MAT 1420 (Algebra and Data Analysis)

Special Activity #1 – Data Modeling – How High Does it Go?

Objective: To investigate the relationship between variables.

Materials: Glass cylinders (various diameters)
Water
Marbles (all the same size)
Metric Ruler (to measure heights in millimeters)

Overall Procedure: Add marbles to a glass cylinder containing water. Measure the height of the water. Add more marbles. Measure the height of the water again. Repeat this process several times.

PART A WHAT DO YOU THINK?

1. a) How many variables are there in this activity?

b) Describe each variable.

c) Which variable is the independent variable?

d) Which variable is the dependent variable?

2. What do you think the relationship is between these variables? Explain. Include a graph.
MAT 1420 (Algebra and Data Analysis)  Special Activity #1 – Continued

PART B  COLLECT THE DATA

3. Select a cylinder. Record the diameter of the cylinder (nearest millimeter) = ________

4. Fill the cylinder (partially) with water. Measure the height of the water.
   Record the height of the water to the nearest millimeter. _________

5. Add a few marbles to the water in the cylinder. Measure the height of the water.
   Add a few more marbles. Measure the height of the water again.
   Continue this process a few more times.

6. Record the data from steps 4 and 5 above.

<table>
<thead>
<tr>
<th>Number of Marbles</th>
<th>Height of the water</th>
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7. Find the average increase in the level of the water for each marble added.

8. Make a graph of your data.
MAT 1420 (Algebra and Data Analysis)  Special Activity #1 – Continued

PART C  ANALYSIS

9. How does your graph in #8 compare to your “guess” graph in #2?

10. Find an equation (based on two points from your graph in #8) that relates the number of marbles and the height of water in the cylinder. Explain how you derived your equation.

11. Find another equation (based on two different points from your graph in #8) that relates the number of marbles and the height of water in the cylinder. Explain how you derived your equation.

12. Are your equations from #10 and #11 above the same? If so, explain why they are. If not, explain why they are not?
MAT 1420 (Algebra and Data Analysis)  Special Activity #1 – Continued

PART C  ANALYSIS - Continued

13. Write your equation from #10 in the form \( y = mx + b \).

   a. What does the \( m \)-value represent in terms of the physical activity?

   b. What does the \( b \)-value represent in terms of the physical activity?

14. Compare your equation from #10 with an equation from another group that used a cylinder with a diameter different than your cylinder.

   a. Diameter of your cylinder: _______  Your equation:_______________________

   b. Diameter of another group’s _______  Their equation:_______________________
      cylinder:

   c. Discuss any differences in the equations in a and b above.

      What are the differences? Why?

      What are the similarities? Why?
MAT 1420 (Algebra and Data Analysis)  Special Activity #1 – Continued

PART D  OVERALL RESULTS AND CONCLUSIONS

15. Why is the equation that you found in #10 above reasonable?

16. Explain what you learned from this activity/lab.

PART E  EXTENSION

17. Describe another activity/lab that would have similar results as this activity/lab. Give details. Be specific.

(Use a separate sheet of paper to answer this question.)