

Pyramid and Cone Power

Find surface area and volume using dimensions and formulas.

GRADE 8 • 8.MG.2

8.MG.2 "The student will investigate and determine the surface area of square-based pyramids and the volume of cones and square-based pyramids. Determine the surface area of square-based pyramids by using concrete objects, nets, diagrams..."

NAME _____

DATE _____

USE THE RIGHT MEASURE

For a square-based pyramid, surface area = $s^2 + 2sl$, where s is the base edge and l is the slant height. Its volume = $\frac{1}{3}s^2h$, and a cone's volume = $\frac{1}{3}\pi r^2h$, where h is the perpendicular height. A cone or pyramid has one-third the volume of a cylinder or prism with the same base and height.

WORKED EXAMPLE

Find the total surface area of a square-based pyramid with a base edge of 9 cm and a slant height of 11 cm.

1. Base area = $9 \times 9 = 81 \text{ cm}^2$.
2. Lateral area = $2 \times 9 \times 11 = 198 \text{ cm}^2$.
3. Total surface area = $81 + 198 = 279 \text{ cm}^2$.

Answer: 279 cm^2

PRACTICE 6 problems

- 1** Find the total surface area of a square-based pyramid with a base edge of 6 cm and a slant height of 8 cm.

ANSWER _____

- 2** Find the volume of a square-based pyramid with a base edge of 4 cm and a perpendicular height of 15 cm.

ANSWER _____

- 3** Find the volume of a cone with radius 3 cm and perpendicular height 10 cm. Leave your answer in terms of π .

ANSWER _____

- 4** A cone and a cylinder have the same radius of 5 cm and the same height of 12 cm. The cylinder's volume is $300\pi \text{ cm}^3$. What is the cone's volume?

ANSWER _____

- 5** Find the volume of a square-based pyramid with a base edge of 7 m and a perpendicular height of 6 m.

ANSWER _____

- 6** Find the total surface area of a square-based pyramid with a base edge of 10 in. and a slant height of 7 in.

ANSWER _____

APPLY IT Show your work

- 1** A snack stand uses cone-shaped cups for shaved ice. Each cup has a radius of 4 cm and a perpendicular height of 15 cm. What is the greatest volume of shaved ice one cup can hold? Leave your answer in terms of pi.

WORK SPACE

ANSWER _____

- 2** For an art display, students cover all five faces of a square-based pyramid with paper. The base edge is 14 cm, and the slant height is 10 cm. How much paper is needed?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A square-based pyramid and a rectangular prism each have a square base with side length 18 cm and a perpendicular height of 20 cm. Find both volumes. Then explain why one volume is greater.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Find the total surface area of a square-based pyramid with a base edge of 6 cm and a slant height of 8 cm.	132 cm²
2	Find the volume of a square-based pyramid with a base edge of 4 cm and a perpendicular height of 15 cm.	80 cm³
3	Find the volume of a cone with radius 3 cm and perpendicular height 10 cm. Leave your answer in terms of pi.	30pi cm³
4	A cone and a cylinder have the same radius of 5 cm and the same height of 12 cm. The cylinder's volume is 300pi cm ³ . What is the cone's volume?	100pi cm³
5	Find the volume of a square-based pyramid with a base edge of 7 m and a perpendicular height of 6 m.	98 m³
6	Find the total surface area of a square-based pyramid with a base edge of 10 in. and a slant height of 7 in.	240 in.²

PART 2 • APPLY IT

- 80pi cm³** Use $V = \frac{1}{3} \pi r^2 h$. Substitute 4 for r and 15 for h : $\frac{1}{3} \times \pi \times 16 \times 15 = 80\pi \text{ cm}^3$.
- 476 cm²** Find total surface area with $s^2 + 2sl$. The base area is 196 cm² and the four triangular faces have area 280 cm².

CHALLENGE

Square-based pyramid: 2160 cm³. Rectangular prism: 6480 cm³. The prism's volume is greater because a pyramid with the same base area and perpendicular height has 1/3 of the prism's volume.

Accept equivalent exact forms containing pi. For surface area, include the square base and all four triangular faces. For volume, use perpendicular height, not slant height.