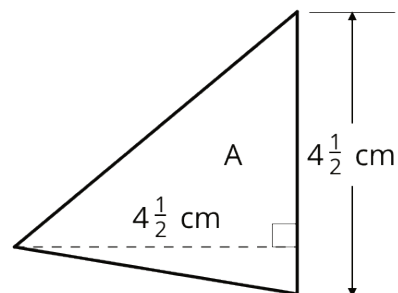


Lesson 14: Fractional Lengths in Triangles and Prisms

Let's explore area and volume when fractions are involved.

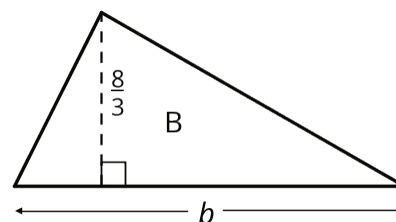
14.1: Area of Triangle

Find the area of Triangle A in square centimeters. Show your reasoning.

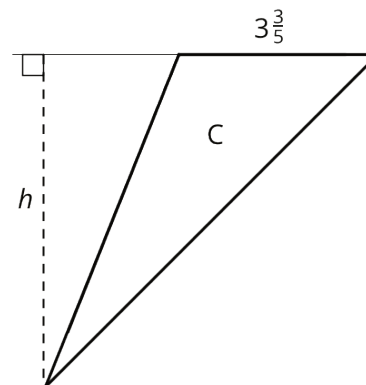


14.2: Bases and Heights of Triangles

1. The area of Triangle B is 8 square units. Find the length of b . Show your reasoning.



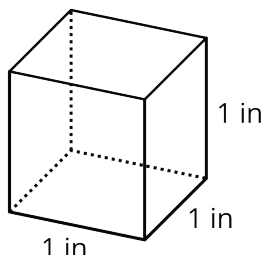
2. The area of Triangle C is $\frac{54}{5}$ square units. What is the length of h ? Show your reasoning.



14.3: Volumes of Cubes and Prisms

Your teacher will give you cubes that have edge lengths of $\frac{1}{2}$ inch.

- Here is a drawing of a cube with edge lengths of 1 inch.



- How many cubes with edge lengths of $\frac{1}{2}$ inch are needed to fill this cube?
- What is the volume, in cubic inches, of a cube with edge lengths of $\frac{1}{2}$ inch?
Explain or show your reasoning.

- Four cubes are piled in a single stack to make a prism. Each cube has an edge length of $\frac{1}{2}$ inch. Sketch the prism, and find its volume in cubic inches.

3. Use cubes with an edge length of $\frac{1}{2}$ inch to build prisms with the lengths, widths, and heights shown in the table.

a. For each prism, record in the table how many $\frac{1}{2}$ -inch cubes can be packed into the prism and the volume of the prism.

| prism length (in) | prism width (in) | prism height (in) | number of $\frac{1}{2}$ -inch cubes in prism | volume of prism (in^3) |
|-------------------|------------------|-------------------|--|-----------------------------------|
| $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | | |
| 1 | 1 | $\frac{1}{2}$ | | |
| 2 | 1 | $\frac{1}{2}$ | | |
| 2 | 2 | 1 | | |
| 4 | 2 | $\frac{3}{2}$ | | |
| 5 | 4 | 2 | | |
| 5 | 4 | $2\frac{1}{2}$ | | |

b. Examine the values in the table. What do you notice about the relationship between the edge lengths of each prism and its volume?

4. What is the volume of a rectangular prism that is $1\frac{1}{2}$ inches by $2\frac{1}{4}$ inches by 4 inches? Show your reasoning.

Are you ready for more?

A unit fraction has a 1 in the numerator.

- These are unit fractions: $\frac{1}{3}$, $\frac{1}{100}$, $\frac{1}{1}$.
- These are *not* unit fractions: $\frac{2}{9}$, $\frac{8}{1}$, $2\frac{1}{5}$.

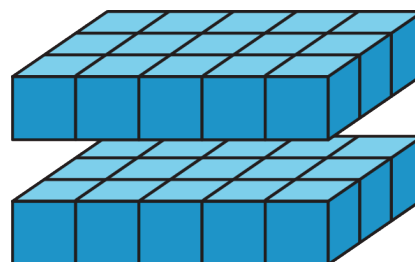
1. Find three unit fractions whose sum is $\frac{1}{2}$. An example is: $\frac{1}{8} + \frac{1}{8} + \frac{1}{4} = \frac{1}{2}$ How many examples like this can you find?

2. Find a box whose surface area in square units equals its volume in cubic units. How many like this can you find?

Lesson 14 Summary

If a rectangular prism has edge lengths of 2 units, 3 units, and 5 units, we can think of it as 2 layers of unit cubes, with each layer having $(3 \cdot 5)$ unit cubes in it. So the volume, in cubic units, is:

$$2 \cdot 3 \cdot 5$$



To find the volume of a rectangular prism with fractional edge lengths, we can think of it as being built of cubes that have a unit fraction for their edge length. For instance, if we build a prism that is $\frac{1}{2}$ -inch tall, $\frac{3}{2}$ -inch wide, and 4 inches long using cubes with a $\frac{1}{2}$ -inch edge length, we would have:

- A height of 1 cube, because $1 \cdot \frac{1}{2} = \frac{1}{2}$.
- A width of 3 cubes, because $3 \cdot \frac{1}{2} = \frac{3}{2}$.
- A length of 8 cubes, because $8 \cdot \frac{1}{2} = 4$.

The volume of the prism would be $1 \cdot 3 \cdot 8$, or 24 cubic units. How do we find its volume in cubic inches? We know that each cube with a $\frac{1}{2}$ -inch edge length has a volume of $\frac{1}{8}$ cubic inch, because $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$. Since the prism is built using 24 of these cubes, its volume, in cubic inches, would then be $24 \cdot \frac{1}{8}$, or 3 cubic inches.

The volume of the prism, in cubic inches, can also be found by multiplying the fractional edge lengths in inches: $\frac{1}{2} \cdot \frac{3}{2} \cdot 4 = 3$