## 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.
* 
1. 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.
* 
	1. How many cubes with edge lengths of $\frac{1}{2}$ inch are needed to fill this cube?
	2. What is the volume, in cubic inches, of a cube with edge lengths of $\frac{1}{2}$ inch? Explain or show your reasoning.
1. 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.
2. Use cubes with an edge length of $\frac{1}{2}$ inch to build prisms with the lengths, widths, and heights shown in the table.
	1. 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.

| * + prismlength (in)
 | * + prismwidth (in)
 | * + prismheight (in)
 | * + number of $\frac{1}{2}$-inchcubes in prism
 | * + volume ofprism (in3)
 |
| --- | --- | --- | --- | --- |
| * + $\frac{1}{2}$
 | * + $\frac{1}{2}$
 | * + $\frac{1}{2}$
 |  |  |
| * + 1
 | * + 1
 | * + $\frac{1}{2}$
 |  |  |
| * + 2
 | * + 1
 | * + $\frac{1}{2}$
 |  |  |
| * + 2
 | * + 2
 | * + 1
 |  |  |
| * + 4
 | * + 2
 | * + $\frac{3}{2}$
 |  |  |
| * + 5
 | * + 4
 | * + 2
 |  |  |
| * + 5
 | * + 4
 | * + $2\frac{1}{2}$
 |  |  |

* 1. Examine the values in the table. What do you notice about the relationship between the edge lengths of each prism and its volume?
1. 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 $\left(3⋅5\right)$ unit cubes in it. So the volume, in cubic units, is: $2⋅3⋅5$



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 $1⋅\frac{1}{2}=\frac{1}{2}$.
* A width of 3 cubes, because $3⋅\frac{1}{2}=\frac{3}{2}$.
* A length of 8 cubes, because $8⋅\frac{1}{2}=4$.

The volume of the prism would be $1⋅3⋅8$, 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 $\frac{1}{2}⋅\frac{1}{2}⋅\frac{1}{2}=\frac{1}{8}$. Since the prism is built using 24 of these cubes, its volume, in cubic inches, would then be $24⋅\frac{1}{8}$, or 3 cubic inches.

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



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