Surface Area and Volume Learning Strategies

What should students be able to do within this interactive?

- Identify a prism, pyramid, cylinder and cone.
- Understand the difference between the concept of surface area and volume.
- Understand the substitution of the dimensions into the formulas for volume and surface area.
- Recognize how changing the dimensions will affect the shape of each figure.
- Recognize how changing the dimensions will affect the surface area and volume of each figure.
- Understand the surface area of a shape is found by adding together the areas of each surface.
- Recognize the volume of a shape is found by multiplying the area of the base by its height.

Common mistakes made by students:

- Not recognizing the difference between a prism and pyramid.
- Not understanding the difference between the meaning of surface area and volume.
- Not understanding the substitution of the dimensions into the surface area or volume formulas.

Curriculum Connections:

- Please note all of the following correlations match outcomes in the new Mathematics Kindergarten to Grade 9 Program of Studies (2007).

Grade 5 Shape and Space SO4: Demonstrate an understanding of volume by:
  - selecting and justifying referents for $cm^3$ or $m^3$ units.
  - estimating volume, using referents for $cm^3$ or $m^3$.
  - Measuring and recording volume ($cm^3$ or $m^3$).
  - Constructing right rectangular prisms for a given volume.

Grade 6 Shape and Space SO3: Develop and apply a formula for determining the:
  - perimeter of polygons
  - area of rectangles
  - volume of right rectangular prisms.

Grade 8 Shape and Space SO2: Draw and construct nets for 3-D objects.
Grade 8 Shape and Space SO3: Determine the surface area of:

- right rectangular prisms
- right triangular prisms
- right cylinders
  to solve problems.

Grade 8 Shape and Space SO4: Develop and apply formulas for determining the volume of right rectangular prisms, right triangular prisms and right cylinders.

Grade 8 Shape and Space SO5: Draw and interpret top, front and side views of 3-D objects composed of right rectangular prisms.

Print Activity notes:
*Note: The Print Activity is not intended to be an assessment piece

It is necessary for students use the “Explore It” mode to work through the Print Activity. Students will be asked to select one of the six given geometric shapes in order to calculate its surface area or volume. Dimensions can be altered by adjusting the sliding bar. The print activity will allow students to identify the shapes and see the steps required to solve for the surface area and volume.

The Print Activity may be opened in Word Format instead of PDF so that changes to questions can be made.

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**Surface Area and Volume Print Activity Key**

Use the “Explore It” mode to answer the following questions:
1. Match the shape to its name:
   a. ![Shape A]  b. ![Shape B]  c. ![Shape C]  d. ![Shape D]  e. ![Shape E]  f. ![Shape F]

   - _a__ Rectangular Prism
   - _b__ Rectangular Pyramid
   - _c__ Triangular Prism
   - _d__ Triangular Pyramid
   - _e__ Cylinder
   - _f__ Cone
2. Match the shapes to their properties:
   a. [Shape] The shapes that have circular bases are e and f.
   b. [Shape] The shapes that have rectangular bases are a and b.
   c. [Shape] The shapes that have triangular bases are c and d.
   d. [Shape]

3. Select Reset. Answer the following:
   a. The shape displayed on both sides of the screen is called a rectangular prism.
   b. The formula beneath each shape is for the volume.
   c. The formula stated in words is \( V = \text{area of the base} \times \text{height} \).
   d. The formula stated in variables is \( V = lwh \).
   e. In this example each side measures 5 m.
   f. The volume of the shape is \( 125 \text{ m}^3 \).
   g. Change the setting to Surface Area. This shape has 6 surfaces and the SA is \( 150 \text{ m}^2 \).

4. Select Reset, Rectangular Prism and Rectangular Pyramid.
   a. The base of both shapes is a rectangle whose area formula is \( A = lw \).
   b. The volume formula for the prism is \( V = lwh \) and the volume \( V = 125 \text{ m}^3 \).
   c. The volume formula for the pyramid is \( V = \frac{1}{3}lwh \) and the volume \( V = 41.67 \text{ m}^3 \).
   d. Select Surface Area for each shape.
      i. The prism is made up of 6 rectangular surfaces and has a surface area of \( 150 \text{ m}^2 \).
      ii. The pyramid is made up of 1 rectangular and 4 triangular surfaces and has a surface area of \( 81 \text{ m}^2 \).

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5. Select **Reset, Triangular Prism** and **Triangular Pyramid**.
   
a. The base of both shapes is a triangle whose area formula is \( A = \frac{1}{2}ab \).

b. The volume formula for the prism is \( V = \frac{1}{2}abh \) and the volume \( V = 70 \text{ m}^3 \).

c. The volume formula for the pyramid is \( V = \frac{1}{3}abh \) and the volume \( V = 116.67 \text{ m}^3 \).

   d. Select **Surface Area** for each shape.
      
i. The prism is made up of 2 triangular surfaces, 3 rectangular surfaces, and its surface area is 103 m².

      ii. The pyramid is made up of 4 triangular surfaces and its surface area is 53.9 m².

6. Select **Reset, Cylinder and Cone**.
   
a. The base of both shapes is a circle whose area formula is \( A = \pi r^2 \).

b. The volume formula for the cylinder is \( V = \pi r^2h \) and the volume \( V = 392.5 \text{ m}^3 \).

c. The volume formula for the cone is \( V = \frac{1}{3} \pi r^2h \) and the volume \( V = 130.83 \text{ m}^3 \).

   d. Select **Surface Area** for each shape. The resulting surface area of the cylinder is 314 m² and for the cone is 166.42 m².

7. Use the dimension sliders to complete the steps for each:
   
a. The volume of a **Triangular Prism** whose base = 10m and height = 6m is:

   \[
   V = \frac{1}{2}abh = \frac{1}{2} \times 10 \times 6 = 30 \text{ m}^3
   \]

b. The surface area of a **Cylinder** whose radius is 7m and height is 7m is:

   \[
   \begin{align*}
   SA &= \pi r^2 + 2\pi rh \\
   SA &= (3.14)(7)^2 + (3.14)(7)(7) \\
   SA &= 615.44 \text{ m}^2
   \end{align*}
   \]
c. The volume of a **Rectangular Pyramid** whose length = 7m, width = 3m and height = 9m is:

\[ V = \frac{1}{3} lwh \]

\[ V = \frac{1}{3} (7)(3)(9) \]

\[ V = \frac{1}{3} (21)(9) \]

\[ V = \frac{1}{3} (189) \]

\[ V = 63m^3 \]

d. The surface area of a **Cone** whose radius = 9m and height = 4m is:

\[ SA = \pi r^2 + \pi r \cdot l \]

\[ SA = 3.14(9)^2 + (3.14)(6)(9) \]

\[ SA = 254.34 + 169.56 \]

\[ SA = 423.9m^2 \]

8. The surface area of any shape is found by **adding** together the areas of each of the surfaces of the shape.

9. When required, choose the shape(s) from the list below to answer the questions.

   i) Cone
   ii) Rectangular Prism
   iii) Triangular Prism
   iv) Rectangular Pyramid
   v) Triangular Pyramid
   vi) Cylinder

   a. How many shapes use \( V = \text{Area of Base} \times h \) to calculate the volume? \( 3 \)

   b. The shapes are ii, iii, vi.

   c. How many shapes use \( V = \frac{1}{3} \text{Area of Base} \times h \) to calculate the volume? \( 3 \)

   d. The shapes are i, iv, v.

   e. The shapes that use the volume formula \( V = \frac{1}{3} \text{Area of Base} \times h \) all have a “top” that is a point.