LESSON MAKER PRO

# Solid Shape Studio

*Find volume and surface area of cones and square pyramids.*

**GRADE 8 · 8.MG.2.d**

**8.MG.2.d** "Solve problems in context involving volume of cones and square-based pyramids and the surface area of square-based pyramids."

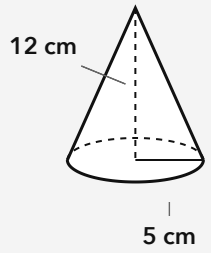
NAME _____ DATE _____

## VOLUME AND SURFACE AREA RULES

For a cone, volume is 1/3 × pi × radius × radius × vertical height. For a square-based pyramid, volume is 1/3 × base edge × base edge × vertical height. Total surface area of a square-based pyramid is base edge × base edge + 2 × base edge × slant height, so use vertical height for volume and slant height for surface area.

## WORKED EXAMPLE

Find the volume of the cone shown. Its radius is 5 cm and its perpendicular height is 12 cm.

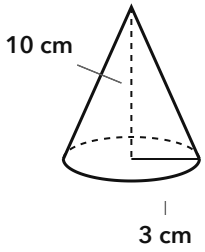



1. Use $V = 1/3 \times \text{pi} \times 5^2 \times 12$.
2. $5^2 = 25$, so $V = 1/3 \times \text{pi} \times 25 \times 12$.
3. Divide 12 by 3: $V = 100\text{pi}\ \text{cm}^3$.
4. The cone's volume is $100\text{pi}\ \text{cm}^3$.

**Answer: $100\text{pi}\ \text{cm}^3$**

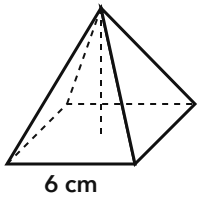
## PRACTICE 6 problems

**1** Find the volume of the cone shown. Its radius is 3 cm and its perpendicular height is 10 cm.




**ANSWER** _____

**2** Find the total surface area of the square-based pyramid shown. Its square base edge is 6 cm, and each triangular face has slant height 7 cm measured perpendicular to that face's base edge. Include the square bottom.




**ANSWER** _____

**3** A cone has a radius of 4 cm and a vertical height of 9 cm. Find its volume.

**ANSWER** _____

**4** A square-based pyramid has a base edge of 8 cm and a vertical height of 15 cm. Find its volume.

**ANSWER** _____

**5** A square-based pyramid has a base edge of 11 cm and a slant height of 13 cm. Find its total surface area.

**ANSWER** _____

**6** A cone has a diameter of 14 cm and a vertical height of 6 cm. Find its volume.

**ANSWER** _____

## APPLY IT Show your work

**1** A student game-design club makes a solid clay trophy shaped like a square-based pyramid. The base edge is 18 cm, and the vertical height is 14 cm. How much clay is needed to make one trophy?

WORK SPACE

**ANSWER** _____

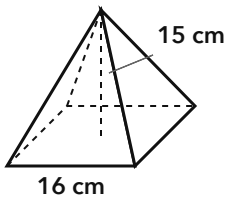
**2** For a school esports event, a square-pyramid light cover has a base edge of 10 in. and a slant height of 13 in. The cover includes the square bottom and all four triangular sides. How much material is needed?

WORK SPACE

**ANSWER** _____

## CHALLENGE One step up

The square-based pyramid shown has base edge 16 cm and perpendicular height 15 cm. Find its total surface area. In 1–2 sentences, explain how you find the triangular face slant height.




WORK SPACE AND ANSWER

# Solid Shape Studio



## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | Find the volume of the cone shown. Its radius is 3 cm and its perpendicular height is 10 cm. | **30pi cm$^3$** |
| 2 | Find the total surface area of the square-based pyramid shown. Its square base edge is 6 cm, and each triangular face has slant height 7 cm measured perpendicular to that face's base edge. Include the square bottom. | **120 cm$^2$** |
| 3 | A cone has a radius of 4 cm and a vertical height of 9 cm. Find its volume. | **48pi cm$^3$** |
| 4 | A square-based pyramid has a base edge of 8 cm and a vertical height of 15 cm. Find its volume. | **320 cm$^3$** |
| 5 | A square-based pyramid has a base edge of 11 cm and a slant height of 13 cm. Find its total surface area. | **407 cm$^2$** |
| 6 | A cone has a diameter of 14 cm and a vertical height of 6 cm. Find its volume. | **98pi cm$^3$** |

## PART 2 · APPLY IT

1. **1512 cm$^3$** Use $V = 1/3 \times 18^2 \times 14$. The base area is 324 cm$^2$, so the volume is 1512 cm$^3$.
2. **360 in$^2$** The square base has area 100 in$^2$. The four triangular faces have total area $2 \times 10 \times 13 = 260$ in$^2$, for 360 in$^2$ altogether.

## CHALLENGE

**The total surface area is 800 cm$^2$. Half the base edge is 8 cm, so the slant height is 17 cm because $8^2 + 15^2 = 17^2$, and $16^2 + 2 \times 16 \times 17 = 800$.**

Accept equivalent expressions with pi, such as 30 × pi cm$^3$. For surface area, require that students include the square base unless the prompt specifically asks for only the triangular faces.