Title: Designers Challenge—Exploring Area

Brief Overview:

The students will use prior knowledge and manipulatives to explore concepts that focus on determining the area of regular and irregular shapes. The series of activities in this unit will assist students with limited experiences and ability, while extending and challenging those students who are knowledgeable about the concepts. The students will have the opportunity to explore a variety of materials such as: geoboards, snap cubes, square tiles, and cereal boxes.

NCTM Content Standard/National Science Education Standard:
Measurement: Area.

Grade/Level:
Third/Fourth

Duration/Length:

Three 75-minute lessons

Student Outcomes:

- Students will: Define area
- Work cooperatively to explore area.
- Solve problems involving perimeter and area using a variety of strategies
- Use snap cubes to create figures with perimeter and area of a given units
- Create their ideal classroom using area

Materials and Resources:
Lesson 1

- Cereal boxes (collected in advance)
- Chez—It crackers (small squares)
- Zip lock baggies
- Math textbook
- Glue
- Construction paper
- Student Resource Sheets #1, 2, & 3

Lesson 2

- Square tiles
- Zip lock baggies
- Geoboards

- Markers
- Scissors
- Rubber bands (at least 12 per group)
- Student Resource Sheet # 4

Lesson 3

- Chart paper
- Dot Paper
- Square tiles
- Student Resource Sheets #5, 6, 7, 8, 9, 10, 11
- Teacher Resource Sheets #3 and 4

Development/Procedures:

Lesson 1:

Preassessment :

Students will participate in a "Quick Write" activity in which they will complete a graphic organizer **(Student Resource Sheet # 1)** that will entail the students recording what they already know about the topic of area. The graphic organizer, asks the students to write what they already know about area, a question that they have about area, and it also asks students to draw a picture to illustrate something that they know about area. Students will discuss their responses and illustrations with the rest of the group.

Launch – Discuss/brainstorm with students what their favorite cereals are. Record student responses on chart paper for later reference. Inform students that they will be using their knowledge and skills related to area to create an original design, using the concept of area.

Teacher Facilitation – The teacher will estimate how many square units it will take to cover the entire sample cereal box **(Teacher Resource Sheet # 1)**. The teacher will then model how to record the data on **(Student Resource Sheet # 2)**. Each pair students will be given a baggie with crackers to go along with their cereal boxes. They will also be given Student Resource 2 in which they will record their estimates, actual findings, and the difference between the estimates and actual outcomes. The teacher will then discuss the fact that covering the cereal boxes with the square units is really finding the area of an object.

Student Application- Student pairs will use non-standard units of measurement -- Chez-It crackers and the box from their favorite cereal to determine the number of square units that are needed to cover one face of their boxes. They will record their findings on **(Student Resource Sheet # 2)**. After students have completed

the task, they will then estimate, measure, and record the number of square units of the other faces of their cereal boxes.

Embedded Assessment –

The teacher will have the students individually find the area of their math textbook using the Chez-It crackers, after they have estimated the number of crackers it will take to cover the book. They will record their findings on the back of **(Student Resource Sheet # 2).**

Reteaching/Extension –

Students who did not fully understand the lesson will be given the opportunity to build their skills/concepts through the use of (**Student Resource Sheet # 3)**, in which they will have to count the shaded areas on the coordinate grid paper.

Student partners who fully understood the lesson will be given the opportunity to extend their knowledge by creating an object that has an area of 24 square units using Chez-Its/colored construction paper cut into squares. They will then paste, label the area, and display their creations on construction paper.

Lesson 2

Preassessment

To review the concept of area, send students on an '**Area Hunt**.' Ask student partners to use square tiles to find one object in their desk with an area of 10 – 12 square units. Square tiles will be placed in zip lock baggies. Have one or two volunteers remind the class what area is and demonstrate how to measure the area of an object with square units.

Launch: Have the students use their square tiles to create a rectangular polygon that has an area of 24 square units. Elicit from the students other methods they can use to calculate the area of the polygon without counting. Lead the students to discover the formula for calculating area—(Area=Length x Width)

Teacher Facilitation

Distribute Geoboards and rubber bands. Explain to the students that they will create as many rectangular polygons as possible with a area of 12 units. Also inform the students that they will have to construct the figures they create on Geoboard grid paper **(Student Resource Sheet # 4**) and record the area of each shape. Model this for students on the overhead projector. Distribute Geoboard grid paper **(Student Resource Sheet # 4).**

Student Application

The students will use their Geoboards and rubber bands and work independently to create as many polygons as possible with a area of 12 units. They will use

markers to outline the figures on Geoboard grid paper. They will then count and record the area of each figure. Encourage the students to use the formula to calculate the area when possible. Give students the opportunity to display one of the figures on an overhead Geoboard grid transparency.

Embedded Assessment

The Geoboard grid paper designs that the students created will be labeled with their area and cut out to make a visual display on chart paper.

Reteaching/Extension

Distribute Student Resource Sheet # 5 with outlines of regular and irregular polygons. Have the students count or use the formula to calculate and record the area of each polygon. The answer key can be found on Teacher Resource Sheet # 1.

Lesson 3

Preassessment:

Review the definition of area with the students through the following activity. Using colored tiles display a model of a rectangular polygon with 12 square units. Write the answer as 6 x 2 = 12 square units. Also display a model that shows perimeter using 12 colored tiles. Write the answer as 16 units. Have students determine which of the examples displayed on the overhead projector is an example of area and which is not. Remind students of the concept of area (the number of square units it takes to cover an object is an object's area; or that area can be found by using the formula A=l x w. Students should be able to justify the examples they chose to represent the concept and the examples that was not selected. Discuss any misunderstanding the students may have.

Launch:

Ask students to think about what items they would like to have in the bedroom of their dream if money was not a problem. Record the students' responses on chart paper for later reference. Explain to the students that they will have the opportunity to design their dream bedroom. Further explain that the following restrictions will apply: 1. The room must contain a bed. 2. The room must contain a desk. 3. The room must contain a dresser.

Teacher Facilitation/Student Application:

The teacher will state the objective for the day. Students will be able to find the area of regular and irregular polygons using the formula **A=l x w**.

The teacher will distribute square tiles and the dot paper. The teacher will explain that they are manipulatives or tools that can represent objects. The teacher will model putting the squares together to form various size objects. The teacher will

also model how to disassemble the squares. Allow 5 minutes for students to explore using the cubes.

Ask the students to construct several different configurations using the square. For example, "Can you construct a closed figure that is 4 units long and 6 units wide?" The students will draw their representations on the dot paper **(Student Resource Sheet # 5)**. Have the students construct 2-3 other examples. They will draw these examples on the dot paper as well. Review the fact that the area of an object can be found by counting the total number of squares that will cover an object, or it can be found by multiplying an object's length by its width.

The teacher will instruct the students to list the items they would like to add to their bedrooms to their Dream Page--**Student Resource Sheet # 6**. Allow 10 minutes for students to think and write.

The students will take their ideas from their Dream Page and the grid paper **(Student Resource Sheets # 5 & 6)** to begin drawing their ideal bedrooms. Students should draw and label each item on the grid paper, as well as list each item and its area on the "What's My Area?" **(Student Resource Sheet # 7).** The teacher should then tell the students to begin drawing, keeping the following guidelines in mind: 1. Students are working to design a bedroom space that is 20 x 20 units. Therefore, the dimensions (in square units) for the following **required** bedroom items should be: bed-4 units by 6 units; dresser- 2 units by 4 units; desk-2 units by 3 units. The other items that the students choose should be given dimensions that are relative to the required items. Each completed item for the design will be labeled, colored, and cut out so that it can be placed on the bedroom page to the student's liking. The teacher should observe the students as they plan and assist with any difficulties that the students may experience.

Embedded Assessment:

The teacher should note any student who has difficulty with the concept of area while applying the concept in the above noted activity. This can be done by using the Area Observation Page **(Teacher Resource Sheet # 3).** These students can further explore the concept using **Student Resource Sheet # 8**.

Reteaching/Extension:

The teacher will pass out the BCR **(Student Resource Sheet # 9)** for the students to complete independently. The class will review and discuss the responses. The rubric for scoring **(Teacher Resource Sheet # 4 and Student Resource Sheet # 10**), should be used to help determine if the students have a clear understanding of the concept.

If time allows, students may be permitted to review the concept of perimeter by calculating the perimeters of the various objects that they chose to include in their plans. This information should be recorded on the "Perimeter Please" **(Student Resource Sheet # 11).** Students should explain how they calculated the

perimeters of the objects and they should also explain how perimeter is different from area.

Summative Assessment:

Students will be given an assessment to reflect the Maryland State Assessment (MSA). There will be a section in which the students will compute the area of given figures.

Answers can be found on Teacher Resource Sheet # 4.

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Student Resource Sheet #1

What I KNOW about AREA!

I think area is....

_____

_____

_____

One question I have about area is...

_____

_____

_____

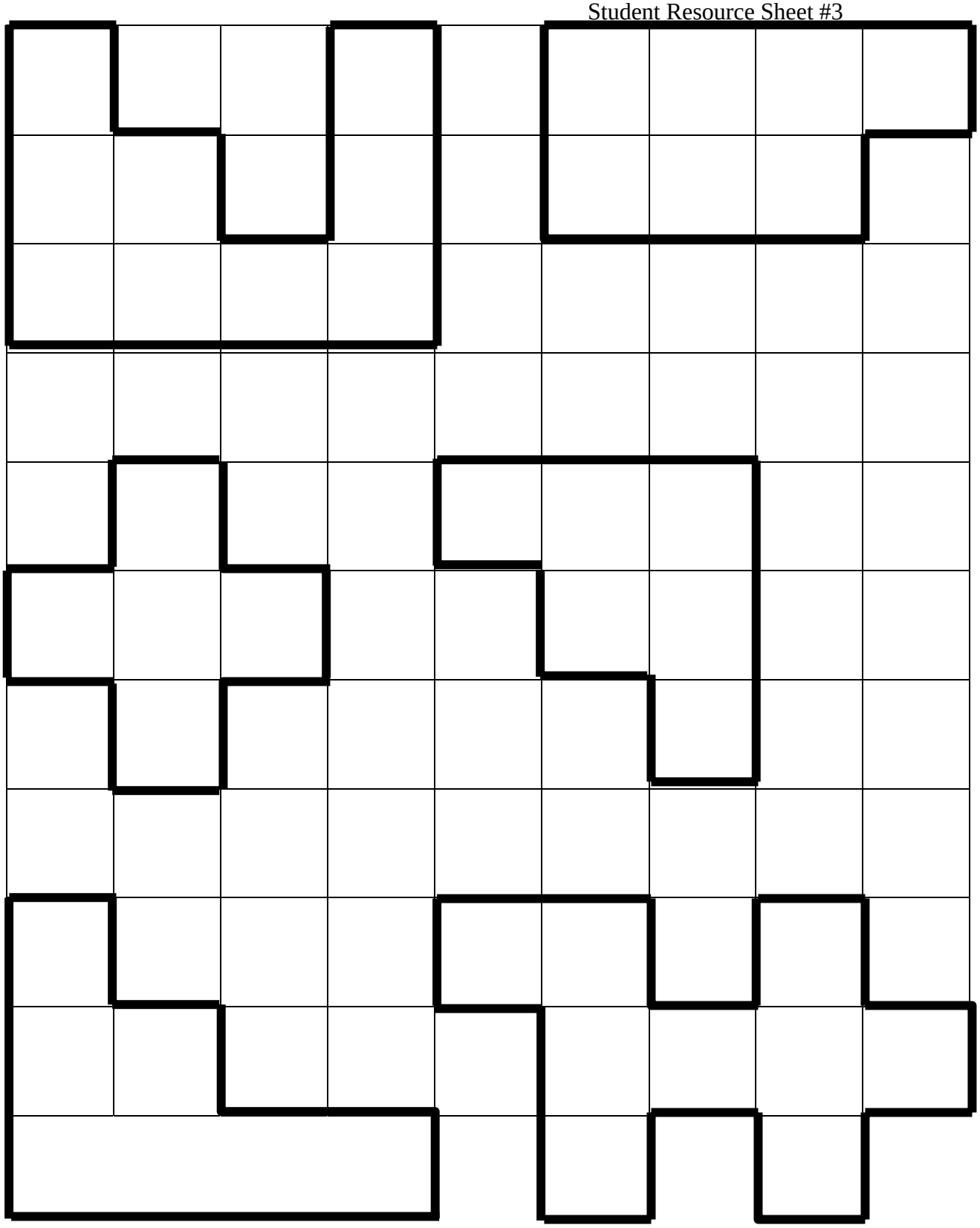
Here's a picture to show what I know about area:

Student Resource Sheet # 2

Name _____ Date_____

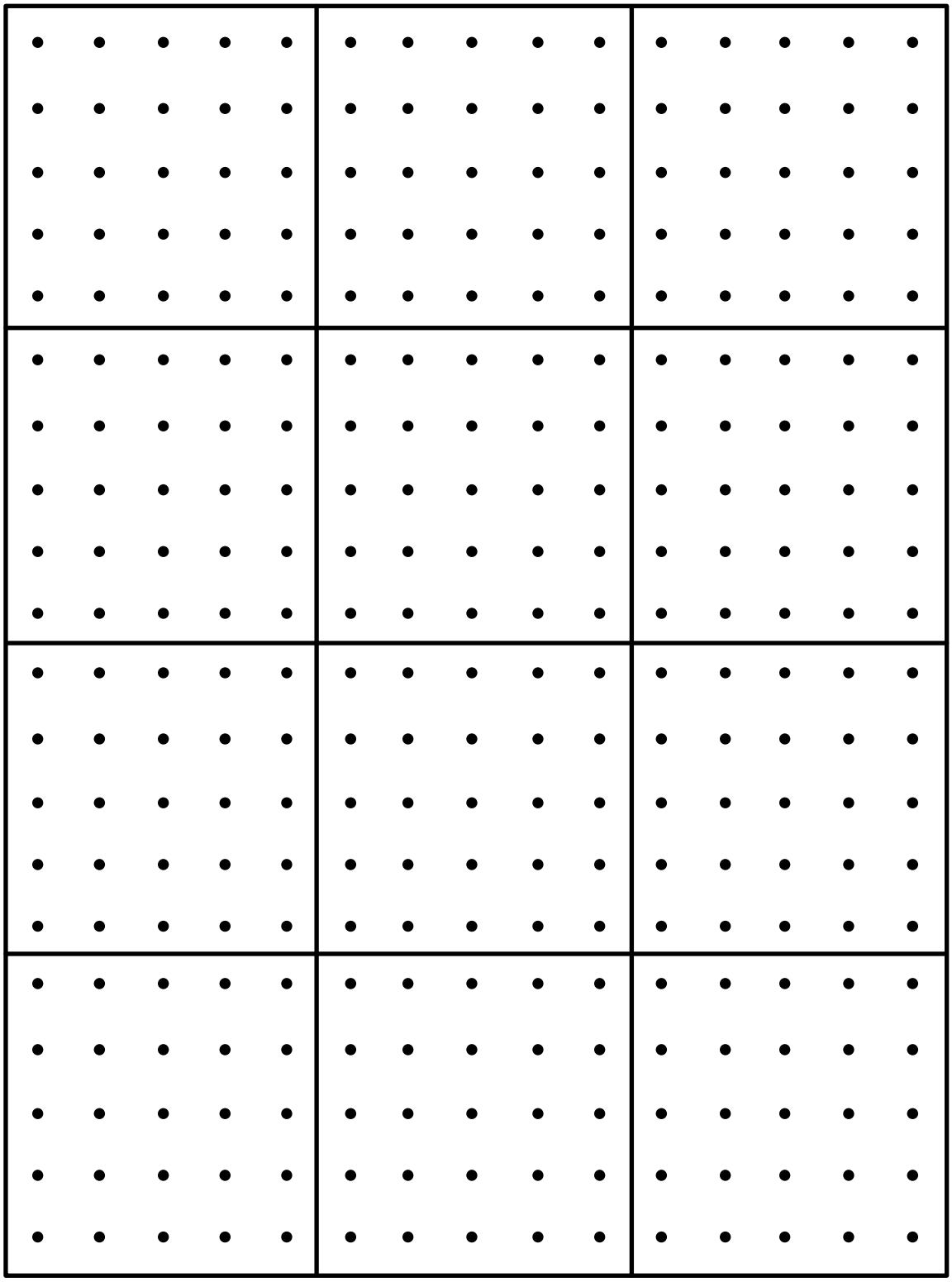
Sides of Cereal box	Estimated Area	Actual Area	Difference
1			
2			
3			
4			
5			
6			

Student Resource Sheet #3



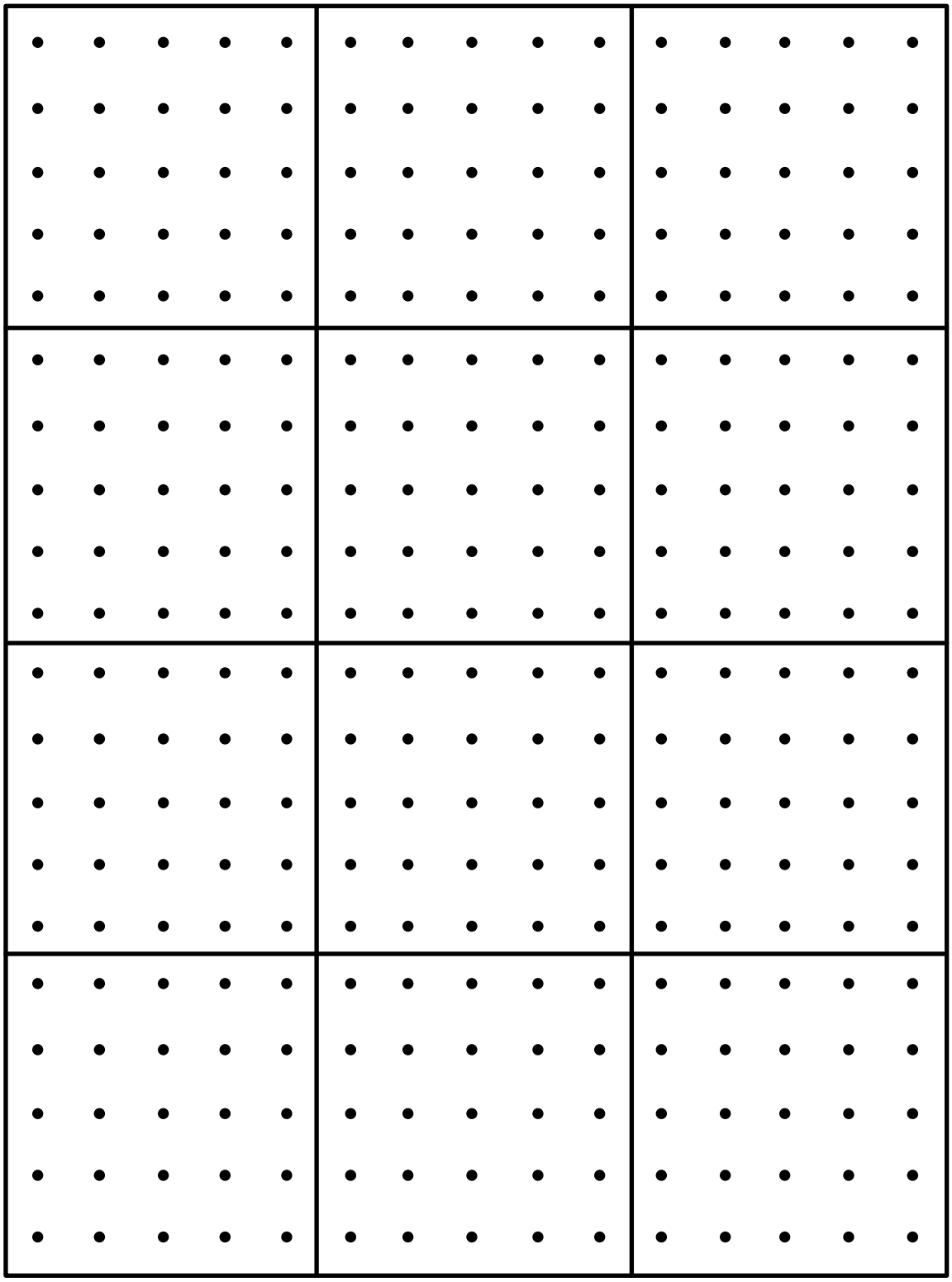
Student Resource Sheet #4

Name: …….. Date:……

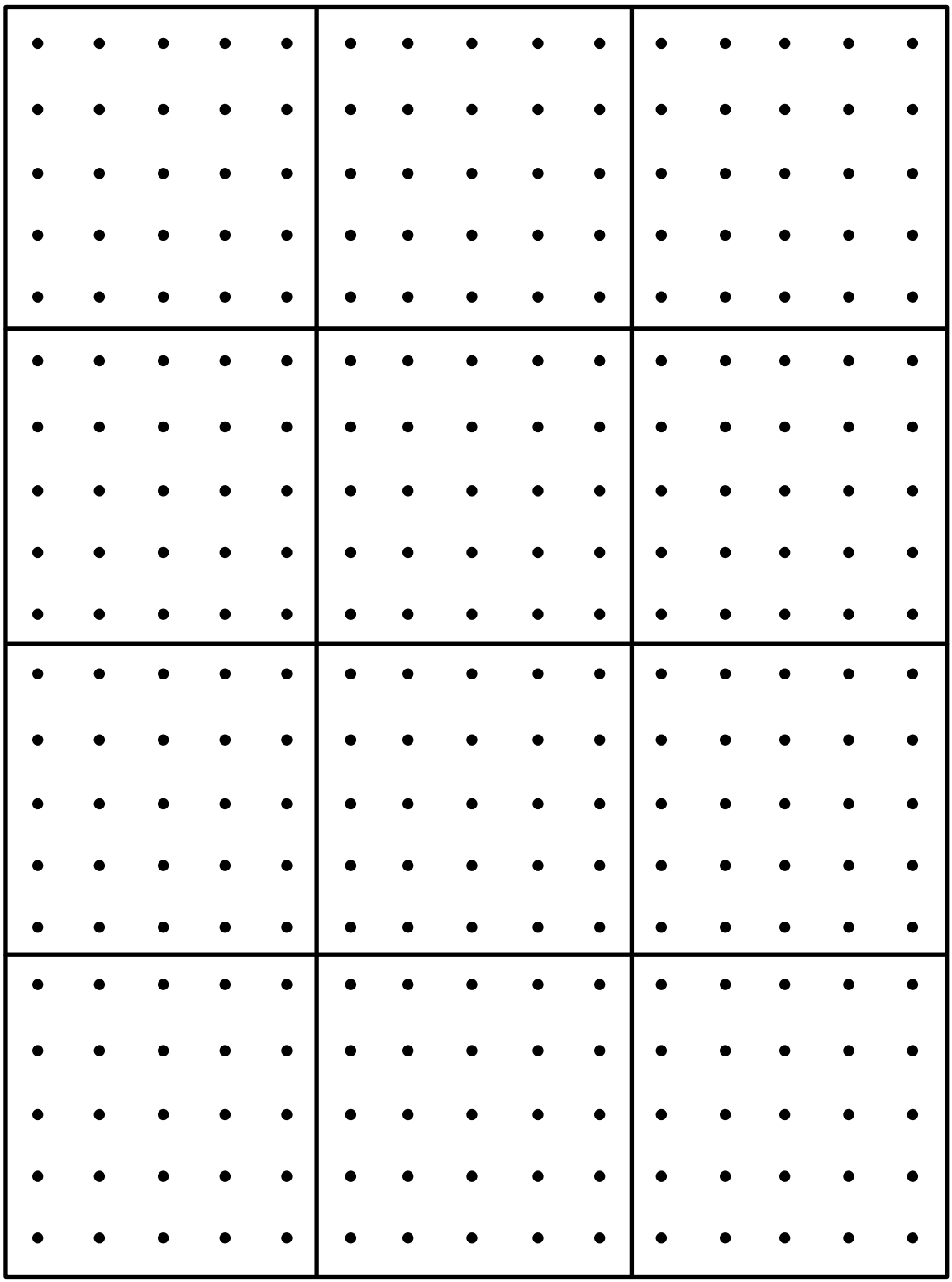


GEOBOARD DOT PAPER

Name: ……..



Name: …….. Date:……



My Dream Bedroom

If I could design my own bedroom, these are the things I would **love** to include:

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

Name_____ Date_____

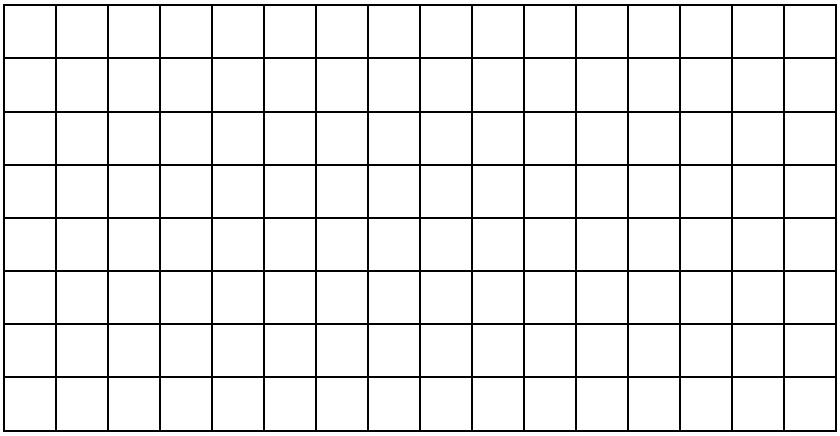
What's My Area?

Bedroom Item:	Area:

Brief Constructed Response (BCR)

1.

A. Melissa constructed a figure with an area of 24 square units. In the space below, draw 2 possible designs Melissa could have made.



B. Using what you know about area, explain why your answer is correct. Use words, numbers, and/or drawings in your explanation.

_____

_____

_____

_____

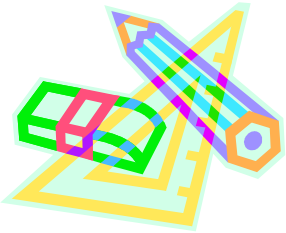
_____

MSA Brief Constructed Response "Kid Speak" Mathematics Rubric Grades 1 through 8

Score	
2	**My answer shows I completely understood the problem and how to solve it:** • **I used a very good, complete strategy to correctly solve the problem.** • **I used my best math vocabulary to clearly explain what I did to solve the problem. My explanation was complete, well organized and logical.** • **I applied what I know about math to correctly solve the problem.** • **I used numbers, words, symbols or pictures (or a combination of them) to show how I solved the problem.**
1	**My answer shows I understood most of the problem and how to solve it:** • **I used a strategy to find a solution that was partly correct.** • **I used some math vocabulary and most of my reasons were correct to explain how I solved the problem. My explanation needed to be more complete, well organized or logical.** • **I partly applied what I know about math to solve the problem.** • **I tried to use numbers, words, symbols or pictures (or a combination of them) to show how I got my answer, but these may not have been completely correct.**
0	**My answer shows I didn't understand the problem and how to solve it:** • **I wasn't able to use a good strategy to solve the problem.** • **My strategy wasn't related to what was asked.** • **I didn't apply what I know about math to solve the problem.** • **I left the answer blank.**

Student Resource Sheet #11

Perimeter, Please



Object:	Perimeter:

Perimeter Ponderings:

Use the back of this page to answer the following questions about perimeter.

1. How do you calculate the ***perimeter*** of an object?
2. How is finding the ***perimeter*** of an object different from finding the ***area*** of an object?

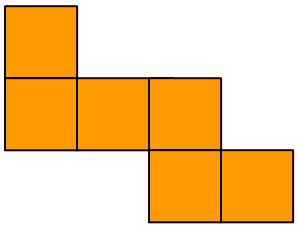
Name:_____ Date:_____

Summative Evaluation

What is the Area?

1. Maria needs a bedroom space of 108 square feet in order to be comfortable. What length and width gives this area? Draw a picture of Maria's bedroom and label the length and width.

2. What is the area of this figure?



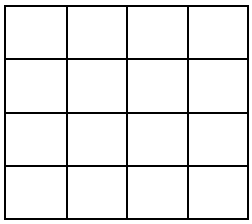
_____square units

3. The dresser in Leo's bedroom is 4 feet wide and 6 feet long. What is the area of Leo's dresser?

4. One of the faces on Christina's favorite cereal box has an area of 96 square inches. If one of the sides is 12 inches long. What is the length of the other side?

Brief Constructed Response

5. Fernando used square tiles to create the following design.



Step A

What is the area of Fernando's figure? Explain two methods that you could use to calculate the area of Fernando's Figure.

_____

Step B

Use what you know about area to explain why your answer is correct. Use words and/or numbers in your explanation.

_____

_____

_____

_____

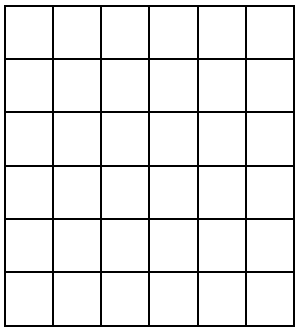
_____

Brief Constructed Response

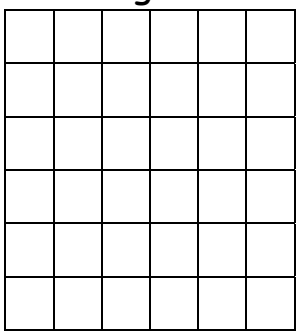
Mia created a design on her geoboard with an area of 24 square units. In the space below, create two designs that Mia might have made.

Step A

Design 1



Design 2



Step B

Use what you know about area to explain why your answer is correct. Use words and/or numbers in your explanation.

_____

_____

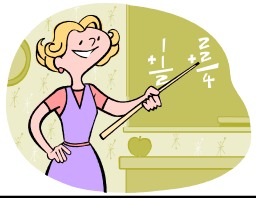
_____

_____

_____

Teacher Resource Sheet #2

Area Observation Page



Student Name:	Observation:	Implications for Instruction:

Teacher Resource Sheet #3

Mathematics BCR Rubric

2 The response demonstrates a complete understanding and analysis of a problem.

- Application of a reasonable strategy in the context of the problem is indicated.
- Explanation[1] of and/or justification[2] for the mathematical process(es) used to solve a problem are clear, developed, and logical.
- Connections and/or extensions made within mathematics or outside of mathematics are clear.
- Supportive information and/or numbers are provided as appropriate.[3]

1 The response demonstrates a minimal understanding and analysis of a problem.

- Partial application of a strategy in the context of the problem is indicated.
- Explanation[1] of and/or justification[2] for the mathematical process(es) used to solve a problem is partially developed, logically flawed, or missing.
- Connections and/or extensions made within mathematics or outside of mathematics are partial or overly general, or flawed.
- Supportive information and/or numbers may or may not be provided as appropriate.[3]

0 The response is completely incorrect, irrelevant to the problem, or missing.[4]

Notes:

[1] **Explanation** refers to students' ability to communicate **how** they arrived at the solution for an item using the language of mathematics.

[2] **Justification** refers to students' ability to support the reasoning used to solve a problem, or to demonstrate **why** the solution is correct using mathematical concepts and principles.

[3] Students need to complete rubric criteria for ***explanation, justification, connections*** and/or ***extensions*** as cued for in a given problem.

[4] Merely an exact copy or paraphrase of the problem will receive a score of "0".

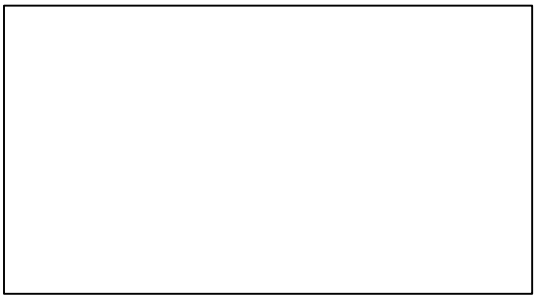
Summative Evaluation

Answer Key

1. Length = 12 feet Width = 9 feet

12 inches

9 inches



2. 6 square units

3. 24 square feet

4. 8 inches