The Size of Things

Objective: To explore the relationship between the length of a side of a cube and its surface area and volume.

Time Required: One 90 minute class period.

Materials needed: Computer

Group size: 3 students per group.

Cube
Solve for surface area

$$A = 6\,a^2$$

a Edge

Cube
Solve for volume ▾

$$V = a^3$$

a Edge
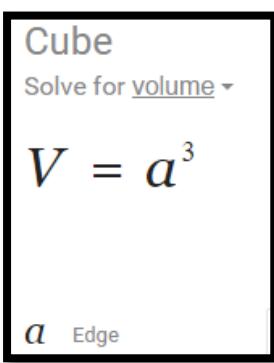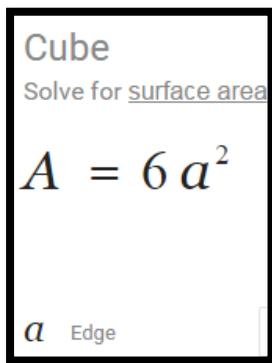
Procedure:
First, make a Google doc.
- Make the title of the document your group names: EXAMPLE "Samiyah Micaeli Leion"
- **Share the doc** with Mrs. O'Mara. Click "Share" in the upper right hand corner. Share it to: amanda.hestdalen@gmail.com **YOU SHOULD SEE A PICTURE OF MRS. O'MARA IF YOU SHARED IT CORRECTLY.**
- Share the doc with **everyone else** in your group. Make sure **everyone in your group** is shared to the document and has access to it. **NOT HAVING ACCESS TO THE DOCUMENT IS NOT AN EXCUSE FOR IT BEING UNFINISHED.**

A.) Imagine a unit cube. Calculate the surface area and volume. Side length = 1 unit. Record your answers in the table you make on your google doc for #1.

B.) Imagine a double cube. The side length of this cube is 2. Calculate the surface area and volume. Side length = 2 units. Record your answers in the table you make on your google doc for #1.

C.) Now imagine a triple cube. The side length of this cube is 3. Calculate the surface area and volume. Side length = 3 units. Record your answers in the table you make on your google doc for #1.

1. Continue filling in the table by extrapolating the surface area and volume of cubes with side lengths of up to 10 units. Make a table just like this in your google doc. Label it #1.

Length of a Side	Surface Area	Volume
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

2. Make a scatter plot of the data on Desmos: **Length of a Side vs. Surface Area.**
   Be sure to change your window to be a helpful, useful window. Label each axis with words. Ask Mrs. O'Mara if you don't know how. Screenshot it, and paste it to your answer document, and label it #2. Answer this question: Is this a line, a curve, or something else?

3. Make a scatter plot of the data on Desmos: **Length of a Side vs. Volume.**
   Be sure to change your window to be a helpful, useful window. Label each axis with words. Ask Mrs. O'Mara if you don't know how. Screenshot it, and paste it to your answer document, and label it #3. Answer this question: Is this a line, a curve, or something else?

4. Which domain and range make sense for your graphs in a real-world situation? Write these answers in your google doc and label it #4.

   Length of a Side <u>vs.</u> Surface Area *Domain*_____ *Range*_____

   Length of a Side <u>vs.</u> Volume   *Domain*_____ *Range*_____

5. Is your data discrete or continuous? Which is more applicable to the real world? (You might want to look that up to remind yourselves.) Write this answer in your google doc and label it #5.

6. Now graph **both sets of data and equations** together on Desmos. Be sure to change your window to be a helpful, useful window. Label each axis with words. Ask Mrs. O'Mara if you don't know how. Screenshot it, and paste it to your answer document, and label it #6. Answer this question: Which point(s) do your equations have in common? Why?

7. Between these two points which graph grows more quickly? After the largest point of intersection which graph grows more quickly? Explain. Write this answers in your google doc and label it #7.

8. In a table like the one below, find the ratio of the surface area of each larger cube to the surface area of the cube with a side length of one unit. Also find the ratio of the volume of each larger cube to the volume of the cube with a side length of one unit. Make a table just like this in your google doc. Label it #8. Ask for help if you need help understanding the directions.

Length of a Side	Ratio of new surface area to original (side length = 1 unit) surface area	Ratio of new volume to original (side length = 1 unit) volume
1	1:1	1:1
2	24:6 = 4:1	8:1
3		
4		
5		
6		
7		
8		
9		
10		

9. When you double the dimensions of a cube, by how many times does the surface area increase? Write this answer in your google doc and label it #9.

10. What about when you triple it? Write this answer in your google doc and label it #10.

11. When you double the dimensions of a cube by how many times does the volume increase? Write this answer in your google doc and label it #11.

12. What about when you triple it? Write this answer in your google doc and label it #12.