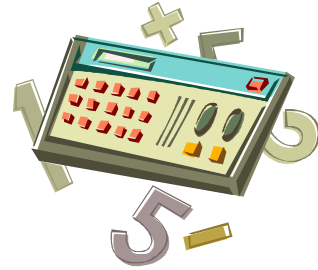


# Algebra/Geometry Institute Summer 2004

## Lesson Plan Two

**Faculty Name:** Denise Taylor  
**School:** Shelby Middle School  
**City:** Shelby, Mississippi  
**Grade Level:** Algebra I (8<sup>th</sup>-9<sup>th</sup> grade)



### 1 Teaching objective(s)

- ❖ The students will be able to communicate using the language of algebra by being able to distinguish between linear and non-linear equations.
- ❖ The students will be able to use the TI-73 calculator in distinguishing linear and non-linear equations.

### 2 Instructional Activities

- ❖ The teacher will ask students what the definition of a linear equation is.
- ❖ The teacher will write definition on overhead or on chalkboard.
- ❖ After students have come to a unanimous decision, ask students to come up with a definition of non-linear equations.
- ❖ The teacher will write this definition for students to refer to later.
- ❖ The teacher gives students hand-out (Attachment 1).
- ❖ The teacher will give students a set of cubic blocks.
- ❖ Allow students to use blocks to build the models and complete the chart for 4, 5, and 6 in the 0 sides column only.
- ❖ When students have finished problem, ask them what values go into the Y column (Answers should be 8, 27, and 64).
- ❖ The teacher will tell students that the length of the side of the cube is X and the number of faces painted is Y.
- ❖ The teacher will ask students what the relationship of the length of the side of cube to zero faces being painted.
- ❖ If no one responds in the correct wait time, tell students that the relationship is  $y = (x - 2)^3$ . Tell students that if you put the value of the side of the cube for X, you should get your Y value.
- ❖ Ask students if they think that the relationship between the length of the side of the cube and the number of zero painted faces represent a linear or a non-linear equation.
- ❖ Instruct students take out calculators (TI-73).
- ❖ Have students press the [Y=] button. Put in  $(x-2)^3$ . Press [Graph] button. Once students have graph on calculator, have them press the [Trace] button. (Students should see X=0; Y=-8).
- ❖ Ask students why everything below the y-axis is insignificant for this particular graph (Answer: When Y is zero, X=2, which is where graph should start).

- ❖ Have students press [ $\rightarrow$ ] button until Y is equal to zero. Ask students what is the value of X (Answer should be 2).
- ❖ Since we start this graph at X=2, let's place it in the calculator to see what happens.
- ❖ Have students press [Window] button, place Xmin=2, Xmax=10, Ymin=0, and Ymax=60. Press [Graph] button.
- ❖ Ask students if this graph is linear or non-linear (Answer: non-linear)
- ❖ After students see that this is a non-linear equation, go to the second column on the hand out and do the cubes that were painted only on one face.
- ❖ Have students complete 4, 5, and 6 of this column (Answers should be 24, 54, and 96). Ask students to determine relationship of these X (being the length of the side of the cube) and Y (being the number of cubes with one face painted). The relationship is  $y=6(x-2)^2$ .
- ❖ After which, ask students if this will be linear or non-linear (Answer: non-linear).
- ❖ Return back to [Y=] button. DO NOT ERASE what is already in there.
- ❖ Press [ $\leftarrow$ ] and make sure that the equal sign is highlighted. Press [ENTER] button. The equal sign should NOT be highlighted. Move down one and it should be blinking on the equal sign of  $Y_2$ . Press [ENTER]. Move to the left one space and type in the function  $6*(x-2)^2$ . Press [GRAPH].
- ❖ Ask students if this graph is linear or non-linear (Answer should be non-linear).
- ❖ Return back to hand out. Have students complete column with 2 faces painted (Answers should be 24, 36, and 48). Ask students to determine the relationship between the length of the side of the cube (X) and the number of cubes with two faces painted (Y). (Answer should be  $y=12(x-2)$ ). Ask students if this equation is linear or non-linear (Answer should be linear).
- ❖ Have students press [Y=] go down one and it should be highlighted on the second equal sign. Press [ENTER]. Move down one and to the left one. Type in the function  $12*(x-2)$ . Press [GRAPH]. Ask student what type of graph is it (Answer should be linear).
- ❖ Have students return to the last column of the hand out. Students should complete 4, 5, and 6. Ask students the relationship between the length of the sides of the cube (X) and the total number of cubes (Y). (Answer should be  $x^3$ ). Ask if it will be linear or non-linear (Answer should be non-linear). Have students to press [Y=], go down 2 spaces and over 1 space to the left. Press [ENTER], move down one space and over to the right one space. Type in  $x^3$ . Press [GRAPH]. Is this relationship linear or non-linear (Answer should be non-linear)?
- ❖ To see the difference between linear and non-linear equations, have students press [Y=] move one space to the right and press [ENTER]. The equal sign should be highlighted. Move the down arrow key and press

[ENTER]. Move one more space down and press [ENTER]. All four equal signs should be highlighted. Then press [GRAPH].

- ❖ Ask students to state or describe the difference between linear and non-linear graphs.

### 3 Materials and Resources

- ❖ Cubic Blocks
- ❖ TI-73 Calculator
- ❖ Hand Out (Attachment 1)
  
- ❖ Activities from the Mathematics Teacher: *Discovery with Cubes*: Keys, Robert E. (January 1974)
  
- ❖ Curriculum and Evaluation Standards for School Mathematics; Patterns and Functions: Phillips, Elizabeth. (1991) Grade 5-8.

### 4 Assessment

- ❖ Teacher will observe students' understanding by listening to their responses.
- ❖ Teacher will walk around and check students' calculators to ensure all students are working on the same graph.

Attachment 1

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Number of Cubes with.....

Length of the Side of the Cube	Zero Sides Painted	One Side Painted	Two Sides Painted	Total Number of Cubes
2	0	0	0	8
3	1	6	12	27
4				
5				
6				
X				