

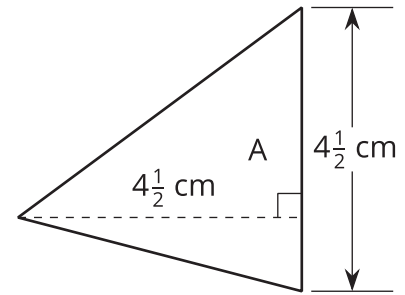


# Fractional Lengths in Triangles and Prisms

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

## 14.1 Area of Triangle

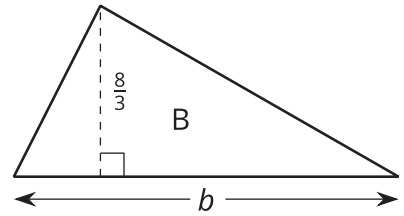
Find the area of Triangle A in square centimeters.  
Show your reasoning.



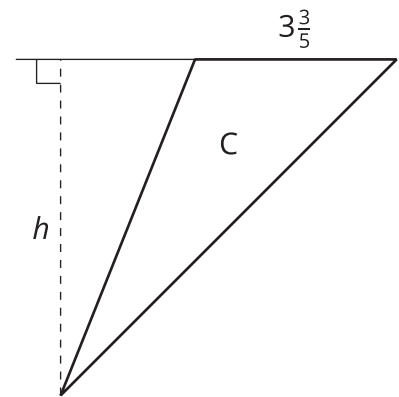
## 14.2

## Bases and Heights of Triangles

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



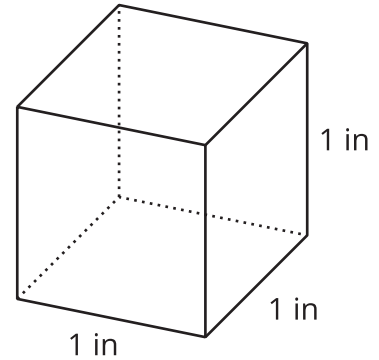
2. The area of Triangle C is  $\frac{54}{5}$  square units. What is the length of  $h$ ? Show your reasoning.



## 14.3 Volumes of Cubes and Prisms

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

1. Here is a drawing of a cube with edge lengths of 1 inch.
  - a. How many cubes with edge lengths of  $\frac{1}{2}$  inch are needed to fill this cube?



- b. What is the volume, in cubic inches, of a cube with edge lengths of  $\frac{1}{2}$  inch? Explain or show your reasoning.
2. 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.

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 <sup>3</sup> ) |
|-------------------|------------------|-------------------|--|------------------------------------|
| $\frac{1}{2}$     | $\frac{1}{2}$    | $\frac{1}{2}$     |  |                                    |
| 1                 | 1                | $\frac{1}{2}$     |  |                                    |
| 2                 | 1                | $\frac{1}{2}$     |  |                                    |
| 2                 | 2                | 1                 |  |                                    |
| 4                 | 2                | $\frac{3}{2}$     |  |                                    |
| 5                 | 4                | 2                 |  |                                    |
| 5                 | 4                | $2\frac{1}{2}$    |  |                                    |

### Are you ready for more?

A unit fraction has a 1 in the numerator.

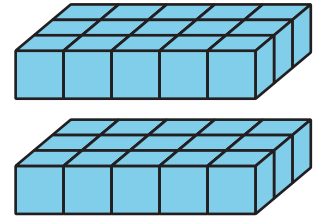
- These are unit fractions:  $\frac{1}{3}$ ,  $\frac{1}{100}$ ,  $\frac{1}{1}$ .
  - These are *not* unit fractions:  $\frac{2}{9}$ ,  $\frac{8}{1}$ ,  $2\frac{1}{5}$ .
1. Find three unit fractions whose sum is  $\frac{1}{2}$ . An example is:  $\frac{1}{8} + \frac{1}{8} + \frac{1}{4} = \frac{1}{2}$ . 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  $1 \cdot 3 \cdot 8$ , which is 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  $24 \cdot \frac{1}{8}$ , which is 3 cubic inches.

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