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Mrs. Joshi

Question: Tracy said that 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.

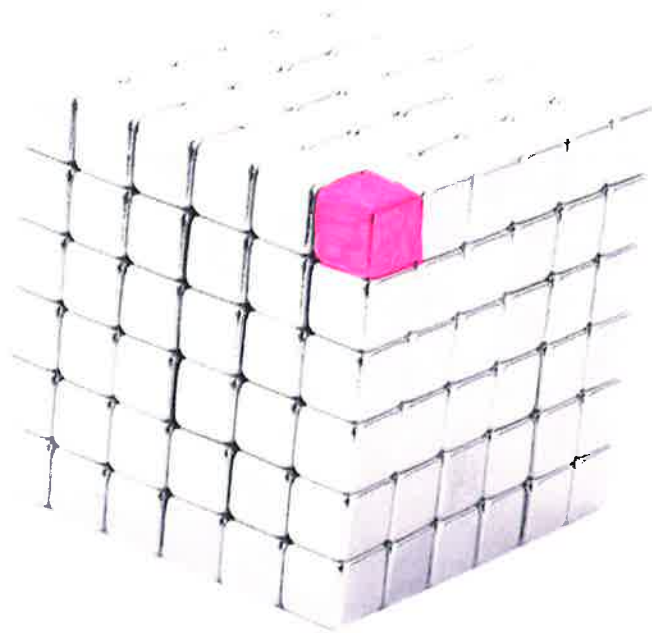


Figure 1. 3-D Shape

Claim: Tracy and Mark are both calculating the volume of a 3D cube and are both correct with their calculations. By evaluating the cube, Tracy uses $3 \times 3 \times 3$ and Mark used $6 \times 6 \times 6 \times \frac{1}{8}$. Tracy used $\frac{1}{2}$ to calculate each cube and then multiplied, but Mark calculated to find the cube volume and then he multiplied it by the number of cubes. See Figure 1.

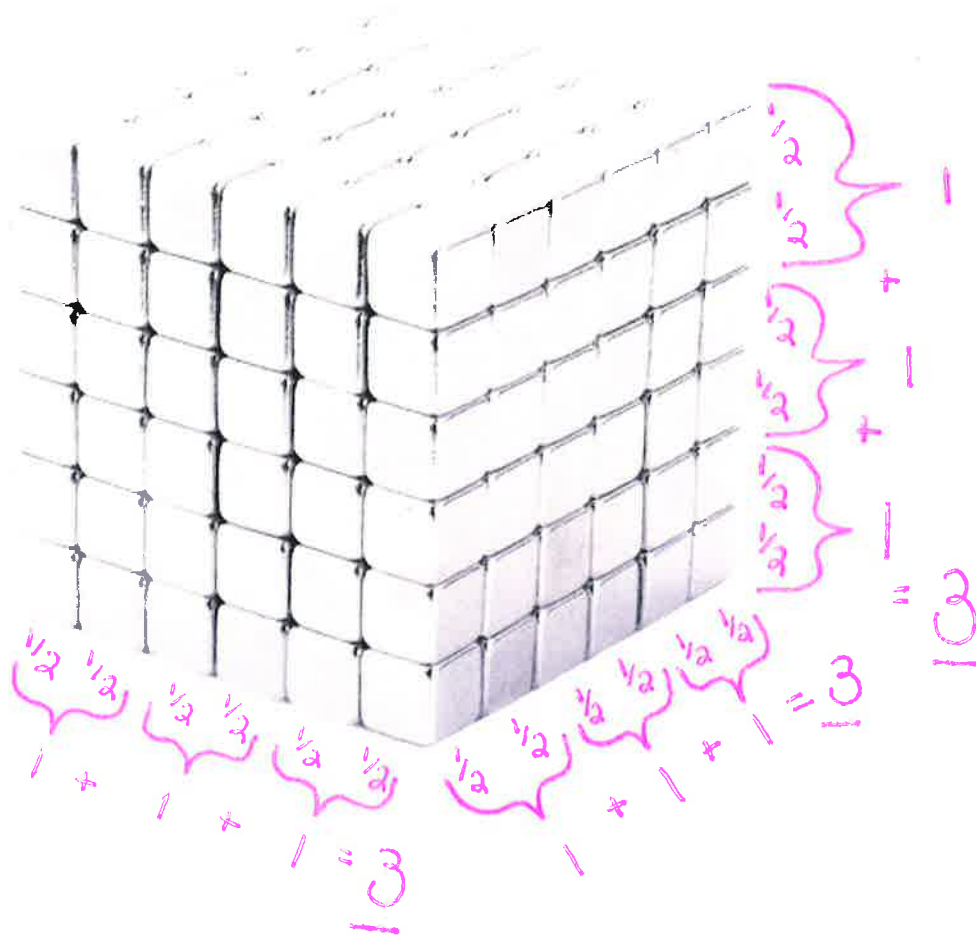
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Data:

See Figure 2 for Tracy's Data: Tracy's used this formula: $V = l \times w \times h$. Tracy used the fractional edge length on one side to calculate the volume.



$$V = L \times W \times H$$
$$V = 3 \times 3 \times 3$$
$$V = 27 \text{ in.}^3$$

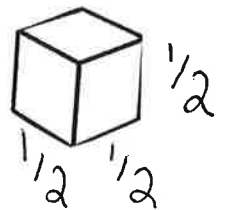


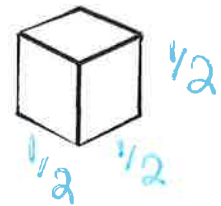
Figure 2. Tracy's Work

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See Figure 3 for Mark's Data: Mark used this formula: $V = l \times w \times h \times v$. Mark used the fractional edge length.



$$V = l \times w \times h \times v$$

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

$$V = \frac{1}{8}$$

$$\begin{array}{r}
 27 \\
 8 \overline{) 216} \\
 \underline{16} \\
 056 \\
 \underline{56} \\
 00
 \end{array}$$

$$\begin{array}{r}
 3 \\
 36 \\
 \times 6 \\
 \hline
 216
 \end{array}$$

$$V = l \times w \times h \times v$$

$$V = 6 \times 6 \times 6 \times v$$

$$V = 216 \times v$$

$$v = \frac{216}{1} \times \frac{1}{8}$$

$$v = \frac{216}{8}$$

$$v = 27 \text{ in. }^3$$

Figure 3. Mark's Work

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Commentary: Both calculations are correct as shown in figure 2 and figure 3.

Here is the formula used by Tracy:

$V = l \times w \times h$ (V means Volume, l means length, w means width and h means height). Then Tracy calculated one side of the fractional edge length to count the cubes on the prism.

Here is the formula used by Mark:

$V = l \times w \times h \times v$ (V means Volume, l means length, w means width, h means height, and v means to calculate the volume one cube). Here is how Mark found the fractional edge length. Using the formula $v = l \times w \times h$ (v means volume of one cube, l means length, w means width and h means height). This is known as the fractional edge length. Then multiply v in Volume Formula.

Let me explain in more details, Tracy's used this formula: $V = l \times w \times h$. Tracy counted one side of the fractional edge length to find out how many cubes are on each side of the prism. She counted each cube $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 3$ length, $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 3$ width, $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 3$ height. Next, Tracy used the formula $V = l \times w \times h \rightarrow V = 3 \times 3 \times 3 = 27\text{in}^3$

However, Mark used $V = l \times w \times h \times v$. First, Mark calculated the fractional edge length. Using the formula $v = l \times w \times h$. $v = \frac{1}{2} * \frac{1}{2} * \frac{1}{2} = 1/8$. Next, Mark counted the cubes on each side of the prism which is length = 6, width = 6, height = 6. Now that Mark knows all the information to calculate the volume, he

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multiplied everything together: $V = l \times w \times h \times v \rightarrow V = 6 \times 6 \times 6 \times 1/8 = 27\text{in}^3$.
Here is how to do step by step: $6 \times 6 \times 6 = 216$. $216/1 \times 1/8 = 216/8 = 27\text{in}^3$

In conclusion, Tracy and Mark are both correct and the answers is 27in^3