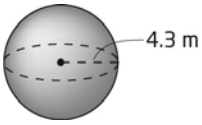
a)



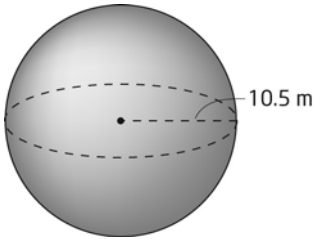
b)



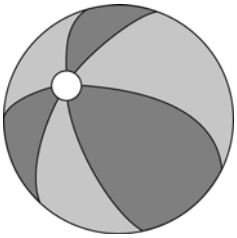
c)



d)



2. A beach ball has a diameter of 30 cm. Calculate its volume to the nearest cubic centimetre.



B

3. A baseball has a diameter of 7.5 cm. Calculate the volume of the baseball. Round your answer to the nearest cubic centimetre.

4. The diameter of the moon is 3476 km. Calculate the volume of the moon. Round your answer to the nearest cubic kilometre.

5. Mary found a sphere-shaped pebble on the shore of a lake. The pebble has a diameter of 6 cm. What is the volume of the pebble to the nearest cubic centimetre.

6. A ball just fits inside a plastic cube with edges 9 cm.

a) Calculate the volume of the ball, to the nearest cubic centimetre.

b) Calculate the volume of the cube.

c) Determine the amount of empty space.

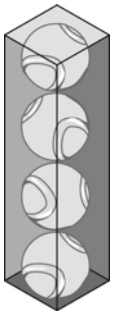
7. A gemologist is designing a ring for a customer. The gemstone to be used in the ring is spherical in shape and has a diameter of 50 mm. Calculate the volume of the gemstone to the nearest cubic millimetre.

8. A spherical glass fixture has a diameter of 25 cm.

a) Calculate the volume of the glass fixture to the nearest tenth of a cubic centimetre.

b) Calculate the surface area of the glass fixture to the nearest tenth of a square centimetre.

9. Tennis balls are stacked four high in a rectangular prism package. The diameter of one ball is 6.5 cm.



a) Calculate the volume of the rectangular prism package.

b) What is the minimum amount of material needed to make the box?

c) Determine the amount of empty space in the rectangular prism package.

d) What assumptions have you made?

10. A cylindrical silo has a hemispherical top (half a sphere). The cylinder has a height of 30 m and a base diameter of 8 m.

a) Estimate the total volume of the silo.

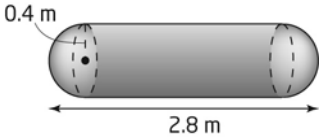
b) Calculate the total volume, to the nearest cubic metre.

c) The silo should be filled to no more than 80% capacity to allow for air circulation. How much grain can be put in the silo?

d) A truck with a bin measuring 8 m by 4 m by 3.5 m delivers grain to the farm. How many truckloads would fill the silo to its recommended capacity?

C

11. A propane tank beside a cottage is in the shape of a cylinder with a hemisphere at both ends. The tank has a radius of 0.4 m and a length of 2 m. Calculate the volume of the tank, to the nearest tenth of a cubic metre.



12. The diameter of the Earth is about 12 800 km. The diameter of Venus is about 12 100 km.

a) Calculate the volume of the Earth, to the nearest square kilometre.

b) Calculate the volume of Venus, to the nearest square kilometre.

c) How much larger is the Earth than Venus?

d) What assumptions have you made?

13. Estimate and then calculate the radius of a sphere with a volume of 500 cm^3. Round your answer to the nearest hundredth of a centimetre, if necessary.

14. If the surface area of a sphere is tripled from 250 cm^2 to 750 cm^2, by what factor does its volume increase? Round your answer to one decimal place.

15. A sphere just fits inside a cube with sides of length 6 cm.

a) Estimate the ratio of the volume of the sphere to the volume of the cube.

b) Calculate the volumes of the sphere and the cube and their ratio.

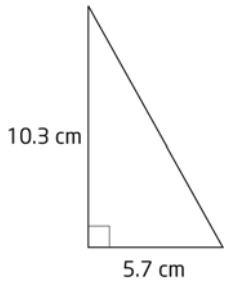
c) How does your answer compare to your estimate?

Chapter 8 Review

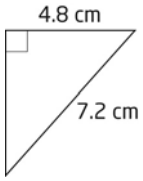
***Principles of Mathematics 9*, pages 470–471**

1. Determine the perimeter and area of each right triangle. Round answers to the nearest tenth of a unit or square unit.

a)

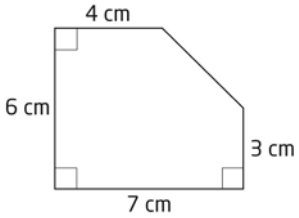


b)

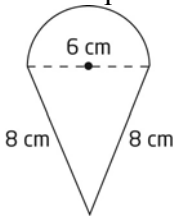


2. A 8-m ladder is leaning against a vertical wall. The top of the ladder is 7 m up the wall. How far from the wall is the base of the ladder? Round to the nearest tenth of a metre.

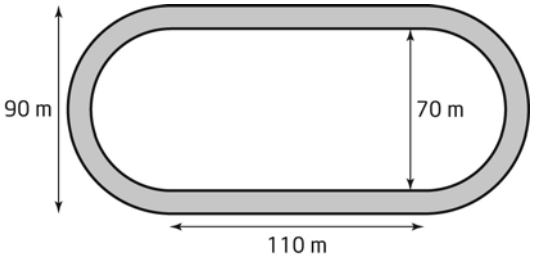
3. Calculate the perimeter and area of the figure. Round answers to the nearest tenth of a unit or square unit, if necessary.



4. Calculate the perimeter and area of the figure. Round answers to the nearest tenth of a unit or square unit.



5. The diagram shows the track for a bicycle race. The track consists of two parallel line segments with a semicircle at each end. The track is 10 m wide.



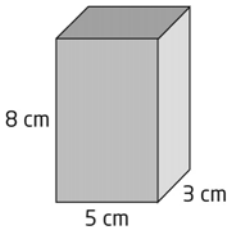
a) Ismail bikes on the inner edge of the track. How far does he bike in one lap, to the nearest tenth of a metre?

b) Carey bikes on the outer edge. How far does he bike in one lap, to the nearest tenth of a metre?

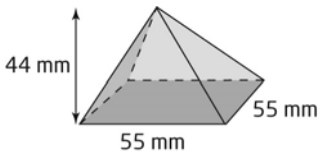
c) Find the difference between the distances biked by Ismail and Carey.

6. Calculate the surface area of each object. Round answers to the nearest square unit.

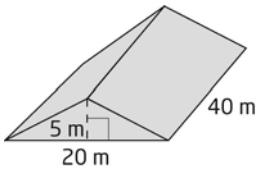
a)



b)



7. **a)** Calculate the volume of the greenhouse.



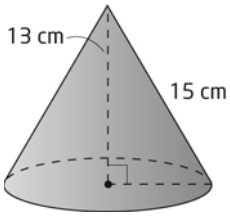
b) How much glass is required to make this greenhouse?

c) Describe any assumptions you made in part b).

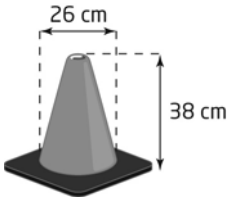
d) How reasonable is your answer in part b)?

8. A cylindrical paint can holds 3.73 L and has a radius of 8.4 cm. Calculate the height of the can, to the nearest centimetre.

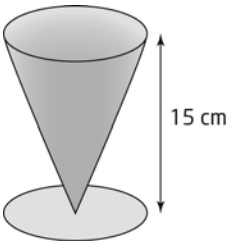
9. Calculate the surface area of a cone with a slant height of 15 cm and a height of 13 cm. Round to the nearest square centimetre.



10. The cone portion of a pylon has a diameter of 26 cm and a vertical height of 38 cm. Calculate the surface area of the cone portion of the pylon, to the nearest square centimetre. Assume that the bottom of the cone is complete.



11. A conical flower vase holds 120 mL. If the height of the vase is 15 cm, determine its radius, to the nearest tenth of a centimetre.



12. Calculate the volume of a cone that just fits inside a cylinder with a base radius of 6 cm and a height of 11 cm. Round to the nearest cubic centimetre. How does the volume of the cone compare to the volume of the cylinder?

13. A ball has a diameter of 23.4 cm. Calculate the amount of material required to cover the ball, to the nearest tenth of a square centimetre.

14. The diameter of Mars is about 6 794 km.

a) Calculate the area of the Northern Hemisphere of Mars, to the nearest square kilometre.

b) What assumptions have you made?

15. Calculate the volume of a tennis ball with a diameter of 8 cm, to the nearest tenth of a cubic centimetre.

16. The tennis ball in question 14 is packaged so that it just fits inside a cube-shaped box.

a) Estimate the amount of empty space inside the box.

b) Calculate the amount of empty space.

c) How close was your estimate?