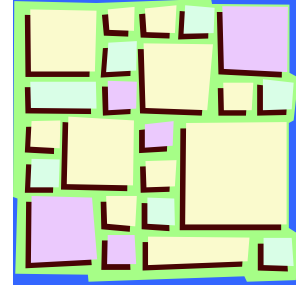# Algebra/Geometry Institute Summer 2009

Faculty Name: Mattie Davis

School: Quitman County Middle School

Grade Level: 8th

Creating Models of One-Step and Two-Step Linear Equations

1   Teaching objective(s)

The student will model one-step and two-step linear equations using algebra tiles.
 Institute framework
- 4e. Model and solve linear equations and inequalities using the properties of equality.

2   Instructional Activities

A. Begin class by activating students' prior knowledge of adding and subtracting negative and positive integers. Bell Ringer: "Model **-3 + 4** and **-5 – 2** using two color counters. Explain the procedures you took to solve the problems."

B. After explaining the bell-ringer, students will be divided into groups of three. Each group will receive a set of algebra tiles. The teacher will provide the students with a description of the algebra tiles using the overhead projector (Attachment 1). Once students are introduced to the algebra tiles, they will complete the Warm-Up Activity (Attachment 2). Go over solutions to Warm-Up Activity by allowing five different students to model the solutions using overhead algebra tiles (Attachment 3 and Attachment 3 cont.).

C. Introduce students to equations by drawing the connection to the bell-ringer. Say "The same procedures used to work the bell-ringer as well as the warm-up activity will be used to solve equations. When solving equations, the goal is to attempt to discover the values of the given variable that will make the equation true." The teacher will model and explain the following one and two step equations using overhead algebra tiles (See Attachment 4 and Attachment 4 cont.).
> **1. x + 4 = 6**
> **2. 2x – 2 = -6**

D. Each student will receive a copy of the Modeling Equation activity sheet (Attachment 5). Students will remain in groups of three. There will be four groups with three students. I will assign each group a number 1-4. Each group will receive an

additional set of algebra tiles, coloring pencils, one ruler, one popsicle stick, three sheets of notebook paper, and three sheets typing paper. Each member of the group will have an assigned task. Students labeled as ones will model the equation. Twos will draw the step-by-step model of the equation using the typing paper and coloring pencils. Threes will write a short paragraph explaining the steps to solve the equation. Each group will have 24 minutes (8 minutes per equation) to complete three equations. At the end of eight minutes, a timer will sound notifying students to rotate clockwise to switch tasks. Each student will have an opportunity to model the equation using algebra tiles, draw the step-by-step model of the equation, and write a short paragraph explaining the solution to the equation. The group will place their names on a sheet of typing paper stating what task he/she performed in the group.

3 Materials and Resources
    a. Materials
      i. Overhead algebra tiles
      ii. Overhead projector
      iii. Coloring Pencils/ Markers/Crayons
      iv. Two set of algebra tiles for each group of three students
      v. Ruler
      vi. Activity Sheets
      vii. Typing Paper
      viii. Popsicle Sticks
      iv. Notebook Paper
      v. Timer

    b. Resources
      i. Bailey, R., Day, R., Frey, P., & Howard, C. (2009). *Mathematics Application and Concepts*. New York, New York: McGraw -Hill Companies, Inc.

      ii. Doyle, D., Ellis, M., Friel, S., Nygard, C., Pugalee, D., & Rachlin, S. (2002). *Navigating through Algebra in Grades 6-8*. Virginia.

4 Assessment
  I will observe the students as they model, draw, and write paragraphs explaining the steps to solve the equations. I will collect and grade the students' drawings and paragraphs.

How to Identify Algebra Tiles

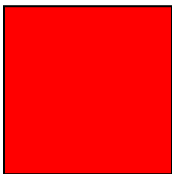**These tiles represent positive variables and numbers.**
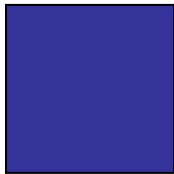
x^2 x 1

These tiles represent negative variables and numbers.

$-x^2$ $-x$ -1

Warm-up Activity

Model the following expressions using algebra tiles.
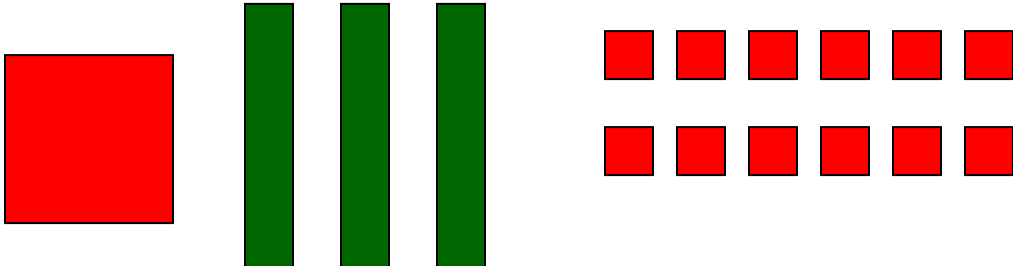
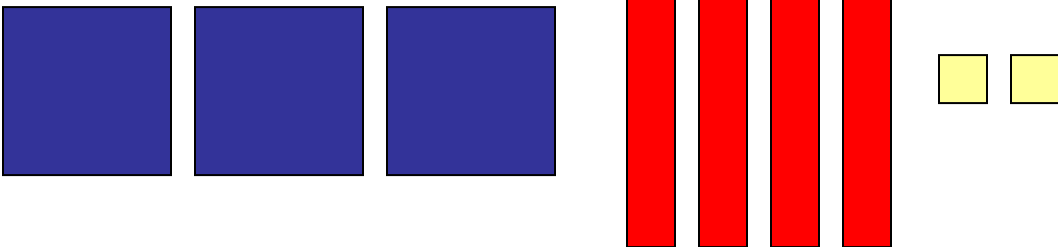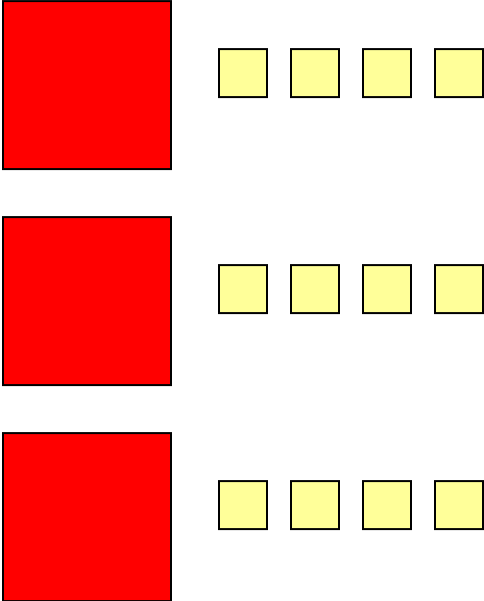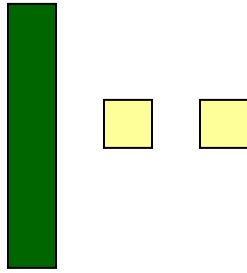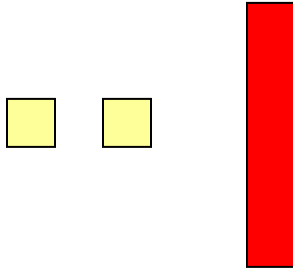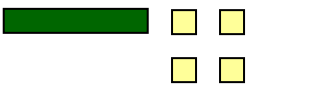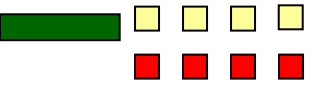1) $-x^2 + 3x - 12$

2) $3x^2 - 4x + 2$

3) $3(-x + 4)$

4) $x + 2$

5) $2 - x$

Answer Key to Warm-up Activity

1) $-x^2 + 3x - 12$

2) $3x^2 - 4x + 2$

3) $3(-x + 4)$

4) x + 2
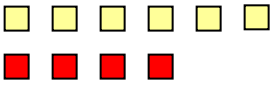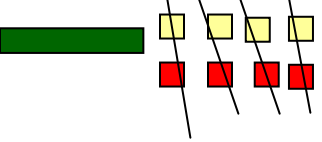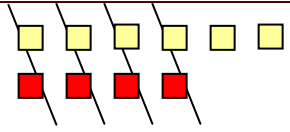
5) 2 − x
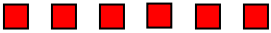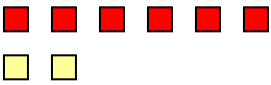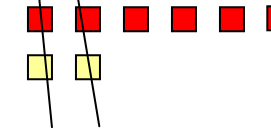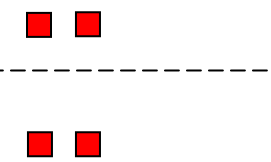
* A dotted line on the overhead will represent the equal sign.

Example 1: x + 4 = 6

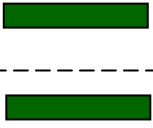| Procedure	Model
1. Place 1 x and 4 1's on the left side of the equal line. Place 6 1's on the right side of the equal line.	
2. Add 4 -1's to each side of the equal line.	
3. Remove any zero pairs.	
4. The solution to the equation is x = 2.	

Example 2: 2x -2 = -6

Procedure	Model	
1. Place 2 x's and 2 -1's on the left side of the equal line. Place 6 -1's on the right side of the equal line.		
2. Add 2 1's to the left side of the equal line and on the right side of the equal line.		
3. Remove zero pairs		
4. Divide each side into two equal groups.		
5. The solution to this equation is x = -2		

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Modeling Equations

Use algebra tiles to model the solution to the following equations. Problem assignments: Group 1: 1-3; Group 2: 4-6; Group 3: 7-8; Group 4: 9-12. Note: Any letter can be substituted for a variable and the model will not change. Use the popsicle stick to represent the equal sign.

1) $4y - 7 = -11$

2) $c - 3 = 7$

3) $2k - 4 = -10$

4) $3f + 4 = 7$

5) $-2b - 8 = 4$

6) $3b - 2 = -8$

7) $4h - 1 = 3$

8) $u - 6 = -3$

9) $-3v + 5 = 11$

10) $-3m - 6 = 12$

11) $p + 1 = -6$

12) $5w + 2 = 12$

Answer Key for Modeling Equations (Attachment 5)

1) y = -1
2) c = 10
3) k = -3
4) f = 1
5) b = -6
6) b = -2
7) h = 1
8) u = 3
9) v = -2
10) m = -6
11) p = -7
12) w = 2