![j0396520[1]]()

Academic Subject(s): Mathematics

Grade Level(s): 8

***Standards Integrated into the Lesson Plan:***

**Student Content National Mathematics Standards:**

 *Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships*

• precisely describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties;

• understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects;

**National Educational Technology Standards for Students**

*3. Research and Information Fluency*

 Students apply digital tools to gather, evaluate, and use information. Students:

*Only the following:*

d. process data and report results.

 *6. Technology Operations and Concepts*

 Students demonstrate a sound understanding of technology concepts, systems, and operations. Students:

a. understand and use technology systems.

b. select and use applications effectively and productively.

c. troubleshoot systems and applications.

d. transfer current knowledge to learning of new technologies.

**Learning Objectives for Lesson Plan:** Based on previous lesson where students created an area and perimeter generator for 10 different rectangles in Excel©, and generated data to present in a graph, the students will create the same type lesson for 3 dimensional figures.

**Featured Technologies:**

* Internet
* Spreadsheet Program

**Prerequisite Student Skills:** Student will have the equations to determine area, perimeter and volume and experience in following links within server-based documents. Students will have previous knowledge regarding description of graphs such as increasing, decreasing, positive and negative slope. Additionally, students will have had previous instruction in basic cell and mathematical operations in Excel©.

**Brief Overview of Lesson:** Students will build edible 3D figures and demonstrate knowledge and application of previous skills. Students will access interactive demonstration of the relationship between area and perimeter of a rectangular figure on the Web Site [Rectangle Prism Surface Area and Volume](http://staff.argyll.epsb.ca/jreed/math9/strand3/formulae.htm#s_v) . Within this interactive application, there will be a brief exploration of assigned dimensions of 3 rectangles. Following this exercise, students will create volume generator in Excel© for 10 different sized rectangular prisms based on known equations for area and perimeter previously investigated, and volume investigated in this exercise. This lesson will fall within the middle of a series of lessons on area and perimeter. It will follow an introduction of the concept, and precede the culminating project to create graphs from data generated in this exercise.

**Teacher To Teacher:** To address diverse technology skills within the classroom, it would be helpful for students to work on this project in cooperative pairs or small groups. Though they may work in groups, each individual student will create and save their own data for a culminating project where they will generate graphs of area and perimeter data points.

**Procedures/Activities:**

* Students complete a bell-ringer displayed on projector screen requesting the equations for area and perimeter as discussed in previous lesson (this would likely occur without technology, on slips of paper so teacher could quickly review answers for understanding).
* Teacher will briefly poll students for understanding regarding characteristics of area and perimeter equations such as appropriate operations and units.
* Teacher will briefly poll students for understanding regarding characteristics and differences of volume equations from area and perimeter equations such as appropriate operations and units.
* Students will log on to computer and obtain electronic instruction document entitled Exploring Area and Perimeter Instructions.
* The teacher will load the web site from the instruction sheet on a projector screen while students locate instruction sheet to demonstrate function of interactive rectangle if necessary.
* This instruction sheet (attached) contains the following step by step instructions:

**MODULE I**

1. Obtain 6 cookies
2. Measure the length and width to the nearest centimeter and record on sheet
3. Place small amount of frosting on plate to use as foundation
4. Stand up four cookies vertically in a square on the foundation, using frosting to glue between the “walls” of the house
5. Put frosting glue on the to edges of two parallel sides
6. Glue the remaining cookies together with frosting, and gently place them on the glue on top of the “house.”
7. Decorate your house with available candy décor items
8. Do the calculations on the following page
9. For each calculation involving a geometric shape, note the name of the shape you are using before calculations

DATA:

Record the length and width of one cookie: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Use this number for the following:

1. What is the area of one cookie?
2. What is the area of the surfaces of all of the walls of the house?
3. What is the area of the roof?
4. What is the area of the surface where the house stands?
5. What is the estimated area of the triangle formed by the roof above the house? (Hint, assume this area were filled in, using the top of a wall as the hypotenuse, and the lengths of the roof edges as the legs of the triangle)
6. What would be the perimeter of the length around the outside of the house?
7. What would be the perimeter of a fence if it were put up one inch from all sides of the house?
8. What would be the area enclosed by the fence? (\*remember to subtract the area of the house from the total)/
9. What would be the volume of the base of the house, not including the roof?
10. What would be the volume of the roof area of the house?

When the above calculations are complete, EAT YOUR HOUSE!

**MODULE II**

Goal:

Use Excel© to create formulas to generate volume of rectangular 3dimensional figures

Steps:

1. Go to the following website [Rectangular Surface Area and Volume](http://staff.argyll.epsb.ca/jreed/math9/strand3/formulae.htm#s_v) and scroll down window with the same title.
2. The rectangular figure should appear with the dimensions 10 cm (units) x 10 cm (units) x 10 cm (units).
3. Change the dimensions to a width of 5 cm by a length of 6 cm by a height of 7 cm by dragging the sides of the shape
4. Record the:
	1. Surface Area:       cm sq
	2. Volume perimeter:       cubic cm
5. Repeat steps 3-5 above for the following dimensions
	1. width 7cm x length 8cm x height 5 cm

Surface Area:

Volume:

b. width 9cm x length 10cm x height 7cm

Surface Area:

Volume:

1. Record the equations use for each value from the screen
	1. Surface Area:
	2. Volume:
2. Load Excel Template: [Exploring Area and Perimeter](http://sitebuilder.yola.com/sites/S3/D593/D264/D3fb/D5aa/U8a4986cb22a977750122aa5bf3462395/8a49866a2729b66801272b55d2431289/resources/Area%20Perimeter%20Volume.xlsx)
	1. Note dimensions for rectangular figures have already been entered
	2. There are three titled sheets, Area and Perimeter
	3. Go To VOLUME sheet
		1. Go to Cell H11, and using the equation in 6 above for a guide, write a formula to calculate VOLUME, and record your formula here:
		2. Hint: \* is multiplication in Excel©
		3. Copy F11 down the column to calculate remaining values
3. Based on the values generated, can you make an educated guess about how the graphs we generated from the AREA and PERIMETER sheets will compare to VOLUME? What will they look like (use descriptive terms such as increasing or decreasing, steep slope, curve opening in a certain direction)?
4. Which values are larger, area or perimeter or volume (highlight correct answer)? In your own words, how do you explain this?
5. BONUS: Between area and perimeter, which of these values is used in calculating volume, yet repeated based on the height of the figure?
* While the students are completing this exercise, the teacher will be moving around the room, careful to check on the progress of each individual student
* If students have questions which may apply to other students, teacher will clarify for the entire class

**Student Assessment and Evaluation**

* Formal
	+ Bell-ringer - Serves as a participation grade, usually completed on a small card or strip of paper, and is a quick way to find out if students understand basic concepts we have been reviewing before engaging in an exercise.
	+ The Internet exercise itself will have answers to fill in and to be graded; actions of an interactive, graphic, visual demonstration will work to help the students visualize the concepts before they put them into practice on the spreadsheet. The particular Internet exercise the students will use shows a clear relationship between the magnitude of area and perimeter of an object that appears to be the same "size."
	+ Excel© spreadsheets will be a template where students enter a formula to generate data recorded in designated cells. The standard is focusing on relationships of the different aspects of the shapes, so some of the raw data was entered where the students could focus on generating the answers to evaluate the data.
	+ The culminating exercise on the instruction sheet, allows the students to fill in answers as they work through the Internet and Excel© exercises. It reinforces the concepts which are similar between two different exercises about the same topic in one place. The final two questions and bonus questions serve to have the student apply their knowledge about the topic, and use critical thinking.
	+ When the worksheet and spreadsheet have been graded, students will have the opportunity to correct errors before starting the graphing part of the unit.
* Informal
	+ Though the Bell-ringer sheet will be collected as a participation grade, the purpose is to give the instructor a quick look at who knows the equations when entering the classroom.
	+ Polling of the students will be informal and scaffolding will be used to lead students who may have made errors on the bell-ringer to the correct form of the equations, so they will not be confused during the lesson.
	+ Teacher will observe answers on the screens as the student complete the exercise, paying particular attention to the format of the equations and formulas, and assist as needed.
	+ Teacher will use scaffolding in response to inquiries about the critical thinking questions to lead students to understanding of concept.
* Criteria
	+ The values entered on the sheets should all be the same values, and will verify if students understand the concepts of area and perimeter
	+ The answers for the critical thinking questions may differ, but will be discussed as a class. As the class listens to other students use their own words, the degree of understanding will be demonstrated beyond filling in numbers correctly.
* Unit Assessment -The grade for the unit will include the demonstrations in this exercise, yet the formal unit assessment will summarize what was demonstrated through the technology exercises for this lesson, previous lessons, and the culminating lesson, graphing the data from the spreadsheets.