Volume of Pyramids

Models and mappings

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

A pyramid has volume $V = \frac{1}{3}Bh$, where B is base area and h is perpendicular distance from the apex to the base plane. For rectangular bases, $B = lw$; for triangular bases, $B = \frac{1}{2}bt$. Base-triangle height t, pyramid height h, and face slant height are different measurements. To reverse the formula, use $h = 3V/B$ or $B = 3V/h$.

Worked example

A pyramid has rectangular base 6 by 5 and perpendicular height 9. Find volume.

1. The rectangular base area is $B = 6(5) = 30$ square units.
2. The perpendicular height is 9 units. Substitute $V = \frac{1}{3}Bh = \frac{1}{3}(30)(9) = 90$ cubic units.
3. The volume is 90 cubic units. The matching prism holds 270 cubic units, exactly three times this amount; surface slant height is not used.
Answer: 90 cubic units

Practice Problems

Show your thinking.

1. A square pyramid has base side 4 and perpendicular height 9. Find volume.

2. A rectangular pyramid has base 8 by 3 and height 5. Find volume.

3. A pyramid has base area 45 and perpendicular height 8. Find volume.

4. A triangular pyramid has base-triangle base 6, base-triangle height 4, and pyramid height 10. Find volume.

5. A square pyramid has base side 7 and height 6. Find volume.

6. A pyramid has trapezoid base with parallel sides $4, 8$ and base-trapezoid height 3. Pyramid height is 7. Find volume.

7. A rectangular pyramid has base 2.5 by 4 and perpendicular height 6. Find volume.

8. A pyramid has parallelogram base with base length 9 and perpendicular base-height 4. Pyramid height is 5. Find volume.

9. A prism and pyramid have the same base area 27 and perpendicular height 8. Find their volume difference.

10. A pyramid has a right-triangle base with perpendicular legs $5, 8$ and perpendicular pyramid height 4.5. Find volume.

Answer Key

1. 48 cubic units
2. 40 cubic units
3. 120 cubic units
4. 40 cubic units
5. 98 cubic units
6. 42 cubic units
7. 20 cubic units
8. 60 cubic units
9. 144 cubic units
10. 30 cubic units

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The square base area is $B = 4^2 = 16$ square units.
2. The perpendicular height is 9 units. Substitute $V = \frac{1}{3}Bh = \frac{1}{3}(16)(9) = 48$ cubic units.
3. The volume is 48 cubic units. The matching prism holds 144 cubic units, exactly three times this amount; surface slant height is not used.

Problem 2

1. The rectangle base area is $B = 8(3) = 24$ square units.
2. The perpendicular height is 5 units. Substitute $V = \frac{1}{3}Bh = \frac{1}{3}(24)(5) = 40$ cubic units.
3. The volume is 40 cubic units. The matching prism holds 120 cubic units, exactly three times this amount; surface slant height is not used.

Problem 3

1. The base area is already given as $B = 45$ square units; do not square this area again.
2. The perpendicular height is 8 units. Substitute $V = \frac{1}{3}Bh = \frac{1}{3}(45)(8) = 120$ cubic units.
3. The volume is 120 cubic units. The matching prism holds 360 cubic units, exactly three times this amount; surface slant height is not used.

Problem 4

1. The triangular base area is $B = \frac{1}{2}(6)(4) = 12$ square units, not 24.
2. The perpendicular height is 10 units. Substitute $V = \frac{1}{3}Bh = \frac{1}{3}(12)(10) = 40$ cubic units.
3. The volume is 40 cubic units. The matching prism holds 120 cubic units, exactly three times this amount; surface slant height is not used.

Problem 5

1. The square base area is $B = 7^2 = 49$ square units.
2. The perpendicular height is 6 units. Substitute $V = \frac{1}{3}Bh = \frac{1}{3}(49)(6) = 98$ cubic units.
3. The volume is 98 cubic units. The matching prism holds 294 cubic units, exactly three times this amount; surface slant height is not used.

Problem 6

1. The trapezoid base area is $B = \frac{1}{2}(4 + 8)(3) = 18$ square units.
2. The perpendicular height is 7 units. Substitute $V = \frac{1}{3}Bh = \frac{1}{3}(18)(7) = 42$ cubic units.
3. The volume is 42 cubic units. The matching prism holds 126 cubic units, exactly three times this amount; surface slant height is not used.

Problem 7

1. The rectangular base area is $B = 2.5(4) = 10$ square units.
2. The perpendicular height is 6 units. Substitute $V = \frac{1}{3}Bh = \frac{1}{3}(10)(6) = 20$ cubic units.
3. The volume is 20 cubic units. The matching prism holds 60 cubic units, exactly three times this amount; surface slant height is not used.

Problem 8

1. The parallelogram base area is $B = 9(4) = 36$ square units; this 4 is not the pyramid height.
2. The perpendicular height is 5 units. Substitute $V = \frac{1}{3}Bh = \frac{1}{3}(36)(5) = 60$ cubic units.
3. The volume is 60 cubic units. The matching prism holds 180 cubic units, exactly three times this amount; surface slant height is not used.

Problem 9

1. The prism volume is $27(8) = 216$ cubic units.
2. The pyramid volume is $\frac{1}{3}(27)(8) = 72$, giving difference $216 - 72 = 144$.
3. The pyramid occupies one third of the corresponding prism volume. The difference 144 is two thirds of 216.

Problem 10

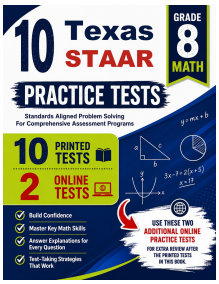
1. The triangular base area is $B = \frac{1}{2}(5)(8) = 20$ square units.
2. The perpendicular height is 4.5 units. Substitute $V = \frac{1}{3}Bh = \frac{1}{3}(20)(4.5) = 30$ cubic units.
3. The volume is 30 cubic units. The matching prism holds 90 cubic units, exactly three times this amount; surface slant height is not used.

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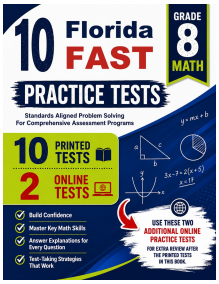
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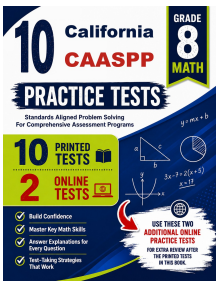
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