CORD Communications
Virginia Supplemental Material

Grade 8

Click on the Bookmark (tab on left of document) provided to view additional material for the following Virginia Math Standards:

SOL 8.2

SOL 8.7(a)

CORD COMMUNICATIONS
tools for contextual teaching

Lesson 1.1 The Set of Real Numbers

Objectives

- Classify numbers.
- Order numbers from least to greatest.

You may think that the names of different types of numbers are unimportant. But later, when you learn and apply different properties of numbers, it will be important to know their names.

Natural Numbers: $\{1, 2, 3, \ldots\}$
The first numbers you learned as a child were the *natural numbers*. These are the numbers you used to count your fingers and toes.

Whole Numbers: $\{0, 1, 2, 3, \ldots\}$
As you grew up, you learned the meaning of "No," "None," and "Nothing." So, your understanding of numbers grew to include zero. The set of natural numbers and *zero* are the *whole numbers*.

Integers: $\{\ldots, -2, -1, 0, 1, 2, 3, \ldots\}$
In school you learned about addition and subtraction. Sometimes you can "take away" more than you have. You swim below the surface of the water. You can take an elevator ride below the ground floor. So, you learned about *negative numbers*. When positive and negative whole numbers are included, the set is the *integers*.

Rational Numbers
Examples of rational numbers: $\frac{1}{2}, \frac{4}{3}, -\frac{8}{10}, 7$
As long as you can get the "whole thing," integers serve you very well. But you live in a world where people divide and share. A pie is divided into six pieces and someone takes $\frac{1}{6}$ of the pie. A meter is divided into 1,000 pieces. All the numbers that can be written as integers or the quotient of two integers are called *rational numbers*.

Irrational Numbers
Examples of irrational numbers: $\sqrt{2}, \sqrt[3]{5}, \pi, e$
You simply cannot write some numbers as quotients of two integers. What number multiplied by itself equals 2? What number is the ratio of a circle's circumference to its diameter? The answers to these questions are not rational numbers. So mathematicians call them *irrational numbers*.

Real Numbers
Examples of real numbers: $-11, -2.4, \sqrt{12}, \frac{2}{3}, 14$
All the rational numbers and irrational numbers make up the set of *real numbers*.

Activity 1 The Set of Real Numbers

To help you visualize how the sets of numbers on the previous page fit together, draw an illustration.

1. Take a blank sheet of paper and draw a large rectangle that fills up almost the whole page. Write a title outside that rectangle, "Real Numbers." This rectangle will represent all the real numbers.

2. Now divide the real-number rectangle in two parts: one for the rational numbers and the other for the irrational numbers. Label the parts. If you have colored pencils, you can shade each section a different color.

3. In the rational-number side show the subsets using smaller rectangles, drawn inside each other. How many rectangles do you draw in the rational-number side?

4. Reread the definitions on the previous page, if necessary. What set of numbers does the largest rectangle inside the rational-number side represent? the middle-sized rectangle? the smallest rectangle?

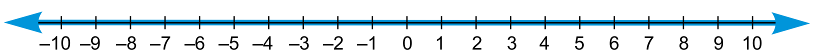
5. What is the difference between the whole numbers and the natural numbers? Can you show that on your illustration?

Ongoing Assessment

Classify each number in as many ways as possible.

1. -9 **2.** 3.5 **3.** 0 **4.** $\sqrt{3}$

A **number line** is used to picture positive and negative numbers. The numbers to the right of zero on a number line are positive. The numbers to the left of zero on a number line are negative. Every real number can be graphed on a number line. And every point on a number line corresponds with a real number. Therefore, a number line can be used as a representation of the real number system. On the number line below, the solid blue line represents all real numbers.



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.

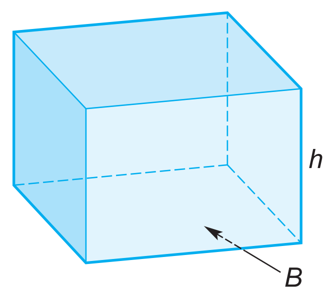
You will double a single dimension of a solid and then compare its original surface area and volume to its new surface area and volume to discover how the measures are related.

Rectangular Prism

h = height

B = length × width

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



$V = Bh$

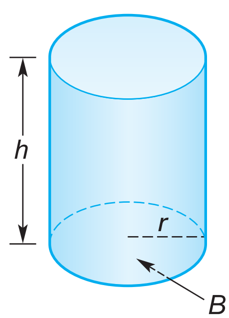
Cylinder

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*B2*B3 + 2*B3*B4 + 2*B2*B4

= B2*B3*B4

= B10/B9

= D10/D9

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.

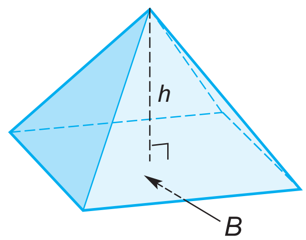
4 Enter formulas to calculate the volumes of the prisms and cylinders. The formula for Rectangular Prism 1 is shown above.

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.

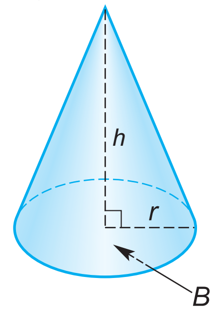
8 Using this spreadsheet as a guide, create a new spreadsheet to investigate changing one dimension at a time of a rectangular pyramid and a cone. Use the dimensions given.



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

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

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.