Math Labs

Activity 4: Volume and Surface Area using a Spreadsheet

Problem Statement

Investigate the relationship between surface areas or volumes of solids when only one dimension of a three-dimensional figure is changed.

Equipment

Spreadsheet computer program

In this activity, you will use a spreadsheet to calculate the surface areas and volumes of various solids.

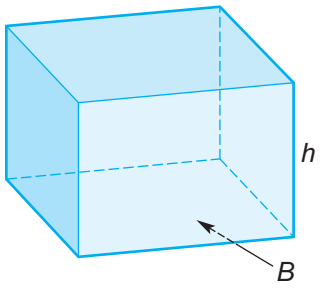
You will double a single dimension of a solid and then compare its original surface area and volume to its new surface area and volume to discover how the measures are related.

Rectangular Prism

h = height

B = length × width

For Rectangular Prism 1, use
h = 3 units,
length = 6 units, and
width = 4 units.



$V = Bh$

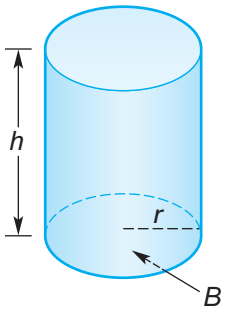
Cylinder

h = height

r = radius

$B = \pi r^2$

For Cylinder 1, use
h = 9 units and
r = 5 units.

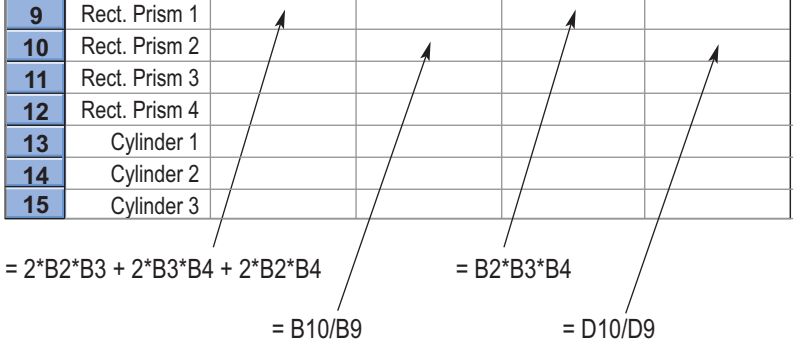


$V = Bh$

Procedure

1 Set up a spreadsheet with labels as shown.

	A	B	C	D	E
1		Rect. Prism 1	Rect. Prism 2	Rect. Prism 3	Rect. Prism 4
2	Length				
3	Width				
4	Height				
5		Cylinder 1	Cylinder 2	Cylinder 3	
6	Radius				
7	Height				
8		Surface Area	Ratio	Volume	Ratio
9	Rect. Prism 1				
10	Rect. Prism 2				
11	Rect. Prism 3				
12	Rect. Prism 4				
13	Cylinder 1				
14	Cylinder 2				
15	Cylinder 3				



2 Enter the dimensions provided for Rectangular Prism 1 and Cylinder 1. For Rectangular Prism 2, double only the length. For Rectangular Prism 3, double only the width. For Rectangular Prism 4, double only the height. For Cylinder 2, double only the radius. For Cylinder 3, double only the height.

3 Enter formulas to calculate the surface areas of the prisms and cylinders. The formula for Rectangular Prism 1 is shown above as an example.

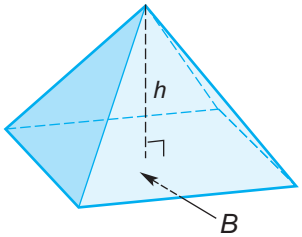
4 Enter formulas to calculate the volumes of the prisms and cylinders. The formula for Rectangular Prism 1 is shown above.

5 Enter formulas to calculate the ratio of each new surface area to the original surface area. The formula for Rectangular Prism 1 is shown above as an example.

6 Enter formulas to calculate the ratio of each new volume to the original volume. The formula for Rectangular Prism 1 is shown above.

7 Use the toolbar commands *Format* / *Cells* / *Number* / *Fraction* so that cells C10–C15 and E10–E15 display entries as fractions.

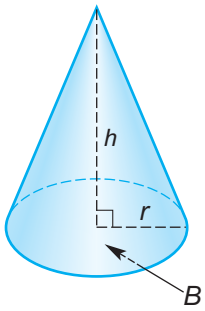
8 Using this spreadsheet as a guide, create a new spreadsheet to investigate changing one dimension at a time of a rectangular pyramid and a cone. Use the dimensions given.



$V = \frac{1}{3}Bh$

$V = \frac{1}{3}lwh$

For the rectangular pyramid, use $h = 3$ units, length $= 6$ units, and width $= 4$ units.



$V = \frac{1}{3}Bh$

$V = \frac{1}{3}\pi r^2 h$

For the cone, use $h = 9$ units and $r = 5$ units.

Discussion Questions

Questions 9–11 refer to Steps 1–7.

9 Using the ratios, what relationship(s) do you see between the surface areas of Rectangular Prism 1 and Rectangular Prisms 2, 3, and 4? What relationship(s) do you see between the surface areas of Cylinder 1 and Cylinders 2 and 3?

10 Using the ratios, what relationship(s) do you see between the volumes of Rectangular Prism 1 and Rectangular Prisms 2, 3, and 4? What relationship(s) do you see between the volumes of Cylinder 1 and Cylinders 2 and 3?

11 Suppose the dimensions are changed by a factor of $\frac{1}{2}$ instead of a factor of 2. Draw conclusions about the ratios of surface areas and volumes.

Questions 12–13 refer to Step 8.

12 Make a conjecture about how changing each dimension of a rectangular pyramid or a cone affects the relationship between the surface areas of the original pyramid or cone and the new pyramid or cone? What about the volumes?

13 Study the volume relationships between prisms and pyramids and cylinders and cones. Describe any pattern you see.