Just In Time Quick Check

Standard of Learning (SOL) G.14b

Strand: Three Dimensional Figures

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The student will apply the concepts of similarity to two- or three-dimensional geometric figures. This will include determining how changes in one or more dimensions of a figure affect area and/or volume of the figure.

Grade Level Skills:

- Describe how changes in one or more dimensions affect other derived measures (perimeter, area, surface area, and volume) of a figure.

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Supporting Resources:

- VDOE Mathematics Instructional Plans (MIPS)
  - G.14 - Similar Solids and Proportional Reasoning (Word) / PDF Version
- VDOE Word Wall Cards: Geometry(Word) | (PDF)
  - Cone
  - Cylinder
  - Polyhedron
  - Sphere
  - Hemisphere
  - Pyramid
- Other VDOE Resources
  - Geometry, Module 14, Topic 3 - Determining How Changes in One Dimension Affect Perimeter, Area, Volume and Vice-Versa[eMediaVA]

Supporting and Prerequisite SOL: 8.6a, 8.6b, 8.10, 7.3, 7.4a, 7.4b

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1. A cylinder has a volume of $72\pi\ \mathrm{m}^3$. The radius of the cylinder is doubled to create a new cylinder with the same height. What is the volume of the new cylinder?

2. Andrew has two square pyramids with the same base. The volume of the larger pyramid is 8 times the volume of the smaller pyramid. How much greater is the height of the larger pyramid than the smaller pyramid?

3. The side lengths of square M are tripled to create square N. Create a statement to show how the area of square M and the area of square N are related.

4. Two different rectangular solids each have a volume equal to $240m^3$.

    a. Create dimensions for each of the two rectangular solids using integer values. Verify that this is possible.

    b. Are the two rectangular solids similar, congruent or neither? Explain your thinking.

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Common Errors/Misconceptions and their Possible Indications

1. A cylinder has a volume of $72\pi \text{ m}^3$. The radius of the cylinder is doubled to create a new cylinder with the same height. What is the volume of the new cylinder?

A common error a student may make is assuming the volume of the new cylinder will double. This may indicate that a student does not understand that the radius is squared in the volume formula for a cylinder. Therefore, the volume will quadruple instead of double. Students with this misconception would benefit from finding the volume of different cylinders and compare how the volume is affected when the radius changes versus when the height changes. Using the dynamic graphing feature within desmos, students can see how the volume changes when r is doubled, tripled, etc. and that the height has a linear relationship. Teachers are encouraged to demonstrate how these changes affect volume by using manipulatives such as nets or relational solids to form cylinders with changing heights and radii.

2. Andrew has two square pyramids with the same base. The volume of the larger pyramid is 8 times the volume of the smaller pyramid. How much greater is the height of the larger pyramid than the smaller pyramid?

A common misconception some students may have is thinking the height of the larger pyramid is two times greater than the height of the smaller pyramid. This may indicate that a student believes the relationship between the two heights can be found using a cube root factor of 8. This may also indicate that students do not understand that changing the height of a square pyramid results in a figure that is not similar to the original figure. Two solids are similar if and only if they are the same type of solid and their corresponding linear measures (heights, base lengths, etc.) are proportional. Teachers are encouraged to model this concept using dynamic software in order to allow students to manipulate dimensions and then to analyze the resulting values for the volume.

3. The side lengths of square M are tripled to create square N. Create a statement to show how the area of square M and the area of square N are related.

A common error students may make is assuming that the area of square N will also triple. This may indicate that students do not understand that all squares are similar and that if the sides increase at a ratio of a:b then the area of the square increases at a ratio of a^2:b^2. Students may benefit from exploring what happens to the areas of squares and cubes when all side lengths increase or decrease.

4. Two different rectangular solids each have a volume equal to $240m^3$.

   a. Create dimensions for each of the two rectangular solids using integer values. Verify that this is possible.

   b. Are the two rectangular solids similar, congruent or neither? Explain your thinking.

A common error students may make is assuming that all rectangular solids with the same volume must be similar or congruent. Students with this misconception would benefit from working with manipulatives to build rectangular solids that have the same capacity. Another teacher strategy could include using dynamic software to create solids for this scenario to determine possible side lengths, height, and area.