

The Area of Solids and Plane Figures

Name: _____

Date: _____

Concepts

- Finding the Area of a Solid Using Algebra
 - Methods to Decompose Figures
 - The Area of Cones
 - The Area of Cylinders
 - The Area of Decomposable Solids
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 - The Area of a Sphere
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Finding the Area of a Solid Using Algebra

1. A shop packs board games in closed rectangular boxes. Every box is 8 cm wide and 5 cm high, but the length changes from game to game. Let x be the length of a box, in centimetres.
- Write a simplified expression for the total surface area of a closed box.
 - Use your expression to find the surface area of a box 12 cm long, and check the result by adding the six faces one at a time.
 - The travel edition ships with no lid. Write a simplified expression for the area of cardboard that version needs.

Methods to Decompose Figures

- 2.** The splash pad at a municipal park is a rectangle 12 m long and 8 m wide, with a semicircle attached to one of its 8 m ends. The straight 8 m end is the one *opposite* the semicircle.
- a) Decompose the figure and find its area, first exactly in terms of π , then to the nearest tenth of a square metre.
 - b) A rubber safety strip runs all the way around the outside. Find the length of strip needed, to the nearest tenth of a metre.

The Area of Cones

- 3.** A party hat is a cone made from a single piece of cardstock, open at the bottom. Its base has a diameter of 18 cm and its slant height is 25 cm.
- a) Find the area of cardstock the hat needs, exactly in terms of π and then to the nearest tenth of a square centimetre.
 - b) A second version has a cardstock disc closing the bottom. Find the total area of that version.

The Area of Cylinders

4. A can of hot chocolate mix is a closed cylinder with a diameter of 14 cm and a height of 20 cm.
- The paper label wraps around the curved side only, with no overlap. Find its area, exactly and to the nearest tenth of a square centimetre.
 - Find the total surface area of the can.

The Area of Decomposable Solids

5. A grain bin is a cylinder with a cone on top. The cylinder has a radius of 3 m and a height of 8 m; the cone has the same radius and a slant height of 5 m. The bin rests on the ground, and only the surfaces you can see from outside are painted.
- Find the painted area, exactly in terms of π and then to the nearest tenth of a square metre.
 - One pail of paint covers 30 m^2 . How many pails must be bought?

The Area of Truncated Solids

6. A lampshade is a truncated cone, open at the top and at the bottom. It began as a cone with a base radius of 12 cm and a slant height of 20 cm; a cut parallel to the base removed a small cone whose radius is 6 cm.

- a) Explain why the small cone's slant height must be 10 cm.
- b) Find the area of fabric the lampshade needs, exactly and to the nearest tenth of a square centimetre.

The Area of a Sphere

7. A paper lantern is a sphere with a diameter of 30 cm, covered on the outside with decorative paper.

- a) Find the area of paper needed, exactly in terms of π and then to the nearest tenth of a square centimetre.
- b) The paper comes on a roll holding 3000 cm^2 . Is one roll enough? Say how much is left over or missing.

The Perimeter and the Area of Regular Polygons - Secondary 3

8. A patio is laid with regular octagonal stones. Each stone has a side of 12 cm and an apothem of 14.5 cm.

- a) Find the perimeter of one stone.
- b) Find the area of one stone.
- c) The patio uses 40 stones. Find the total area they cover, in square metres.

Synthesis — drawing on several sheets in this topic

9. A bubble-tea shop displays its syrup in a container built from a closed cylinder with a hemispherical dome on top. The cylinder has a radius of 5 cm and a height of 14 cm, and the dome has the same radius. The outside is frosted: the bottom disc, the curved side, and the dome.

- a) Find the frosted area, exactly in terms of π and then to the nearest tenth of a square centimetre.
- b) Explain why the top disc of the cylinder is not part of your answer.
- c) A taller model keeps the radius at 5 cm but has cylinder height h cm. Write a simplified expression for its frosted area, and check that $h = 14$ returns your answer from a).

Want the harder problems and the worked solutions?

The *Challenge Problems* set and the *Answer Keys* for The Area of Solids and Plane Figures — with the reasoning written out in full — are available at tutorinmontreal.ca.