

Task: Volume of a Cube

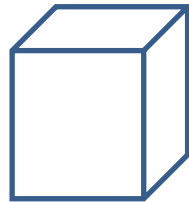
Algebra II/Core Math II

1. The area of a square is $16a^3b^5$.



- Come up with two different expressions for the length of one side of the square.
- Explain how you know your expressions are equivalent.

2. The volume of a cube is $64a^4b^3c^7$.



- Write an expression for the length of one edge of the cube.
- Find a way to show that your answer is correct
- Come up with an expression for the surface area of the cube.

Teacher Notes:

This is a different approach to teaching rational exponents and the concept of square and cube roots of algebraic expressions.

This is a great way for students to visualize the concept of $1/2$ and $1/3$ power

Common Core State Standards for Mathematical Content

N-RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Common Core State Standards for Mathematical Practice

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Essential Understandings

Some representations of a function may be more useful than others, depending on the context.

Explore Phase**Possible Solution Paths**

$$1a) \sqrt{16a^3b^5}$$

or

$$4ab^2\sqrt{ab}$$

or

$$4a^{3/2}b^{5/2}$$

Assessing and Advancing Questions

Assessing – If I know the area of a square, how do I find the length of one side?

Why did you choose these 2 representations?

Advancing- Would there be a third representation that would also work?

$$1b) \sqrt{16a^3b^5}$$

or

$$4ab^2\sqrt{ab}$$

or

$$4a^{3/2}b^{5/2}$$

Assessing – What approach did you take to show that your expressions are equivalent? Why?

Advancing- Is there a third expression that you could show is also equivalent?

2a) $4a^{4/3}bc^{7/3}$

or

$$4abc^2\sqrt[3]{ab}$$

Assessing – If I know the volume of a cube, how do I find the length of one edge?

How did you come up with your answer?

Advancing- Is there another representation that would also work?

2b) $(4a^{4/3}bc^{7/3})^3 = 64a^4b^3c^7$

Or

$$(4a^{4/3}bc^{7/3})(4a^{4/3}bc^{7/3})(4a^{4/3}bc^{7/3}) = 64a^4b^3c^7$$

Assessing - How did you know to take your answer and raise it to the third power?

Advancing- Is there another way to show your answer is correct, other than what you did?

<p>2c) $6(4a^{4/3}bc^{7/3})^2$</p> <p>Or</p> <p>$96a^{8/3}b^2c^{14/3}$</p>	<p>Assessing – How can you find the surface area of a cube?</p> <p>Advancing- What if the original coefficient had been a non-perfect cube such as 40? How would you write your answer to part c?</p>
<p>Possible Student Misconceptions</p>	
<p>1a) Students may struggle to write two expressions for the side.</p>	<p>Assessing – How did you come up with your expression for the side?</p> <p>Advancing – How can we use his to help come up with another expression?</p>
<p>1b) Students may struggle to show how the expressions are equivalent.</p>	<p>Assessing – What was your reasoning to show that your expressions are equivalent?</p> <p>Advancing – Is there another expression that would also be equivalent to your two expressions?</p>
<p>2a) Students may struggle to write the expression for the edge.</p>	<p>Assessing – If we know the volume of a cube is 125 how can we come up with one edge of the cube?</p> <p>Advancing – How can we use this to help us with this part?</p>
<p>2b) Students may struggle to show how they know they are correct.</p>	<p>Assessing – If you knew an edge of a cube is 5, how would you come up with the volume?</p> <p>Advancing – How can we use this to help us with this part?</p>
<p>2c) Students may not understand how to go from the volume to the surface area.</p>	<p>Assessing – What does surface area mean? What is the formula for surface area of a cube?</p>

	Advancing - How can we use the formula to work this out?
Entry/Extensions	Assessing and Advancing Questions
If students can't get started....	<p>Assessing- What if the area of the square is 36? What is the length of one side? What if the volume of the cube is 125? What is length of one edge?</p> <p>Advancing- How can we use this information to help us answer the questions?</p>
If students finish early....	<p>Assessing- Can you find a second way to write the expression for the edge of the cube and show that it is equivalent to your answer to 2b?</p> <p>Advancing- Could you come up with a tangible way to have a problem similar to this for a fourth root?</p>
Whole Group Questions	
<ul style="list-style-type: none"> • If I know the length of the side of a square, how do I find the area? What operation is this? • What if I know the area of a square, how do I find the length of one side? What operation is this? How are the operations for these questions related? • What about for a cube? What if I know the length of one side and want to know the volume? What operation is this? • What if I know the volume and want to know the length of one side? How are these operations related? • How did this activity help you understand the concept of cube root and the $1/3$ power? • Does one representation of your answer make more sense to you than others? Why or why not? 	

Volume of a Cube

Name _____

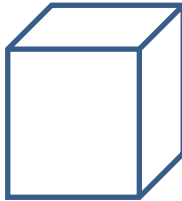
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a) Come up with two different expressions for the length of one side of the square.

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2. The volume of a cube is $64a^4b^3c^7$.



c) Write an expression for the length of one edge of the cube.

d) Find a way to show that your answer is correct.

Come up with an expression for the surface area of the cube.