Algebra/Geometry Institute Summer 2010

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School: John F Kennedy Memorial High School
Mound Bayou, Mississippi

Grade Level: 9th grade Transition Algebra

1 Teaching objectives

This activity has been designed to help students develop problem solving skills, think critically, and most importantly think "outside of the box" and find novel solutions to apparently unsolvable problems. This supports a basic reinforcement of Strand 2. – Algebra, in the understanding and analysis of mathematical patterns, as well Institute Content II a – recognize and continue a number pattern. It is a hands on problem solving activity that is designed to provide multiple solutions to many of the problems encountered.

2 Instructional Activities

1. Divide the class into groups of four students each using any method suitable, however it would be best to have an academically diverse make up for each group.
2. Have each group select a group leader, a presenter, a recorder, and a resource person
3. Ask the groups to send their resource person to the front of the class and pick up 24 Popsicle sticks (algebra tile x markers, tooth picks etc), return to their group, and put the Popsicle sticks in a pile in the center of their work area.
4. The teacher will start the group discussion by telling a story or reviewing an incident that clearly demonstrates a problem being solved by employing a novel approach, the so called thinking outside of the box. One such example is a young boy in a TV commercial talking about how the company his dad works for encourages their employees to think outside of the box. The young man goes on to say that he doesn't quite know what that means, but his dad sure likes to go to work every day. During this discussion the young man is trying to make himself a glass of chocolate milk by scraping every last bit of chocolate syrup from the bottom of the syrup can. He apparently cannot get enough syrup out so he pours

his glass of milk into the syrup can, puts the lid on, gives it a real good shake and then empties a perfect glass of chocolate milk from the can back into his glass. The commercial closes with the young man taking a very satisfying long drink of his chocolate milk.

5. Ask the students to share any outside the box solutions they have encountered in their lives.
6. At the conclusion of the discussion draw the student's attention to their Popsicle sticks. Tell them we are going to use these sticks to make patterns that involve different numbers and sizes of squares. At this point ask the question "what makes a square unique?" and allow this discussion to take place.
7. Ask the resource person from each group to come up to the front and get 4 pages of ¼ lined grid paper.
8. Proceed to have the groups start to build the figures. Start by assigning the most straight forward first and proceed through the figures from a to j in Appendix A. Describe to the students the construction objective for each figure such as " build 2 squares with 3 Popsicle sticks per side" Allow ample time for solving each figure before introducing the next in the list. Make sure the recorder is making a sketch of the figure on the provided quartile ruled paper. Encourage peer tutoring and group sharing.
9. As each figure is successfully built have a student come up to the overhead and build the figure and explain his group's thinking
10. This activity may take more than one class period depending upon the level of difficulty the students have in solving some of the more challenging figures

3 Materials and Resources

This activity requires very few materials

1. 24 popsicle sticks per group of four students
2. Quartile ruled paper – 4 sheets per group of four students

Themes and layouts adopted from:

3. Kordemsky, Boris A. The Moscow puzzles (1956), In Gardner, Martin (ed,1972),Charles Scribner's Sons, New York

4 Assessment

1. Teacher observation with particular attention being paid to student involvement in the problem solving process. 20 points
2. Grade assigned to the recorders sheets that have the diagrams of the models constructed will be based on a 25 point system:
    - 2 points each for the 10 figures

- 2 points for a title, date, and the names of the team members
- 3 points for neatness

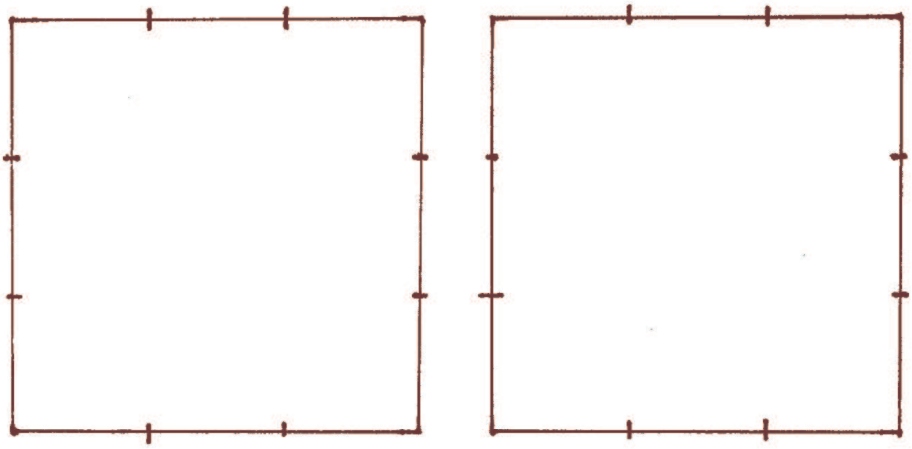
Appendix A

List of Figures

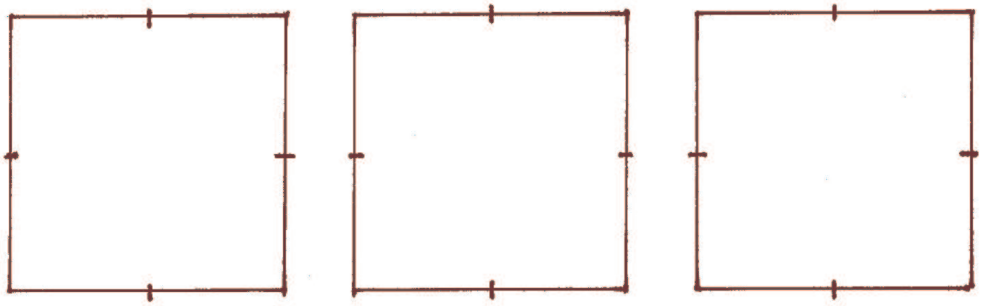
a) Two squares 3 x 3
b) Three squares 2 x 2
c) Three squares: two squares 3 x 3 ; one square 1 x 1
d) Three squares: two squares 3 x 3 ; one square 2 x 2
e) Seven squares: three squares 2 x 2 ; four squares 1 x 1
f) Ten squares: two squares 2 x 2 ; eight squares 1 x 1
g) Fourteen squares: one square 3 x 3 ; four squares 2 x 2 ; nine squares 1 x 1
h) Six squares 1 x 1
i) Nine squares: one square 2 x 2 ; eight squares 1 x 1
j) Seven squares 1 x 1

Note: Students recorder sheets should be compared to attached figures a - j

a)



b)



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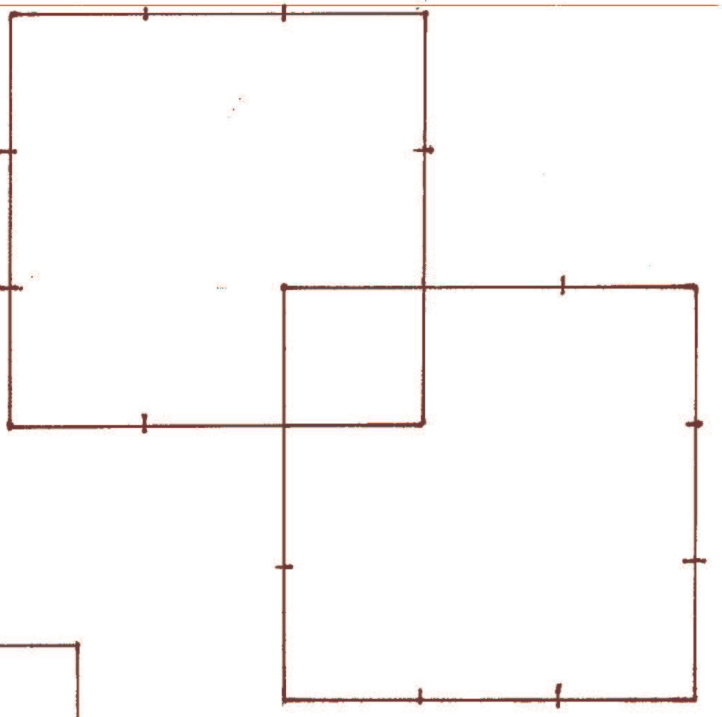

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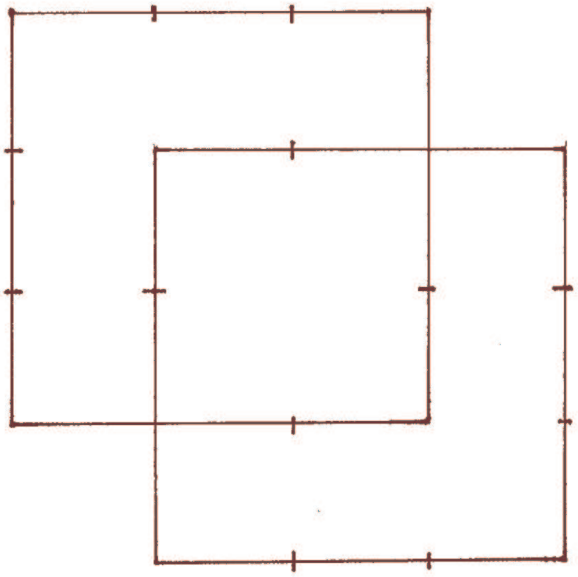

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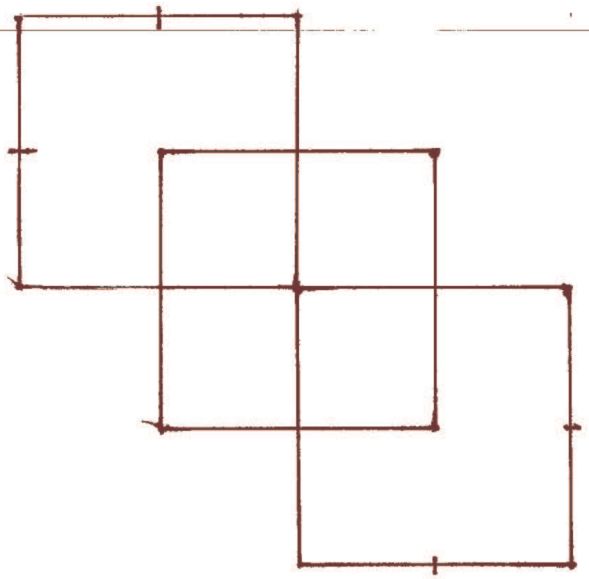

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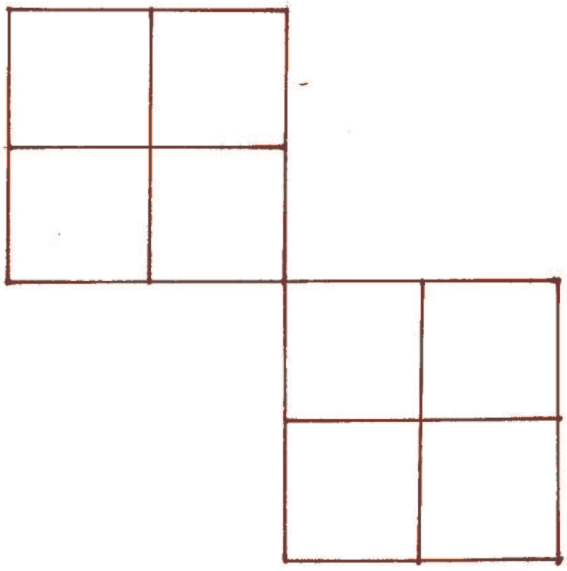
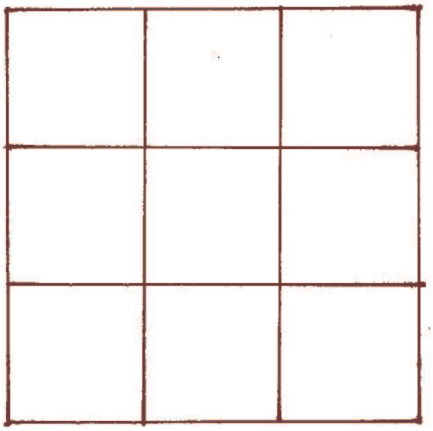
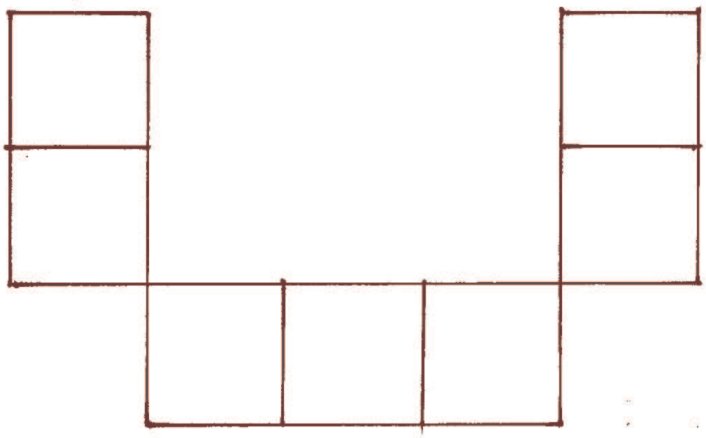




g)



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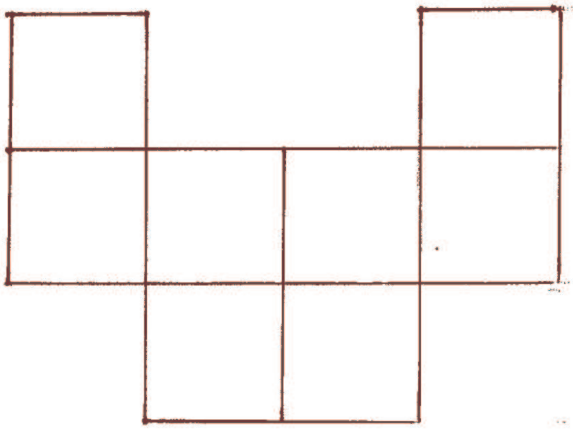

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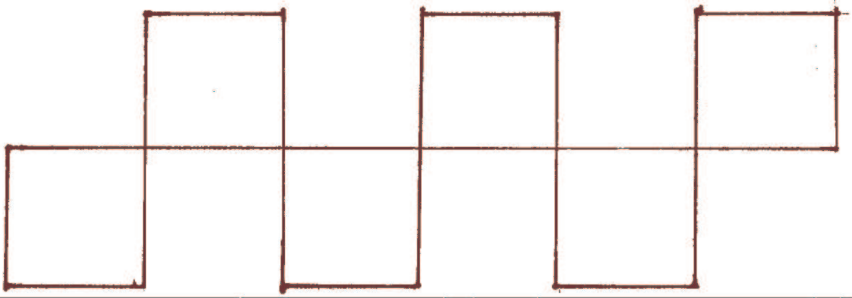

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