Volume of Prisms

Apply the skill to decisions and designs

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QUICK REVIEW

Prism volume is $V = Bh$, where B is the base area and h is the perpendicular distance between matching bases. A right triangle with legs $3, 4$ cm has $B = 6$ cm^2; prism length 5 cm gives $V = 6(5) = 30$ cm^3.

Worked example

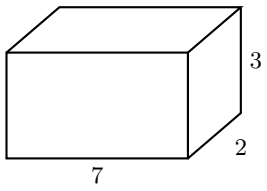
A prism base area is 12 cm^2 and height 5 cm. Find volume.

1. Use $V = Bh$ with $B = 12$, $h = 5$.
2. $V = 12(5) = 60$ cm^3.
3. Check: $60/12 = 5$ cm.
Answer: 60 cm^3.

Practice Problems

Show your thinking.

1. A box has inside dimensions 7 by 2 by 3 cm. How many 1 cm^3 cubes fill it with no gaps?

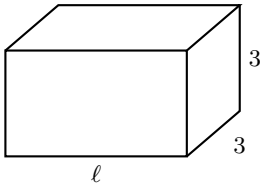


2. A load of 96 cm^3 is poured into a container of base area 24 cm^2. Find its fill depth and the space left above it in a 5 cm tall container.

3. A triangular channel has cross-section base 9 cm and perpendicular height 4 cm. Find its capacity for length 3 cm.

4. A cubic box has inside edge 6 cm. How many such boxes have total capacity 648 cm^3?

5. A box holds 99 cm^3. With width 3 cm and height 3 cm fixed, find its length and how much to extend it to hold another 9 cm^3.



6. Two containers of base area 48 cm^2 have heights 4 and 5 cm. Which fits a 193 cm^3 load? Find its unused capacity.

7. A channel has triangular cross-section base 5 cm and perpendicular height 3 cm. Find its length for 60 cm^3 of capacity and compare with a 7 cm design.

8. A box has a 9 by 4 cm base and height 3 cm. Increase the height by half of itself. Find the new volume and the increase.

Answer Key

1. 42 unit cubes.
2. Fill depth 4 cm; 1 cm of height remains.
3. 54 cm^3.
4. 3 boxes.
5. Length 11 cm. Extend it by 1 cm.
6. Only the taller fits; 47 cm^3 unused.
7. Need 8 cm; the 7 cm design is 1 cm too short.
8. New volume 162 cm^3; increase 54 cm^3.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The base area is $7(2) = 14$ cm^2.
2. There are 3 layers of 14 unit cubes, so $V = 14(3) = 42$ cm^3.
3. Each unit cube fills 1 cm^3, so the count equals the volume in cubic centimeters.

Problem 2

1. From $V = Bh$, set $24h = 96$.
2. Divide by the base area: $h = 96/24 = 4$ cm.
3. The fill fits, leaving $(5) - 4 = 1$ cm of height.

Problem 3

1. Triangle area: $(9)(4)/2 = 18$ cm^2.
2. Volume: $18(3) = 54$ cm^3.
3. Without the half, $9(4)(3) = 108$ cm^3 would be a rectangular prism, twice this volume.

Problem 4

1. Each box holds $6^3 = 216$ cm^3.
2. Divide the required capacity by one box: $648/216 = 3$.
3. Three boxes hold $3(216) = 648$ cm^3, exactly the target.

Problem 5

1. The end area is $3(3) = 9$ cm^2.
2. Divide volume by the end area: $\ell = 99/9 = 11$ cm.
3. For the extra volume, extend length by $9/9 = 1$ cm.

Problem 6

1. Shorter volume: $48(4) = 192$ cm^3.
2. Taller volume: $48(5) = 240$ cm^3.
3. $192 < 193 \leq 240$, so only the taller fits.
4. Unused capacity: $240 - (193) = 47$ cm^3.

Problem 7

1. Triangle area: $(1/2)(5)(3) = 15/2$ cm^2.
2. Divide target volume by area: $60/(15/2) = 8$ cm.
3. The proposed length is $8 - 7 = 1$ cm too short.

Problem 8

1. Base area is $9(4) = 36$ cm^2. Original volume is $36(3) = 108$ cm^3.
2. New height: $3 + 3/2 = 9/2$ cm. New volume: $36(9/2) = 162$ cm^3.
3. Capacity increase: $162 - 108 = 54$ cm^3.

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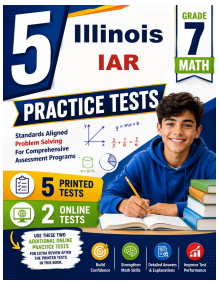

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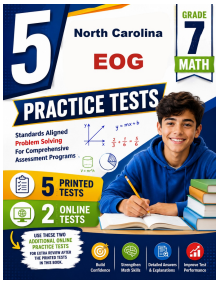

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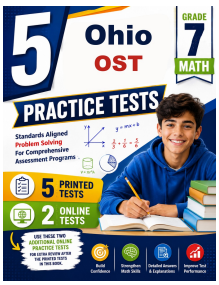

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