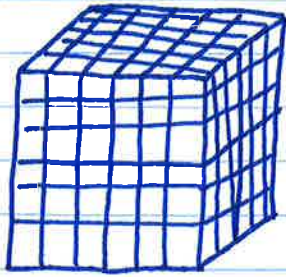Sophia Nguyen

Math CDC —Mrs. Joshi 2/13/2020

Problem: Tracy said the volume of this 3-D shape was $3 \times 3 \times 3$. Mark said the volume was $6 \times 6 \times 6 \times \frac{1}{8}$. Who is correct? Explain with proper reasoning.

$\frac{1}{2}$ in $\frac{1}{2}$ in $\frac{1}{2}$ in

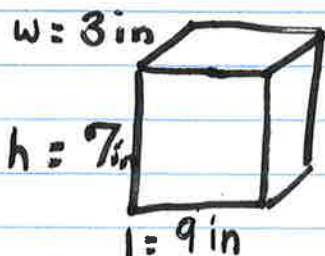**Claim:** There are many ways to find volume with fractional edge, but you must know many skills to do it correctly.

Data: First, to see who is correct, we must know how to do fractional edge length.

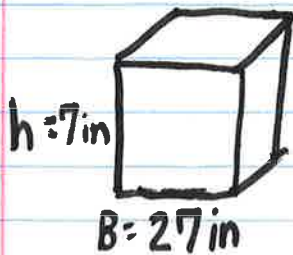Formula for volume: $\mathbf{V = lwh}$ or $\mathbf{V = Bh}$

Volume   width   Volume   Base   height
length   height
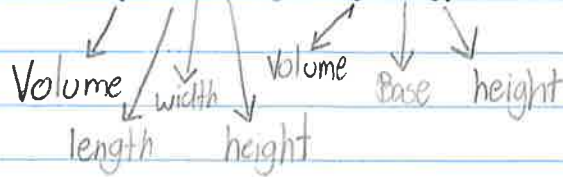
How do we know which formula to use?

$V = lwh$ will be shown like this:
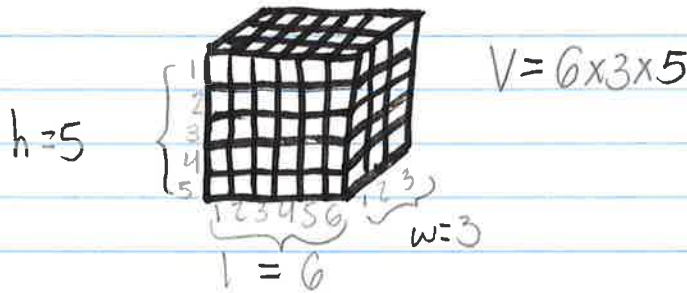
w = 3 in
h = 7 in
l = 9 in

There will be numbers showing the length, height, and width of the shape.

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And V=Bh will be shown like this:
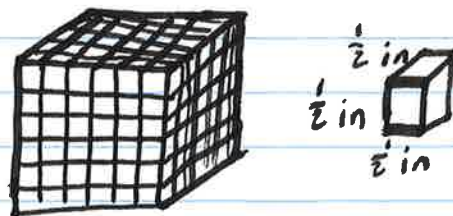
h=7in

B=27in

There are only 2 numbers here because B is actually length times width. So, all you have to do is multiply B and h to get the formula

Sometimes, you will have to count the cubes in order to find the measurment.

h=5 {1 2 3 4 5

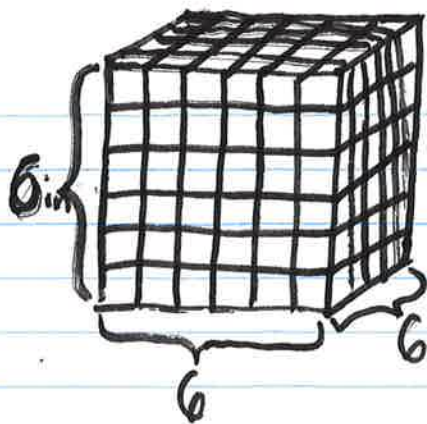1 2 3 4 5 6   1 2 3

l = 6   w=3

V= 6x3x5

Now, to find fractional edge length, you must first find the volume of the unit

½ in

½ in

½ in

Using the formula, the equation will look like this:

$$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$$

Now that we have the volume of the unit, we will now find the measurments.
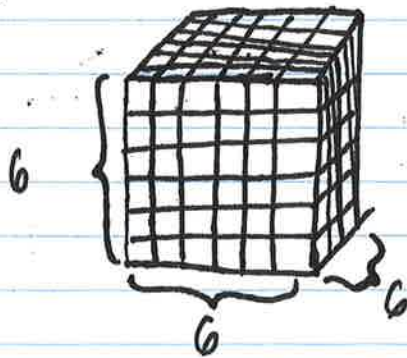
$V = lwh \longrightarrow 6 \times 6 \times 6 = 216$

Now that we have the volume, we will multiply it by the volume of the unit

$216 = \frac{216}{1}$ $\frac{216}{1} \times \frac{1}{8} = \frac{216}{8}$ **ALWAYS** simplify fractions

$\frac{216}{8} = 27 \text{ in}^3 \leftarrow$ Remember the cubed!
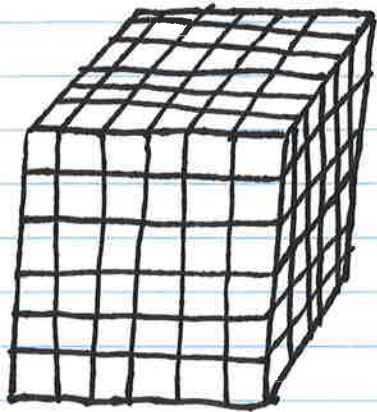
$\uparrow$ Don't forget the measurment!

Mark:

$6 \times 6 \times 6 \times \frac{1}{8} = 27 \text{ in}^3$

Mark's method is correct!

Tracy:

Since each side of the unit is $\frac{1}{2}$ and we know two $\frac{1}{2}$ make a whole unit, we would count the cube like this:
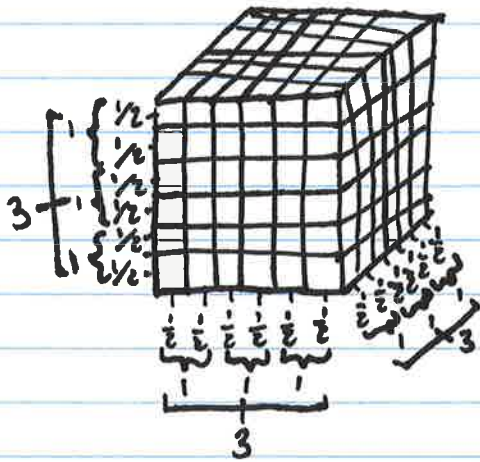
$$3 \times 3 \times 3 = 27 \text{ in.}^3$$

Tracy's method is also correct!

Commentary: Like I shown in the beginning, there are many ways to find volume with fractional edge length. But, before even finding the volume, we must know the formulas. The first one is V=lwh. V stands for volume, which is what

you'll be solving for. Volume is the space inside of a 3d shape. 'l is length, which is how long it is. w is width, how wide it is, and h is height, how high it is. Then, after you've found your l, w, and h, you multiply all 3 of them to find your volume. Another formula is $V=Bh$. You already know what V and h stand for, so what is B? B stands for base, which is length and width combined, so all you have to do is multiply B and h to find your volume. Now that we know 2 of the formulas for volume, how do we know which one to use? To begin, for $V=lwh$, you will see 3 numbers close to the length, width, and height of the shape. In some word problems, it may even tell you the measurments. For $V=Bh$, you'll see there is only a number for the height and one for the base of the shape. Sometimes, the shape won't even have measurments, and you'll just have to count them. Some shapes have fractional edge length, like the one in the problem. When solving a shape like this, you'll first have to find the volume of the unit. This is what Mark did. The measurments of the unit is $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$, which gives us $\frac{1}{8}$. Then, after counting how many units are in the shape, the length, width, and height is 6. The volume for $6 \times 6 \times 6$ is 216. Now, we take the $\frac{1}{8}$ and multiply it by 216, giving us $\frac{216}{8}$ and simplifying it to 27. Before this can be the answer, we must put in the type of measurment, which, in this case is inches, and we must put ³ (cubed) at the end. Your answer should look like this: 27 in.³. Tracy found the volume a bit differently than Mark. As I have mentioned earlier, each side of the unit is $\frac{1}{2}$, and each side of the shape is 6 inches. Since each side is only $\frac{1}{2}$ and we know $\frac{1}{2} + \frac{1}{2}$ is 2, six $\frac{1}{2}$'s would add up to 3. This is

why on Tracy's equation, all of the sides are 3 instead of 6 like Mark's. So, $3 \times 3 \times 3$ is 27 and with the measurment and ^{3}, her answer would be 27 in.^{3}. Now you know how to find the fractional edge length of a shape and you can see why both Mark and Tracy are correct.