Title: Awesome Area

Brief Overview:

Students will explore the concept of area in a realistic application. They will develop their understanding of area through constructing, drawing, and labeling spaces. Throughout the problem-solving process, students will analyze and communicate their mathematical thinking. Finally, students will explain their understanding of area by justifying their answers.

NCTM Content Standard/National Science Education Standard:

Measurement
Communication
Problem Solving
Representation

Grade/Level:

2-3

Duration/Length:

3-4 days for 50-60 minutes daily; 1 day will be used for assessment

Student Outcomes:

Students will:

- Use models and drawings in order to identify the area of a given space.
- Construct and label a drawing in order to represent the area of a given space.
- Communicate their understanding of area in oral and written form.

Materials and Resources:

Lesson One:

- Masking Tape
- Make It Shape It Cards (Teacher Resource Sheet1)
- Journal Prompt "Think About It" (Student Resource Sheet 1) -1 sheet per student
- Desk, chair, waste can, overhead cart
- Chart paper
- Vocabulary card that includes a definition for the word "area"
- Base ten unit blocks-30 units per student
- Centimeter Grid Paper (Student Resource Sheet 2) -2 sheets per student

- Crayons
- Overhead Transparency of Centimeter Grid Paper (Student Resource Sheet 2)
- Teacher Observational Checklist (Teacher Resource Sheet 2)
- Large grid paper (24”x36”)

Lesson Two

- Pentominoes
- Inch Tile – 5 per student
- Centimeter Grid Paper – (Student Resource Sheet 2)
- Overhead transparency of Student Resource Sheet 2
- My Bedroom (Student Resource Sheet 3) (one per student)
- Large Grid Paper (24”x 30”) – 1 sheet
- Grid paper (Student Resource Sheet 5) (1 per student)
- Teacher checklist chart (Teacher Resource Sheet 3)
- Dream Room Furniture Cards (Teacher Resource Sheet 4)
- Dream Room (Student Resource Sheet 4) – one per student
- Grid Paper (Student Resource Sheet 5)- one per student
- My Dream Room Student checklist (Student Resource Sheet 6) (1 per student)
- Crayons
- Glue
- Scissors
- Teacher Observational Checklist (Teacher Resource Sheet 2)
- Connecting Cubes
- Inch Grid Paper

Lesson Three-

- Triangles! Triangles! (Student Resource Sheet 7) -2 per student
- Scissors – 1 pair per student
- Fill It Up! (Student Resource Sheet 8) -1 per student
- Teacher drawing of a Space Ship on large grid paper. (Teacher Resource Sheet 5)
- Markers
- Count It Up! (Student Resource Sheet 9) – one per pair of students
- Overhead Transparency of Student Resource Sheet 9
- Teacher Observational Checklist (Teacher Resource Sheet 2)
- Large Grid paper showing various shapes (Reteach Activity)
- Cut up squares and triangles to use in determining the area of shapes in the reteach activity.

Development/Procedures:

Lesson 1

Advance Preparation-

- Tape 4 spaces on the classroom tile floor of various areas. For example: 12 square units, 20 square units, etc.
- Duplicate and cut "Make IT Shape IT" cards, one set for each group.

Pre-Assessment –

- Direct students to walk around the classroom and observe the taped spaces on the floor.
- Have the students write what they noticed about the spaces on Student Resource Sheet 1 "Think About It".
- Have students share their responses.

Launch –

- Display a variety of items, such as, a desk, chair, trashcan, and overhead projector cart.
- Assist students in taping around the perimeter of the base of each object on the floor. Be sure to use a floor with square tiles.
- Estimate and count the number of whole floor squares the object occupies.

Teacher Facilitation –

- Compare the areas the students taped on the floor in the launch activity. You may want to record information from the students on the chalkboard.

For example:

Object	Estimated Area	Actual Area

- Introduce the vocabulary word "area" and its definition.
- Discuss the ways the students determined the area of the space.
- Ask, "How did you determine the area of this space?"
- Ask, "How did you know which squares to count?"
- Remind students that the area is an interior space and all squares units share at least one side.
- Label square units.
- Demonstrate how an area is labeled with square units. For example, if I count 24 squares, then I would label it 24 square units.

Student Application –

- Distribute materials. Each student will need 30 base ten unit blocks and crayons.
- Each student will need two copies of the centimeter grid paper (Student Resource Sheet 2).
- Divide students into groups of 4 or 5 students. Distribute the "Make IT Shape IT" cards, one set to each group. (Teacher Resource Sheet 1). Direct students in each group to create each of the shapes on their grid paper using base ten unit blocks. Direct students to trace the perimeter of their shape, and determine and label the area. Students can rotate the "Make It Shape It" cards. Allow 10 minutes for this activity.
- Have students share their drawing of the model with other students in their group.

Embedded Assessment –

- While students are working in groups, the teacher will use a teacher observational checklist (Teacher Resource Sheet 2) to note:
- Are students correctly differentiating area and perimeter?
- Are students using repeated addition and/or multiplication to calculate area?
- Are they using 1-1 correspondence?
- Are they using any mathematical vocabulary in their responses?

Reteaching/Extension –

- If a student does not understand the concept, give more opportunities to practice counting and labeling the area of given spaces. Provide unit blocks for students to construct additional shapes. Have students explain how they are measuring the area of their shape.
- If a student shows understanding of the concept, display a rectangular figure traced on hundred chart paper and have students answer the following question in their journal or on a sheet of paper: "How could you use addition and multiplication to find the area of this shape?"

Lesson 2

Teacher Preparation-

- Duplicate and cut one set of Dream Room Furniture Cards (Teacher Resource Sheet 4)
- Prepare a chart listing the directions for the Reteaching and Extension Activity

Pre-Assessment –

- Distribute one pentominoe to each student. Ask, "What is the area of this shape?'

- Distribute 5-inch tiles to each student.
- Say, "Now using what you know about area, draw as many shapes as you can on a sheet of inch grid paper (Student Resource Sheet 2) that have an area of 5 square units. Allow approximately 10 minutes for this activity. The teacher may model one example on the overhead.
- Have students share their drawings with a partner. Think-pair-share.
- As students are working, ask them to explain what they notice about the shapes. Ask them what conclusions they can draw. For example, many different shapes have the same area, some shapes may appear larger, some shapes may appear smaller, etc

Launch –

- Explain that today we will use what we know about area to construct a drawing that represents a bedroom. Teacher note: Depending on the level of your students, you may want to explain that the drawings will not be to scale.
- Have students complete the "My Bedroom" (Student Resource Sheet 3) Allow approximately 5 minutes.
- Allow time for some of the students to share their drawings. Elicit from the students that items in their room are of a similar shape. Ask students to tell which items have about the same area, which items take up the most area of the room, etc.

Teacher Facilitation –

- Gather students in a group on the floor in front of the chalkboard. Create with the students a drawing that shows the perimeter of the teacher's bedroom. For example, it could be 60 square units. The drawing does not need to be a regular rectangle.
- Have students calculate the area of the drawing and explain how they know it is correct.
- Brainstorm a short list of possible furnishings that may be placed on the floor of a bedroom. Ex.: bed, desk, chair, bookcase, table, toy box, nightstand, and dresser. Be sure to only include items that can be placed on the floor. Teacher note: these items should correspond to the list designed in the teacher preparation section.
- Choose students to draw and label furnishings on the Teacher's Bedroom chart.
- Complete the "Teacher's Bedroom Checklist". (Teacher Resource Sheet 3)
- Have students state observations about the completed diagram of the teacher's bedroom. Note the students' responses: are they making comparisons?
- Explain that now the students will prepare to design a new bedroom for themselves. They will need to think about the area that each piece of furniture occupies.

- Display the set of cards that show the approximate area for each item that students may put into their design. (Teacher Resource Sheet 4)
- Have students match the area card with a corresponding furnishing. Ask students to explain why they made that particular match and why it makes sense. Elicit an every-pupil-response for each match. Ask, "How do you know that your card would not match another item? Which item do you think has the greatest area? Could more than one answer be correct? Why?"
- Relate this discussion to yesterday's observations of taped spaces on the floor. Ask, "Do you recall the area of our classroom desk? Would a desk at home perhaps be a similar size?

Student Application –

- Distribute "My Dream Room" (Student Resource Sheet 4) and a piece of grid paper to each student. (Student Resource Sheet 5). Direct the students to choose 5 furnishings from the ones listed on the board. Have the students draw and label each piece of furniture and its area on Student Resource Sheet 5. When each item is drawn, colored, and labeled, they should cut out each piece and place it on the "Dream Room" paper.
- Have students complete the student checklist. (Student Resource Sheet 6)
- Have students meet with a partner to explain why their drawing is complete and correct.

Embedded Assessment –

- While students are constructing the drawing representing their dream bedroom, observe and record behaviors on another teacher observation checklist. (Teacher Resource Sheet 2). Share with the students that you will assess their performance as they work. Discuss with the students what you will be looking for. Ex: using math vocabulary, accurately drawing area, etc.

Reteaching/Extension –

- Have the following activities written on chart paper taped to the chalkboard.
- Students who have difficulty drawing a given area should practice using connecting cubes or inch tiles to construct 2 shapes that have an area of 13 square units.
- Students who demonstrate an ability to draw a given area may use connecting cubes or inch tiles to show four shapes with an area of 30 square units.

Lesson 3

Teacher Preparation-

- Draw the space ship from Teacher Resource Sheet 5 onto large grid paper.
- Draw various large shapes on large grid paper to use in the Reteach activity.
- Cut out squares and triangles (half squares) for the students to use as manipulatives to cover the large drawn shapes in the reteach activity.

Pre-Assessment –

- Direct students to cut out the triangles from "Triangles! Triangles! (Student Resource Sheet 7). Two sheets per student.
- Have students manipulate the triangles to make any shape using only square units.
- Allow time for students to walk around the room and notice shapes that other students have made.

Launch –

- Explain to students that today we will continue to investigate the concept of area by looking at shapes that may not be made of only squares.
- Direct students to use "Fill It Up" (Student Resource Sheet 8) and try to fill the area using their cut out triangles.
- Circulate and notice students that may be having spatial difficulties.
- Discuss how to calculate the area of the shape by counting the squares made by the triangles. One triangle equals one-half square unit and two triangles will create one whole unit.

Teacher Facilitation –

- Gather students together on the rug and show the drawing of the Space Ship on large grid paper taped to the chalkboard. (Teacher Resource Sheet 5)
- Ask students what they notice about the shape of this figure? How could we determine the area, remembering that area is expressed in square units?
- Have students use markers to trace the square units on the figure.
- Discuss how to think of putting the triangle areas together to make square units.
- Count the number of square units and label the area on the picture.
- Help students summarize how to determine the area of a shape that is not made of only squares.

Student Application –

- Direct students to work in pairs to determine the area of the shapes on "Count It Up!"(Student Resource Sheet 9) Suggest that one student tally the square units as the partner counts the squares.
- Circulate and complete another Teacher Observation Checklist (Teacher Resource Sheet 2) as students are working. Ask students to explain how they are finding the area of each figure.
- Share results of the activity.

- Check the student responses using an overhead of "Count It Up! (Student Resource Sheet 9)

Embedded Assessment –

- Observe students during the pre-assessment activity to be aware of those who may have difficult manipulating the triangles into squares.
- Notice those students who have difficulty manipulating the triangles in the launch activity.
- Listen for students' explanations and use of fraction vocabulary.
- While students are completing the "Count It Up!" activity, complete the Teacher Observation Checklist (Teacher Resource Sheet 2)

Reteaching/Extension –

- Have the following activities written on chart paper taped to the chalkboard:
- Have students who are experiencing difficulty counting the square units practice in pairs using another teacher made large example along with cut up squares and triangles to determine the area of the shape.
- Have students who are adept at determining the area of shapes create a new design on Student Resource Sheet 5 and calculate its area.

Summative Assessment:

Students will demonstrate an understanding of area by completing two brief constructed responses. They will need to use appropriate mathematical reasoning and vocabulary to explain their thinking.

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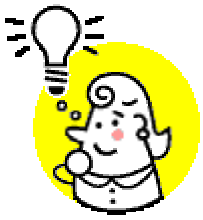


Think About It!

Look at the shapes on the floor. On the lines below write what you notice about the shapes.

Shape A:

Shape B:

Shape C:

Shape D:

Name_____ Date_____

Make IT Shape IT

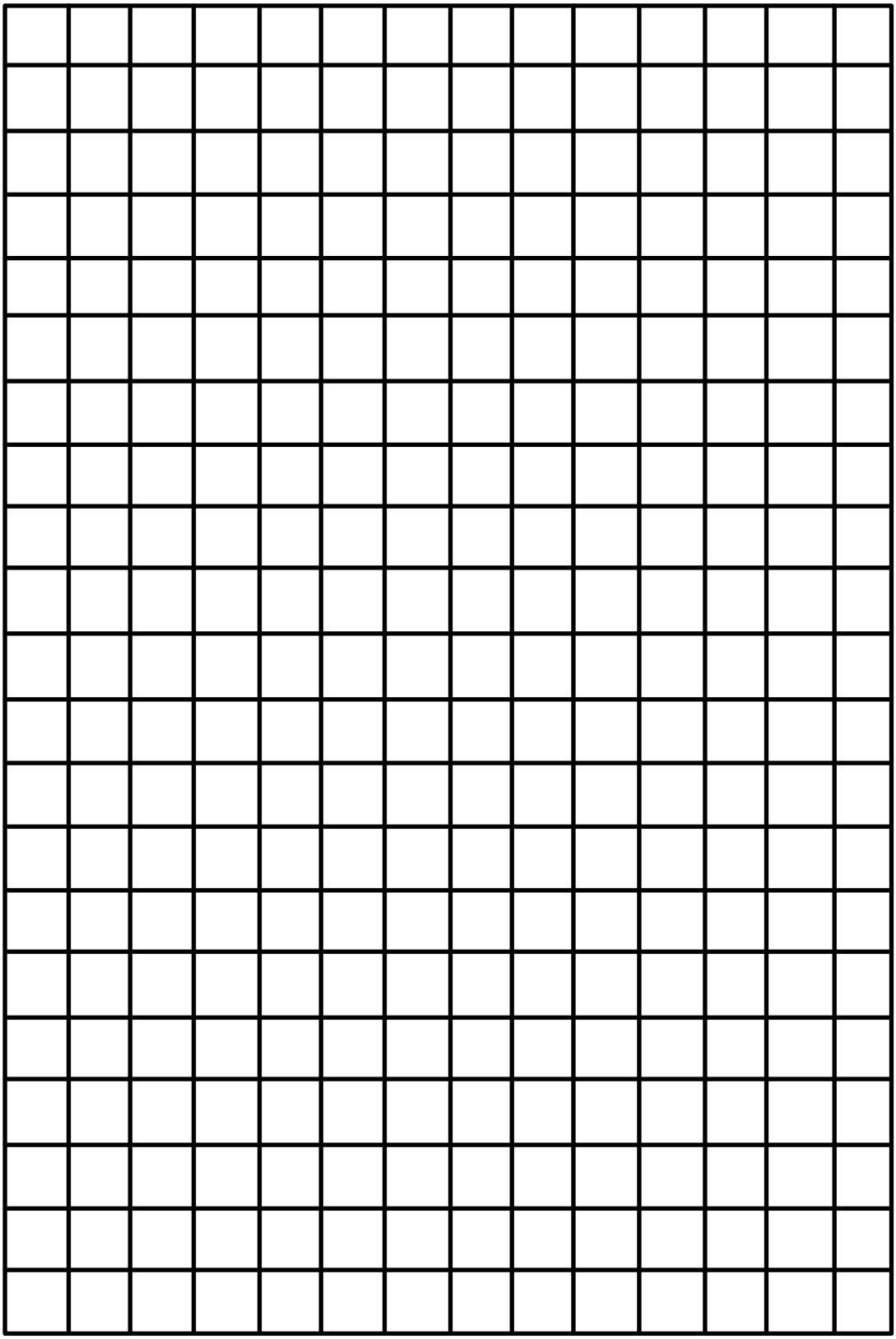
Create an area that is greater than 15 square units, but less than 30 square units.

Create an area that has a perimeter of 10 units.

Create an area that is 13 square units.

Create an area that has an odd perimeter.

Create an area that has an odd number of square units.



Teacher Observational Checklist

Criteria	Names of Students																												
Correctly differentiating perimeter and area																													
Using repeated addition and/or multiplication																													
One-to-one correspondence																													
Using math vocabulary																													

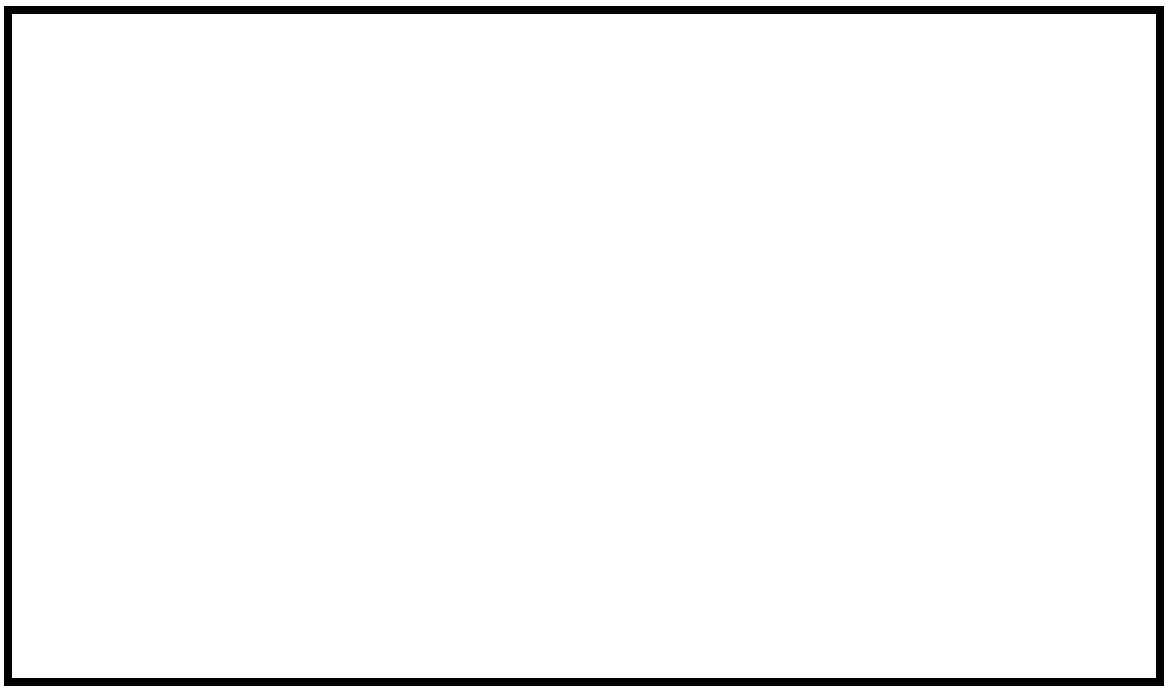
Teacher Notes / Anecdotal Records

My Bedroom

Think about your bedroom at home.

- What furniture do you have?
- Where is it?

Draw and label furniture that you have in your bedroom in the space below.



Name _____ Date_____

Bedroom Design
Teacher Checklist

Put a check next to the sentence when you have completed that step.

_____There are five items in my room.

_____The items are labeled.

_____The area for each item is labeled correctly.

_____ Nothing is in front of the doorway and closet.

Match Cards

BED	24 sq.units

TOY BOX	6 sq. units

BOOKCASE

3 sq. units

DESK

6 sq. units

CHAIR

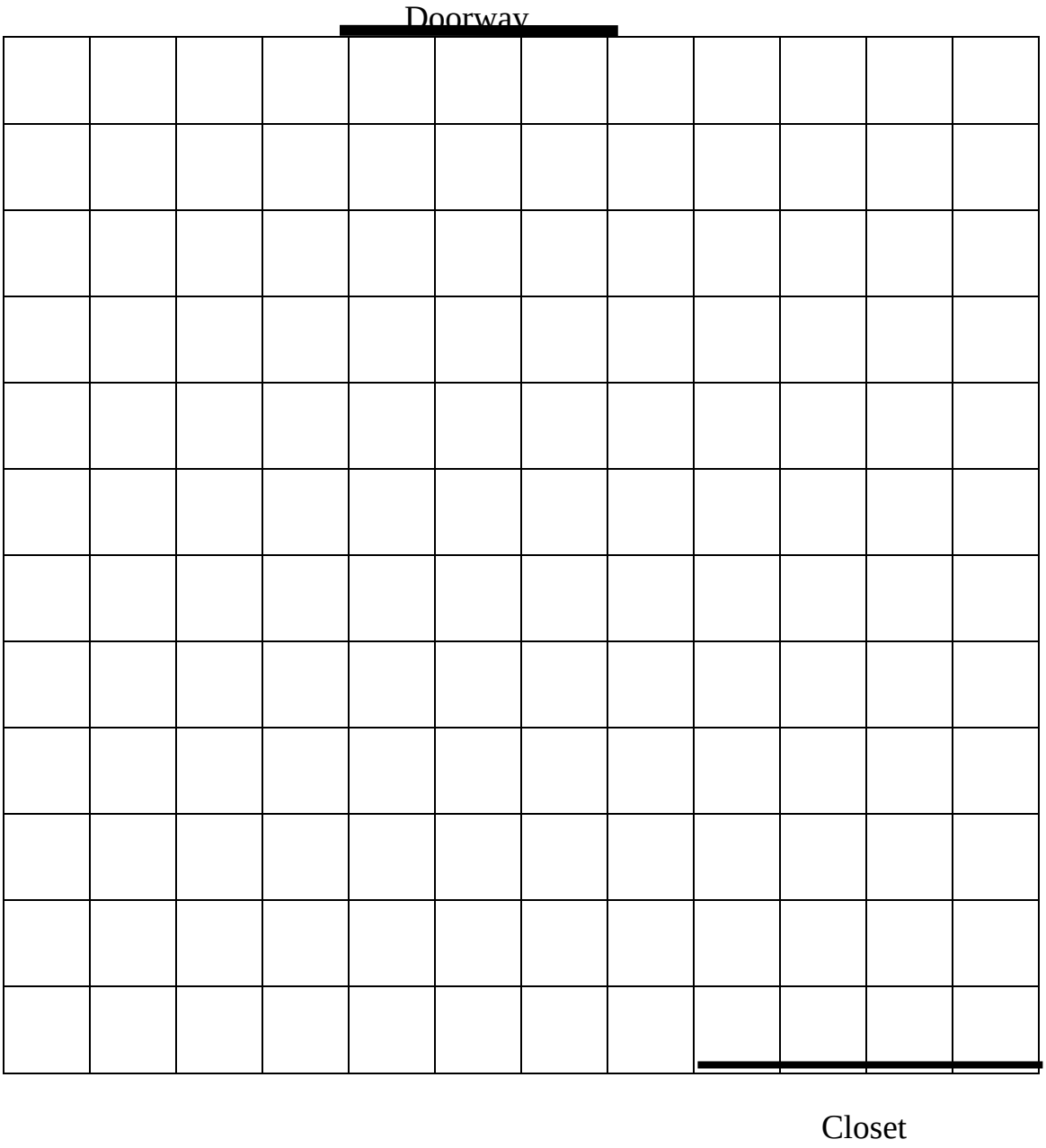
4 sq. units

DRESSER

12 sq. units

Night Stand	9 sq. units

My Dream Room



Grid Paper

Dream Bedroom Design
Student Checklist

Put a check next to the sentence when you have completed that step.

_____There are five items in my room.

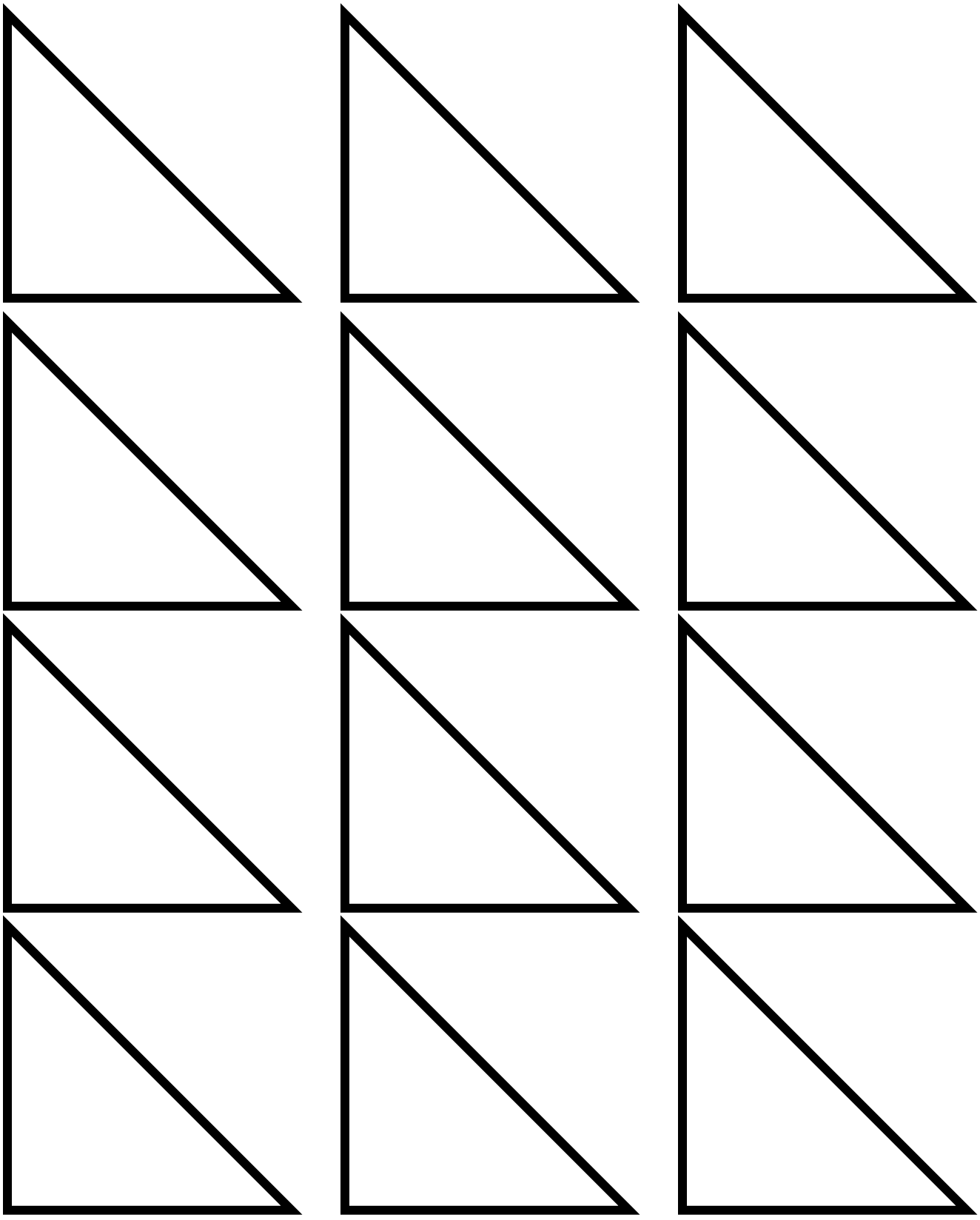
_____The items are labeled.

_____The area for each item is labeled correctly.

_____ Nothing is in front of the doorway and closet.

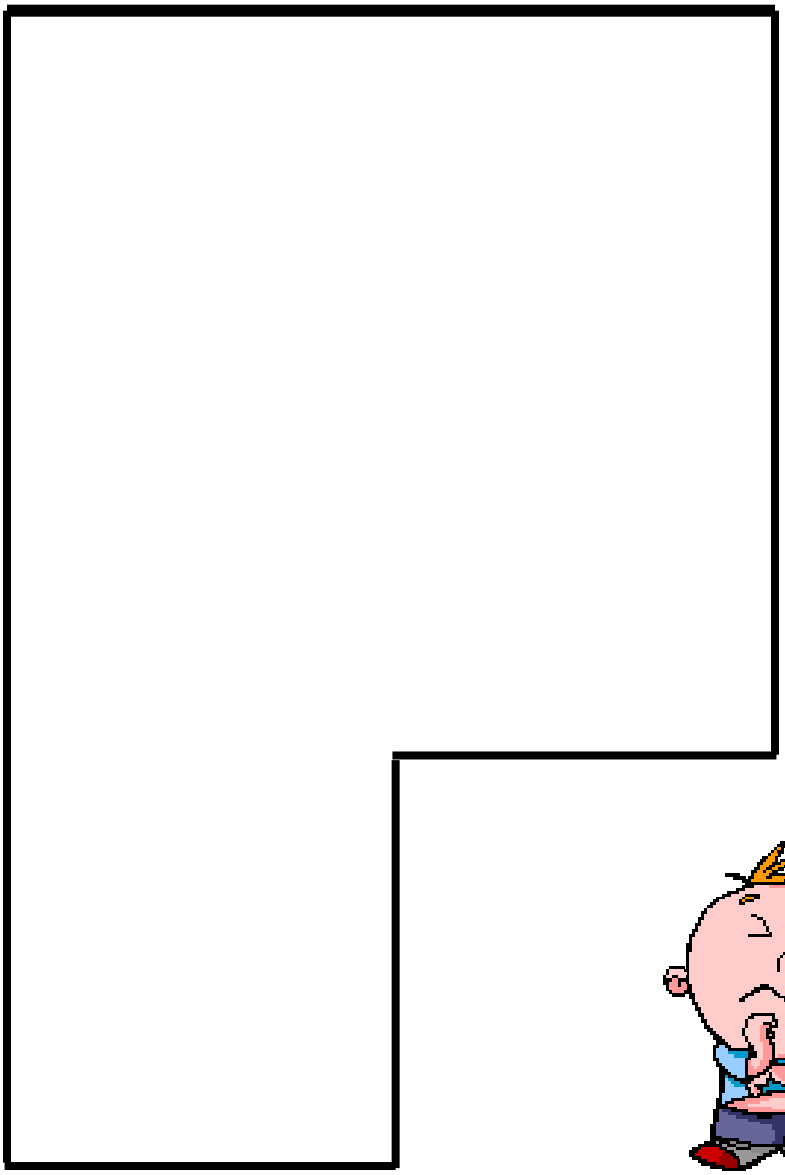
Name_____ Date_____

Triangles! Triangles!



Fill It Up!

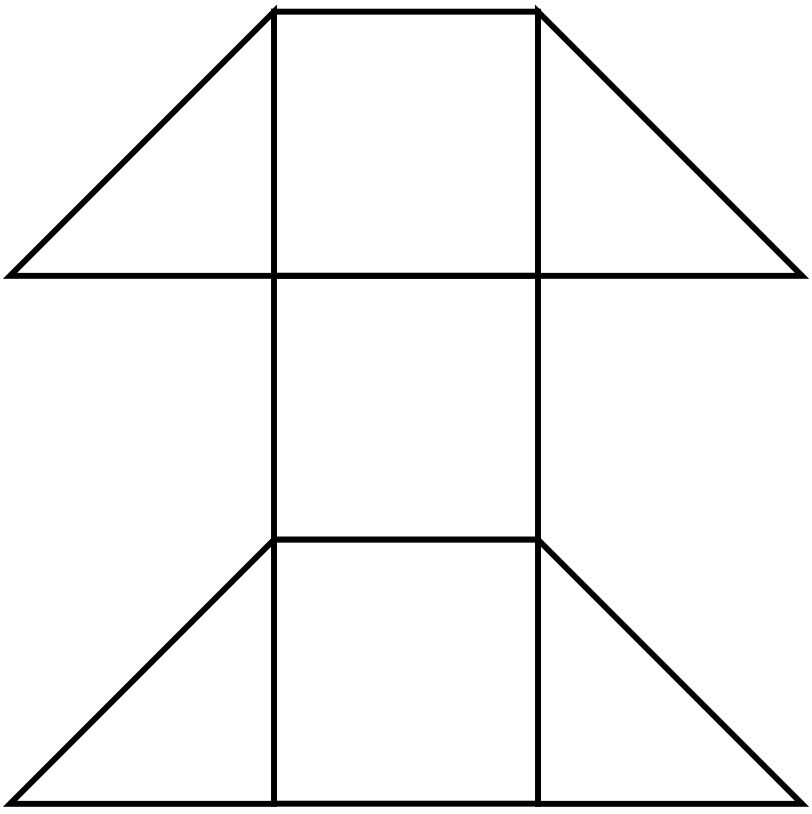
I think this figure has an area of _____ square units.



The area has an area of _____ square units.

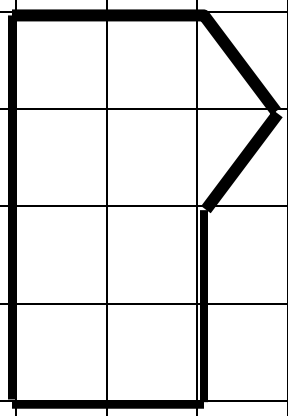
Name_____ Date_____

Space Ship



Count It Up!

1.



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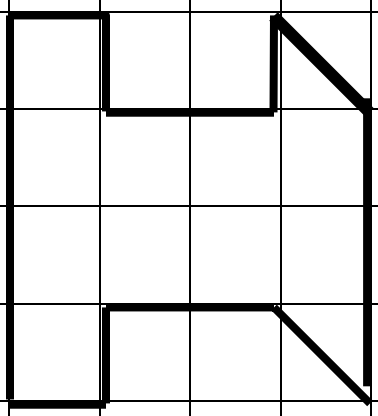

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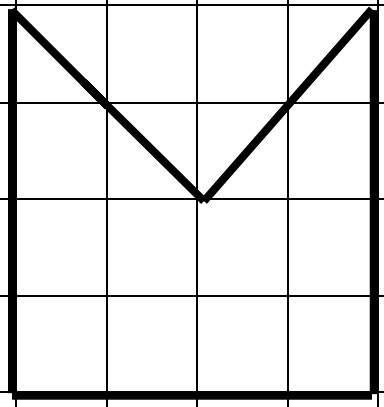

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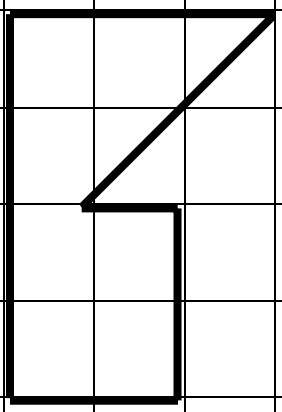


Brief Constructed Response

The librarian has to choose a new bookshelf for the library. She wants the bookcase with the least area.

Figure A

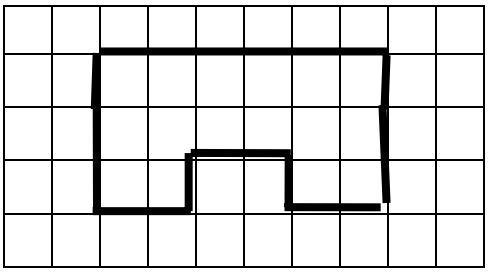
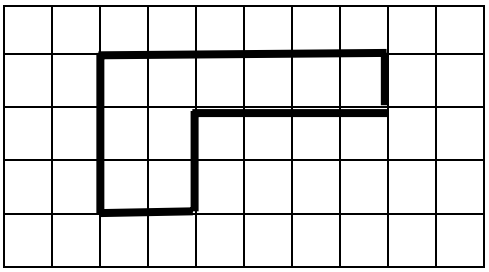


Figure B



Part A

Which table takes up the least area?

_____

Part B

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

_____

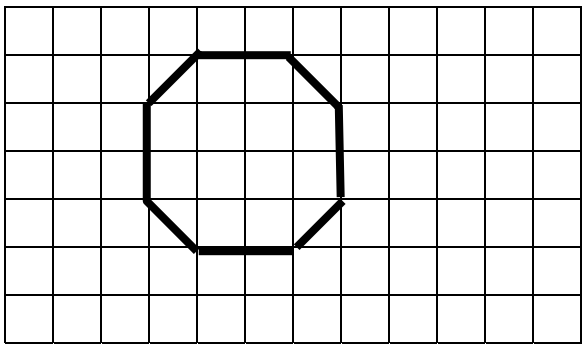
_____

_____

_____

Brief Constructed Response

The librarian also bought a new student work table for the library. It is shown below. Determine the area of the table.



Part A

What is the area of the new student worktable?

Part B

Use what you know about area to explain how you found your answer. Use numbers and/or words in your explanation.

Brief Constructed Response

The librarian has to choose a new bookshelf for the library. She wants the bookcase with the least area.

Figure A

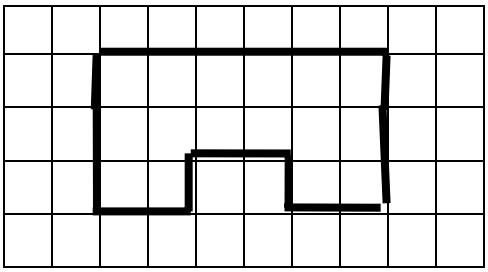
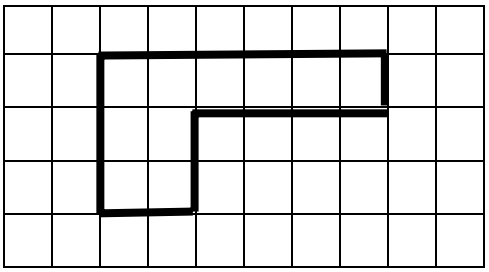


Figure B



Part A

Which table takes up the least area?

Figure B

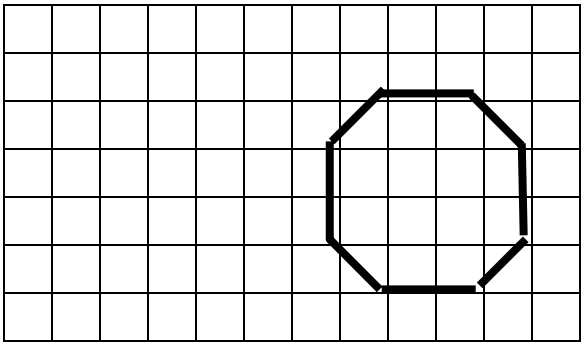
Part B

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

Figure B has the least area. I counted the squares inside the figures to find the area. Figure A has an area of 16 square units. Figure B has an area of 10 square units. 10 < 16, so Figure A has the least area.

Brief Constructed Response

The librarian also bought a new student work table for the library. It is shown below. Determine the area of the table.



Part A

What is the area of the new student worktable?

14 square units

Part B

Use what you know about area to explain how you found your answer. Use numbers and/or words in your explanation.

- **I know area is the space inside the perimeter.**
- **I counted all of the whole square units first. There are 12 whole square units.**
- **Next, I counted the half square, triangle units. There are 4 of those. 4 halves = 2 square units.**
- **12 square units + 2 square units = 14 square units.**