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Unit 7, Lesson 12: Volume of Right Prisms

Let's look at volumes of prisms.

12.1: Three Prisms with the Same Volume

Rectangles A, B, and C represent bases of
three prisms.

1. If each prism has the same height, which one will have the greatest volume, and
   which will have the least. Explain your reasoning.

2. If each prism has the same volume, which one will have the tallest height, and which
   will have the shortest. Explain your reasoning.

12.2: Finding Volume with Cubes

m.openup.org/1/7-7-12-2

Your teacher will give you a paper with a shape on it and some snap cubes.

1. Using the face of a snap cube as your area unit, what is the area of the shape? Explain or show your reasoning.

2. Use snap cubes to build the shape from the paper. Add another layer of cubes on top of the shape you have built. Describe this three-dimensional object.

3. What is the volume of your object? Explain your reasoning.

4. Right now, your object has a height of 2. What would the volume be:

    a. if it had a height of 5?

    b. if it had a height of 8.5?

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12.3: Can You Find the Volume?

Your teacher will give you a set of three-dimensional figures.

1. For each figure, determine whether the shape is a prism.

2. For each prism:
   a. Find the area of the base of the prism.

   b. Find the height of the prism.

   c. Calculate the volume of the prism.

	Is it a prism?	area of prism base (cm²)	height (cm)	volume (cm³)
figure A				
figure B				
figure C				
figure D				
figure E				
figure F				

Are you ready for more?

Imagine a large, solid cube made out of 64 white snap cubes. Someone spray paints all 6 faces of the large cube blue. After the paint dries, they disassemble the large cube into a pile of 64 snap cubes.

1. How many of those 64 snap cubes have exactly 2 faces that are blue?

2. What are the other possible numbers of blue faces the cubes can have? How many of each are there?

3. Try this problem again with some larger-sized cubes that use more than 64 snap cubes to build. What patterns do you notice?

12.4: What's the Prism's Height?

There are 4 different prisms that all have the same volume. Here is what the base of each prism looks like.
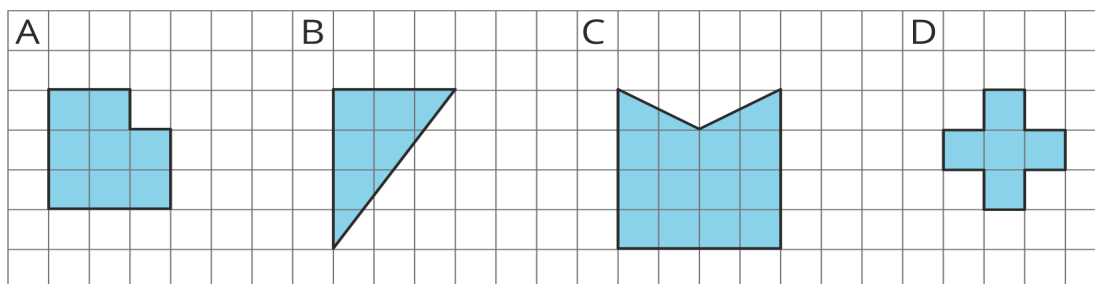
1. Order the prisms from shortest to tallest. Explain your reasoning.

2. If the volume of each prism is 60 units^3, what would be the height of each prism?

3. For a volume other than 60 units^3, what could be the height of each prism?

4. Discuss your thinking with your partner. If you disagree, work to reach an agreement.

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Lesson 12 Summary

Any cross section of a prism that is parallel to the base will be identical to the base. This means we can slice prisms up to help find their volume. For example, if we have a rectangular prism that is 3 units tall and has a base that is 4 units by 5 units, we can think of this as 3 layers, where each layer has 4 · 5 cubic units.
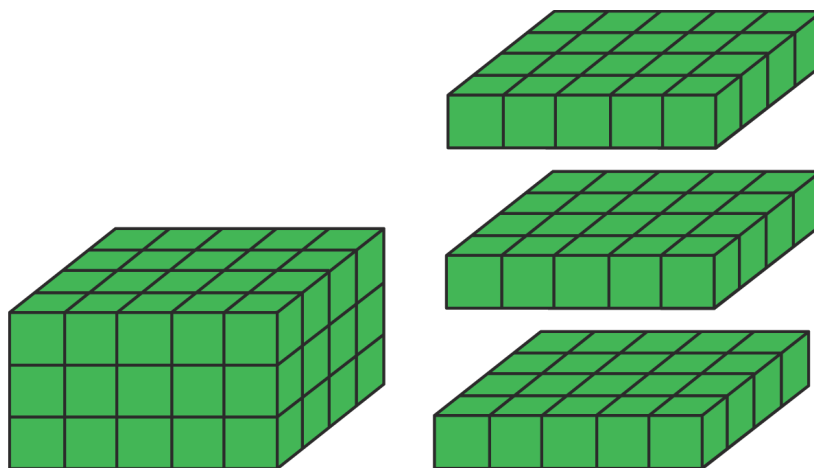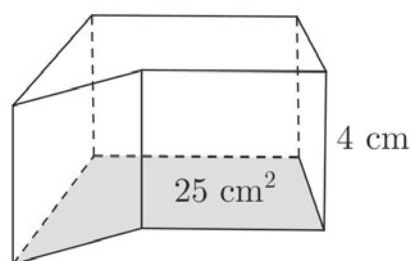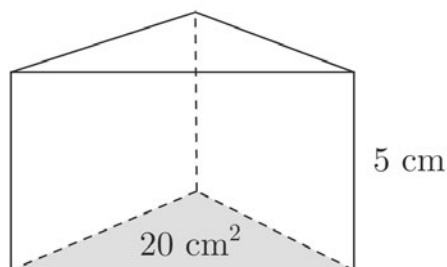
That means the volume of the original rectangular prism is 3(4 · 5) cubic units.

This works with any prism! If we have a prism with height 3 cm that has a base of area 20 cm^2, then the volume is 3 · 20 cm^3 regardless of the shape of the base. In general, the volume of a prism with height h and area B is

$$V = B \cdot h$$

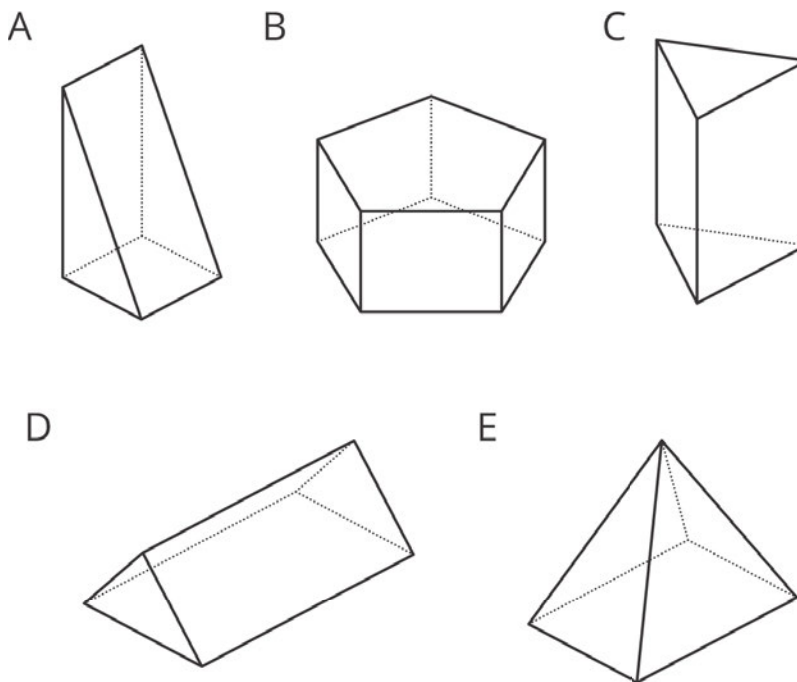For example, these two prisms both have a volume of 100 cm^3.

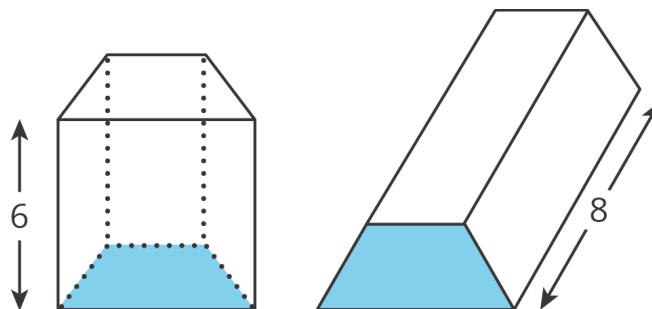5 cm

20 cm^2

4 cm

25 cm^2

Unit 7, Lesson 12: Volume of Right Prisms

1. a. Select **all** the prisms.

   b. For each prism, shade one of its bases.

A   B   C

D   E

2. The volume of both of these trapezoidal prisms is 24 cubic units. Their heights are 6 and 8 units, as labeled. What is the area of a trapezoidal base of each prism?

6   8

3. Two angles are complementary. One has a measure of 19 degrees. What is the measure of the other?

   (from Unit 7, Lesson 2)

4. Two angles are supplementary. One has a measure that is twice as large as the other. Find the two

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angle measures.

(from Unit 7, Lesson 2)

5. Match each expression in the first list with an equivalent expression from the second list.

A. $7(x + 2) - x + 3$

B. $6x + 3 + 4x + 5$

C. $\frac{-2}{5}x - 7 + \frac{3}{5}x - 3$

D. $8x - 5 + 4 - 9$

E. $24x + 36$

1. $\frac{1}{5}x - 10$

2. $6x + 17$

3. $2(5x + 4)$

4. $12(2x + 3)$

5. $8x + (-5) + 4 + (-9)$

(from Unit 6, Lesson 22)

6. Clare paid 50% more for her notebook than Priya paid for hers. Priya paid x for her notebook and Clare paid y dollars for hers. Write an equation that represents the relationship between y and x.

(from Unit 4, Lesson 8)