

## Perimeter, Area & Mass

### Measurement

#### STATE GOAL 6:

Estimate, make and use measurement of objects, quantities and relationships and determine acceptable levels of accuracy..

#### Statement of Purpose

The Illinois Learning Standards state that measurement provides a way to answer questions about "how many", "how much", and "how far." During the late elementary years, it is important that we help students to make connections between different systems of measurement (metric and customary), different units of measurement (feet vs. inches, cm vs. m), and different methods of measurement (direct measurement, comparison, estimation, use of appropriate instrument). It is during this time that students should also begin to understand the relationships between measurements in one, two, and three dimensions (length, area, and volume). As the NCTM Principles and Standards points out, measurement skills and concepts can be developed across the curriculum and throughout the year. With the hands-on activities in this unit we strive to build the students' understanding of the concepts of perimeter, area, and mass and have them apply these understandings in a variety of situations.



This unit includes a number of measuring experiences. The students will explore the concepts of perimeter, area, and mass.

#### Connections to the Illinois Learning Standards.

**Standard 7.A. -- Measure and compare quantities using appropriate units, instruments, and methods.** Participants develop the concepts of perimeter and area by measuring objects with both non-standard and standard units, working with geoboards and constructing rectangles with colored tiles and straws.

**Standard 7.A. -- Estimate measurements and determine acceptable levels of accuracy.** Participants will estimate mass, area and perimeter and select the appropriate units in both the customary and metric systems.

**Standard 7.C. -- Select and use appropriate technology, instruments, and formulas to solve problems, interpret results, and communicate findings.** Students will construct and draw figures with given perimeters and area. Students will work together in groups to design a scale drawing of their classroom.



## Table of Contents

## Page Number

Materials	3
What is Perimeter?	4
Straw Polygons and Their Perimeters	6
Perimeter of Some Body	8
Pacing to Find Perimeter	10
What is Area?	12
Area By Design	14
Area on the Geoboard	16
Areas of Non-rectangular Shapes	20
Constant Perimeter and Different Areas	22
Estimating and Measuring Mass	26
Fruit Basket	28
Area of Fruit Peels	30
Area of Student Names	30
<b>Appendices</b>	
Appendix A - Centimeter grid	33
Appendix B - Inch grid	35
Appendix C - Tetrominoes	37
Appendix D - Geoboard grids	39
Appendix E—Area of Non-rectangular Shapes Transparency Master	41
Appendix F - Graphing Rectangles with Perimeter of 24	43
Appendix G - Constant Perimeter / Changing Area	45
Appendix H - Class Data Sheet for Mass of Fruit	47
Appendix I - Class Data Sheet for Area of Fruit Peel	49

Note: Appendices are printed only on the odd pages. This is done to make photocopying easier. That is, each participant/student should have a copy of the odd numbered pages. While the instructors should have a copy of all the pages.

The logo consists of the text "M2T2" in a bold, blue, sans-serif font, centered within a blue rectangular box with horizontal lines.The word "Materials" is written in a bold, black, sans-serif font, positioned inside a blue-outlined triangle that points to the right.

## **MATERIALS LIST**

### **Minimal:**

- Chart paper or chalkboard
- Butcher paper
- Straws
- Tape
- Magic markers
- Box of regular paper clips, box of large paper clips
- Index cards—3x5 and 4x6
- Oranges, bananas, grapefruit, tangerine
- Scales
- Calculators
- Rulers, yardsticks, measuring tapes, meter stick
- Ball of heavy string
- One-inch tiles
- Paper towels
- Geoboards
- Overhead geoboard

M2T2

Instructor  
Page

## What is Perimeter?

### Activity Instructions:

#### Introductory Activity: What is Perimeter?

The distance around a figure is called its perimeter. The word *perimeter* comes from two Greek words: *peri*, meaning *around*, and *metron*, meaning *measure*. Some examples of other words derived from these same roots are *peripheral*, *periscope*, *speedometer*, *thermometer*.

- ▷ The teacher divides the class into groups of 4 or 5 students. The student groups use markers and write words, drawings, or symbols on chart paper to demonstrate their ideas of the concept of perimeter.
- ▷ Each group then shares and explains what they have on their chart paper. Through discussion, the class comes to consensus on the meaning of perimeter.
- ▷ Each student makes a journal entry for the meaning of perimeter and explains how to find the perimeter of a shape.

#### Activity 1: Finding Perimeter

Each student receives a large index card (4x6) and an envelope containing 25 paper clips and a piece of string about 2 feet long. Some students should receive large paper clips and the others should get a smaller size. After students measure and share their findings with the class, discuss the problems with using paper clips to measure. Did everyone have the same results? Why or why not? How did students measure around the corners? Ask students to suggest a measurement unit that would give everyone the same result.

Next students place the piece of string all around the edges of the index card and cut the string so it is exactly long enough to go around the perimeter of the index card. The length of the string is the perimeter of the card. Discuss these measurements. Does everyone have the same result now? Why or why not?

### Mathematical Background and Comments

- Perimeter is the distance around any figure. It is a linear measure. Using a string to go around the figure and then measuring the string emphasizes that the perimeter is not the interior of the figure.
- We use perimeter when we make a border or build a fence. Ask the students to think of other examples.
- The paper clip is a non-standard unit of measure. The number of paper clips needed to go around the index card varies with the size of the paper clip. Also, there should be discussion about rounding and accuracy of any measurement. Even when using standard units, we measure "to the nearest inch" or "to the nearest half inch" or "to the nearest centimeter"
- Discuss why we derive so many mathematical terms from the ancient Greeks. As a history connection students could research aspects of Greek civilization.

#### Materials:

- chart paper
- markers
- 4"x6" index cards
- small paper clips
- large paper clips
- small envelopes
- string
- rulers

### References:

<http://www.shodor.org/interactivate/elementary/index.html>

This website has several perimeter and area activities listed under *Geometry and Measurement Concepts*.

**Participant Page**

**Journal Activities:**

Explain how to find the perimeter of a figure.

Make a list of some situations when we need to find the perimeter.

Find other words in the dictionary derived from the roots *peri* and *metron*. What do these words have to do with *around* and *measure*?

**What is Perimeter?**

- ▷ Use the paperclips in the envelope to make a chain.
- ▷ Place the paper clip chain around the edge of your index card as though you are making a frame for it.
- ▷ Count the number of paper clips needed to go all around the index card. This is the perimeter in paper clips. Record this number in the chart. Discuss your results with the class. What problems do you have when measuring with paper clips?
- ▷ Place the piece of string all around the edges of the index card. Cut the string so it is exactly long enough to go around the perimeter of the index card. The length of the string is the perimeter of the card. Estimate the perimeter of the index card (length of the string) in inches.
- ▷ Use a ruler to measure the length of the string in inches. The result is the perimeter of the index card in inches. Record this number in the chart.

Perimeter in paper clips	Estimate of perimeter in inches	Perimeter in inches
_____ paper clips	_____ inches	_____ inches

▷ Does everyone have the same perimeter in paper clips? \_\_\_\_\_ Why or why not? \_\_\_\_\_

▷ Does everyone have the same perimeter in inches? \_\_\_\_\_ Why or why not? \_\_\_\_\_

**Extension:**

Use string and a ruler to measure the perimeter of these items:

Student desk top \_\_\_\_\_ A page of the math textbook \_\_\_\_\_

A sheet of notebook paper \_\_\_\_\_ The chalkboard \_\_\_\_\_

In your classroom, find items that have an approximate perimeter of:

\_\_\_\_\_ 20 in.      \_\_\_\_\_ 40 in.      \_\_\_\_\_ 30 cm

\_\_\_\_\_ 4 ft.      \_\_\_\_\_ 12 ft.      \_\_\_\_\_ 10 m

Find another item that has a perimeter of 20 inches. \_\_\_\_\_



## Instructor Page

In the previous activity students

discussed the need for standard units of measure. In this activity all of the measurements are in inches.

Investigate the names of the standard traditional units for measuring length. Why do 12 inches make a foot and 3 feet make a yard?

Compare the development of the metric units with the traditional system.

Triangles can be classified by the lengths of their sides. An **equilateral** triangle has three sides of equal length. An **isosceles** triangle has at least two side of equal length, and a **scalene** triangle has three sides of unequal lengths.

## Straw Polygons and Their Perimeters

### Activity Instructions:

- ▷ Each student measures and cuts three pieces of string 30 inches long. One piece of string and three or four cut straws are used for each figure.
- ▷ Figure One uses four drinking straws that are each six inches long. When threaded together the four straws form a quadrilateral. Everyone's figure will be a **rhombus** and some will be **squares**. (Some students may want to call their quadrilaterals "diamonds". The word "diamond" is not much used in mathematics. Notice that a diamond is just a rhombus when viewed from a certain perspective. For example, a baseball diamond is a square viewed from a vertex, like home plate or one of the bases, rather than from a side.) The perimeter of every one of these shapes is 24 inches. Talk about how these different shapes can all have the same perimeter.
- ▷ Figure Two uses three straw pieces of different lengths. When the three straws are threaded together a **scalene triangle** is formed. Everyone's figure will be exactly the same size and same shape as everyone else's. All of these triangles are **congruent**. The perimeters will all be 21 inches.
- ▷ Figure Three uses drinking straws cut into two 6-inch lengths and two 4-inch lengths. There is more than one possible **quadrilateral** that may be formed. The straws may form a **rectangle**, a **parallelogram**, or a **kite**. The perimeter of every one of these shapes is 20 inches. Talk about how these different shapes can all have the same perimeter.

### Extensions:

- Use drinking straws cut into three 6-inch lengths to make an **equilateral** triangle, and use two 8-inch lengths and one 5-inch length to make an **isosceles** triangle. Find the perimeters. For each type, all of the triangles will be **congruent**. The students can hold their triangles against each other to show that they are exact matches of each other.
- Use straws cut into two 4-inch lengths, one 6-inch and one 8-inch to make a trapezoid. Some students may make isosceles trapezoids. Are any other quadrilaterals possible? What are the perimeters?
- Point out that there are many different quadrilaterals that can be made by threading four given straws, but given three straws only one triangle can be formed. This means that triangles are rigid, while quadrilaterals can be deformed. That's why bridges and skyscrapers and the roofs of houses have triangular strut work in them.

### References:

[http://www.npl.co.uk/about/history\\_length/](http://www.npl.co.uk/about/history_length/)

[http://www.slcc.edu/schools/hum\\_sci/physics/tutor/2210/measurement/history.html](http://www.slcc.edu/schools/hum_sci/physics/tutor/2210/measurement/history.html)

### Literature Connections:

Myllar, Rolf. *How Big Is A Foot?* Dell Yearling, 1990.

Read the story to the class.

- Elect a person from the class to be "King". Draw around the "King's" foot and use this copy to draw a life-size picture of the Queen's bed. Talk about the size of this bed. Who could sleep in it?
- Ask the students to write a letter to the King telling him why or why not the apprentice should be freed from jail. What did he do wrong? Was it his fault?

## M2T2

Participant  
Page

## Straw Polygons and Their Perimeters

Use some of these terms when you describe the figures made from the pieces of straws.

- rectangle
- square
- parallelogram
- rhombus
- triangle
- perimeter
- congruent

Each student measures and cuts three pieces of string. Each piece is 30 inches long.

## Figure One

- Measure and cut four drinking straws so that each is six inches long.
- Thread one of the string pieces through all four straws and tie the string ends to form a quadrilateral.
- Find the perimeter of this figure. \_\_\_\_\_
- Describe the figure.

---



---



---



---

- Do all of the figures look the same? Are all of the perimeters the same? Explain. \_\_\_\_\_

## Figure Two

- Measure and cut three drinking straws so that one is five inches long, one is seven inches, and the third is nine inches .
- Thread one of the string pieces through all three straws and tie the string ends to form a triangle.
- Find the perimeter of this figure. \_\_\_\_\_
- Describe the figure.

- \_\_\_\_\_
- Do all of the figures look the same? Are all of the perimeters the same? Explain.
- \_\_\_\_\_
- \_\_\_\_\_

## Figure Three

- Measure and cut drinking straws into two 6-inch lengths and two 4-inch lengths.
- Thread one of the string pieces through all four straws and tie the string ends to form a quadrilateral.
- Find the perimeter of this figure. \_\_\_\_\_
- Describe the figure.

- \_\_\_\_\_
- Do all of the figures look the same? Are all of the perimeters the same? Explain.
- \_\_\_\_\_
- \_\_\_\_\_



M2T2

Instructor  
Page

## Perimeter of Some Body

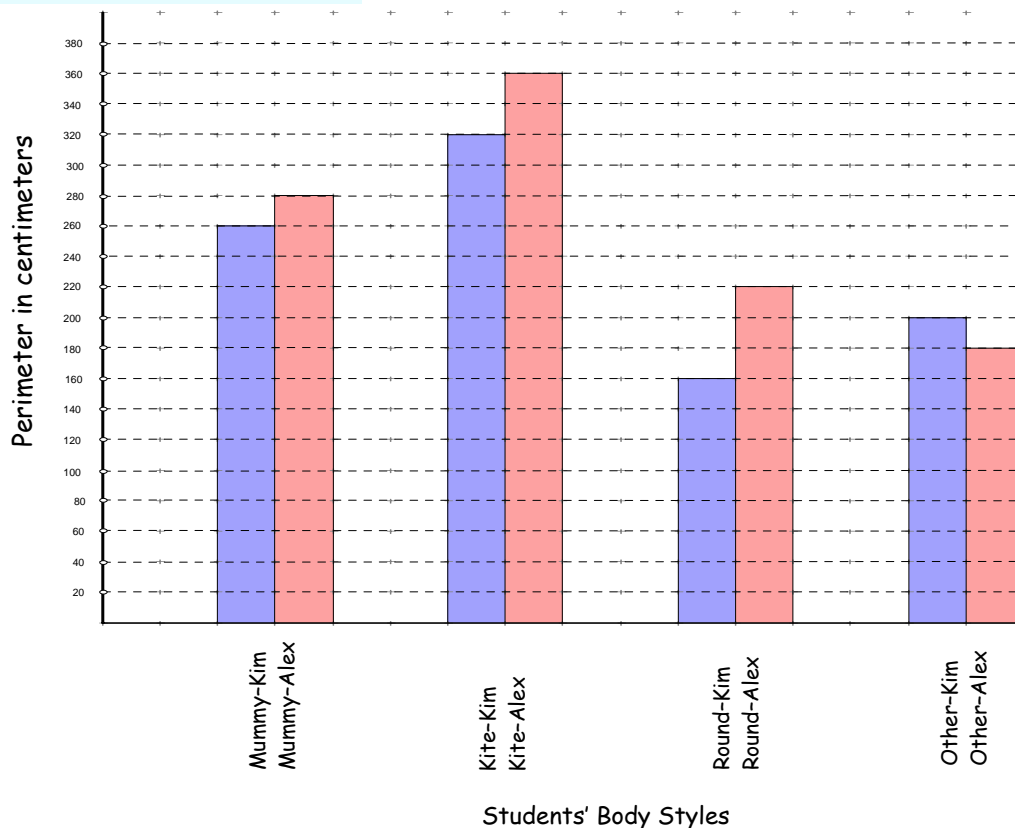
### Activity Instructions

These activities are designed to emphasize that perimeter is the measure of distance around a shape. In many text books perimeter and area are taught together and students often confuse the two ideas.

Students work with a partner to measure the perimeters of their body tracings. They first trace around their bodies and then place string on the tracing. Finally, they measure the string with a meter stick or tape measure.

Perimeter is a linear measure. Using a piece of string to go around the "body style tracing" and then measuring the string illustrates this idea. (Students can think of the string as a line.)

Ask for some other examples of linear measures.



This activity requires students to measure and record data. The chart is one way to display the data, but the double bar graph makes comparisons more obvious. Discuss what conclusions become more apparent when viewing the graph than when just looking at the chart.

#### Materials:

- butcher paper and markers or floor area where you can trace with chalk
- string
- tape measures

#### References:

<http://www.shodor.org/interactivate/elementary/index.html>

This website has several perimeter and area activities listed under *Geometry and Measurement Concepts*.

#### Extension:

Make a chart and record the **height in cm** and "mummy tracing perimeter" for each student in the class. Make a **scatter plot** using these pairs of data. What does the scatter look like? Do taller students have longer perimeters? If this is generally true, we say that these measures have **positive correlation**. Could you use your scatter plot to



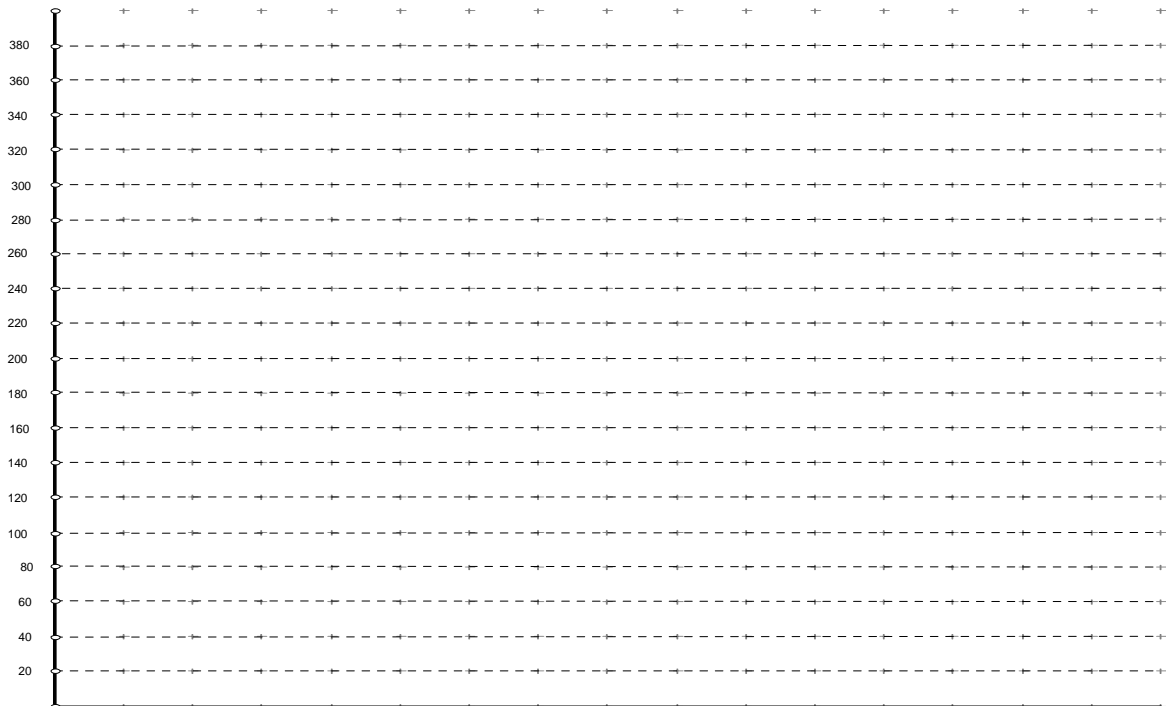
**Perimeter of Some Body**

What is the perimeter of your body tracing? Work with a partner to measure the perimeter of each of your tracings.

- Lie on a piece of butcher paper with your arms at your sides and your feet together (mummy style). Lie still while your partner draws around the silhouette of your body. Place a piece of string all around the tracing. Use a tape measure or meter stick to measure the string in centimeters. This measure is the perimeter of your "mummy style" body tracing.
- This time lie on the butcher paper with both feet together and both arms straight out. Now your body silhouette forms the diagonals of a kite. Stretch a piece of string from the top of your head to your finger tips, then to your toes and on to the finger tips of the other hand and back to your head. Measure the string and record the perimeter of your "kite style" body tracing.
- Form your body into a ball and lie on the butcher paper. Trace around the outline of your "round style" body silhouette. Place a piece of string around the perimeter of your tracing. Measure the string and record the perimeter of your "round style" body tracing.
- Could you form your body silhouette into a triangle or a pentagon? Maybe you could think of another shape. Trace the perimeter of your body tracing for a shape that you choose and put string around the tracing. Measure the string and record the style and perimeter of "your style" body

Tracing Style	My perimeter (cm)	My partner's perimeter (cm)
Mummy style		
Kite style		
Round style		

5. Use the data in your chart to make a double bar graph



Remember to label the axes

## M2T2

## Pacing to Find Perimeter

Instructor  
Page

A pace is the length of a single step. Most people naturally walk with a rhythm that makes each of their paces about the same length. So knowing your own pace length allows you to estimate any distance that you can walk. Discuss some situations where a person might use pacing to measure.

**Vocabulary Note:** The words *perimeter* and *circumference* mean exactly the same thing, but *perimeter* has origins in the Greek and *circumference* has Latin origins. *Circumference* is more commonly used for the perimeter of circles. *Circumference* comes from two Latin words: *circum*, meaning *around*, and *ferre*, meaning *to carry*.

Activity Instructions:

- ▷ Each student estimates the number of steps (paces) s/he would take to walk around the classroom.
- ▷ Each student then walks around the classroom and counts his paces.
- ▷ Record and compare data.
- ▷ Discuss why the measurements of the various students are different? Why is there a need for a standard unit of measure? When might a person want to use his/her pace to measure?
- ▷ Use yardsticks or measuring tapes to find the perimeter in feet and record this information.

Mathematical Background and Comments:

Even though a pace is a non-standard unit, it is frequently used for estimating. If a person knows the length of his/her pace, it is possible to measure distance fairly accurately without any measuring tools.

Each student measures the length of his/her pace. Count the number of paces to walk around the school track or the cafeteria then calculate the perimeter.

For example, if a person takes 530 steps to go around the track and his/her pace measures 2.5 feet, the distance around the track is 2.5 times 230 or 1325 feet.

Extensions:

- The circumference of the Assembly Hall at the University of Illinois at Urbana-Champaign is 1256 feet. Using what you have found out about your pace, figure out how many steps you would have to take to walk around the entire Assembly Hall. About how many steps would you have to take to walk a mile?
- Use the chart that compares number of paces and number of feet. Make a **scatter plot** using these pairs of data. What does the scatter look like? The points should be nearly collinear. These measures have **positive correlation**. They are also an example of **direct variation**. Could you use your scatter plot to estimate the number of feet covered in 30 paces?

Language Connections:

Students can use a dictionary to find other English words derived from *circum* and *ferre*. Discuss how their meanings relate to the root words meanings, *around* and *carry*. Some examples are *circumnavigate*, *circumvent*, *circle*, *circus*, *ferry*, *coniferous*.

**Pacing to Find Perimeter**

**Participant Page**

**Journal Activity**

Estimate the number of your steps (paces) it takes to walk around the perimeter of the class room and record. Then walk around the room and determine the perimeter in paces and record.

Why do we need standard units of measure?  
When might it be ok to use non-standard units?

Record the length of your pace. Think of some situations where you might use your pace to measure distance.

Estimated number of paces	Actual number of paces	Estimated number of feet	Actual number of feet

▷ Do you agree with your classmates' number of paces? \_\_\_\_\_

▷ Why?

---

Estimate the perimeter of the classroom in feet and record. Then using a yardstick or measuring tape, work with a partner and measure the perimeter of the classroom in feet and record this.

▷ Do you agree with your classmates' number of feet? \_\_\_\_\_

▷ Why?

---

▷ What are standard units of measure and why do we need them?

**How Long is Your Pace?**

Take 10 steps, then measure the distance you walk in feet. Record the information in the chart. Use proportional reasoning to complete the chart. Once you know the length of your pace, you can use your pace to estimate any distance that you can walk.

Count your paces as you walk around the perimeter of the cafeteria. Use a proportion to find the perimeter of the cafeteria in feet.

Paces	Feet
10	
20	
30	
5	
2	
1	


**Instructor  
Page**

Area is a measure of covering. It is the number of square units needed to cover a figure.

Standard units for area are **square** units. Square inches, square feet, square miles, square centimeters, square meters are all examples of units used for measuring area. An abbreviation for square inches is sq. in. Another shortened form is to write "in<sup>2</sup>". Students often are confused by this exponent. The notation indicates that inches are multiplied by inches to get square inches, but students may think that the number of square inches needs to be squared. Using the "sq. in" abbreviation until the concept is well developed may avoid this confusion.

**Materials:**

- Chart paper
- Markers
- Square inch tiles
- 3"x5" index cards
- 4"x6" index cards
- rulers & measuring tapes
- inch graph paper
- crayons or markers

## What is Area?

### Introductory Activity

- ▷ Groups of 3 or 4 students use markers and write words, drawings, or symbols on chart paper to demonstrate their ideas of the concept of area.
- ▷ Each group then shares and explains what they have on their chart paper. Through discussion, the class comes to consensus on the meaning of area.
- ▷ Each student makes a journal entry explaining the meaning of area and describes a situation where s/he would need to find area.

### **Finding Area Using Non-standard Units**

Each student finds the area of the front cover of his/her math book (and/or desktop) using index cards as the unit of measurement and record the data. Make sure that some students receive 3" x 5" index cards and others 4" x 6" index cards to use for this activity. Students discuss their findings.

Discuss:

- ▷ Did everyone have the same number of index cards for area? What problems are caused by using more than one size index card?
- ▷ How did you find the area when the index cards didn't fit exactly?
- ▷ Did anyone need to use parts of units (e.g. 12 1/4 units)?

Using the index cards, work in small groups and find the area of three more items in the room. Discuss the following:

- ▷ Did any of the items have the same area as the math book or desktop? If so, were they the same shape?
- ▷ Did you need to cut the index card to make it cover better?
- ▷ Which of the items had the largest area, the smallest area?
- ▷ In which situations is having cards of different sizes a problem? When is it not?
- ▷ Why are standard units of measuring area?

### **Constructing Areas**

Give students 1-inch square tiles or construction paper squares and sheets of inch graph paper. Each tile is one square inch. Students use the tiles to make figures with the specified area and color the same figure on the 1-inch grid paper. There should be a variety of shapes all having the same area.

As they experiment the students should be making generalizations about area and trying to find methods for finding the areas of various shapes.

### Extension:

Shapes that are composed of four adjacent squares are tetrominoes. (Each tetromino has an area of four square units.) They are the same shapes that make up the puzzle Tetris. There are only five unique "free" tetrominoes. Can your students find all five?

There is a tetromino activity and reference in the appendix.

M2T2

Participant  
Page

## Journal Activity:

When do we need to know  
the area of something?

Can different shapes have  
the same area?

## What is Area?

## Finding Area Using Non-standard Units

- Estimate the number of index cards it will take to cover your math book.
- Measure the area of your math book by covering it with index cards.
- Record your estimates and actual area of your math book and desktop using an index card as the unit of measure.

Estimated area of book in index cards	Area of book in index cards	Estimated area of desk in index cards	Area of desk in index cards

Using the index cards, work with your group and find the area of three more items in the room and record their area below.

Item measured	Area (in index cards)
1.	
2.	
3.	

## Constructing Areas:

Using 1 inch square tiles:

1. Make a figure with an area of 4 square inches. Copy this figure on the 1-inch graph paper by coloring in the squares to show area of 4 square inches .
2. Make a different figure with an area of 4 square inches and copy on the graph paper.
3. Make a figure with an area of 5 square inches and copy on the graph. Make as many different figures with area of 5 square inches as you can.
4. Make a rectangle with an area of 8 square inches.
5. Make as many different rectangles as you can with an area of 12 square inches. Use another sheet of inch graph paper if you need it.
6. Make a figure with an area of 7 square inches. Draw a line that separates it into two equal parts. What is the area of each part?

## M2T2

## Area By Design

Instructor  
Page

This activity asks students to use a scale of one unit square on the grid for one square foot in the actual pizza parlor.

To help visualize one square foot, each student makes a life size square foot out of construction paper. The students in the class put their squares on the floor and arrange them into rectangles or squares. This gives us a benchmark for the actual size of the kitchen or the counter

**Activity Instructions:**

- ▷ Each student makes a life size square foot out of construction paper. Several students put their squares together to make a life size model of the area of a small table or the condiment counter.
- ▷ The students design a floor plan using all of the items listed in the chart.
- ▷ The dimensions of the items must be as listed.
- ▷ Color code the items.
- ▷ Draw each item on grid paper (see Appendix A for grid paper) using a scale of one square unit for each square foot. Color the item according to your color code.
- ▷ Arrange the cutouts into a pizza parlor floor plan.
- ▷ Tape or glue the cutouts on the large grid.
- ▷ Find the requested areas in square feet.

**Questions for Discussion**

- ▷ Are all of the proposed pizza parlors the same size and shape?
- ▷ Which have the smallest area?
- ▷ Which shape uses the space more effectively?

**Mathematical Background and Comments**

At first students find area by counting the unit squares. As they gain experience they develop more efficient methods for counting. Discuss the students' methods for finding the area of a rectangle. Someone may suggest counting the number of unit squares in one row and counting the number of rows. In the rectangle at the right there are 7 unit squares in each row and 5 rows. The students may count by seven's to get the area of 35 square units. Through discussion formalize the rule for finding the area of a rectangle:

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35

**Area of a rectangle = length times width**  
 $A = l \times w$

Display the floor plans on the bulletin board.

Discuss what makes a good restaurant design. Where do customers like to sit? What arrangements are convenient for the workers? Where are good places for the restrooms?

**Extension questions:**

The pizza parlor has to pay rent based on the area of the space. If the rent is \$.75 per square foot per month, how much is the monthly rent payment? How much would this be per year?

If a large pizza sells for \$14.50 and costs \$10.00 to make, how many pizzas have to be sold just to pay the rent?

The floor tile for the dining area costs \$2.25 per square foot. How much will it cost to cover the dining area floor?

### Area By Design

## Participant Page

You have been hired to design a floor plan for a new pizza parlor. It needs to include all of the items listed below. The size of each item has also been listed.

To help you organize all the items that need to be included, you should color code them.

Select a different color for each item and color the box in the chart. Draw each item on grid paper using a scale of one square unit for each square foot. Color the item according to your color code and cut it out. Arrange the cut outs into a good floor plan for a pizza parlor. Combine the three counter cut outs to form a U-shaped counter. Tape or glue your cutouts to the large grid. Express your areas in square feet.

Color	Item	Dimensions (ft)
<input type="checkbox"/>	kitchen	15 x 20
<input type="checkbox"/>	counter	2 x 8
<input type="checkbox"/>	counter	2 x 8
<input type="checkbox"/>	counter	2 x 12
<input type="checkbox"/>	8 large tables	4 x 8 each
<input type="checkbox"/>	4 medium tables	4 x 6 each
<input type="checkbox"/>	6 small tables	4 x 4 each
<input type="checkbox"/>	salad bar	4 x 10
<input type="checkbox"/>	ladies' room	8 x 12
<input type="checkbox"/>	men's room	8 x 12
<input type="checkbox"/>	soda fountain	2 x 4
<input type="checkbox"/>	condiment counter	2 x 6
<input type="checkbox"/>	4 trash cans	2 x 2 each

What is the area of the salad bar?  
\_\_\_\_\_

What is the total area of the counter?  
\_\_\_\_\_

What is the total area of all the small tables? \_\_\_\_\_

What is the total area of all the large tables? \_\_\_\_\_

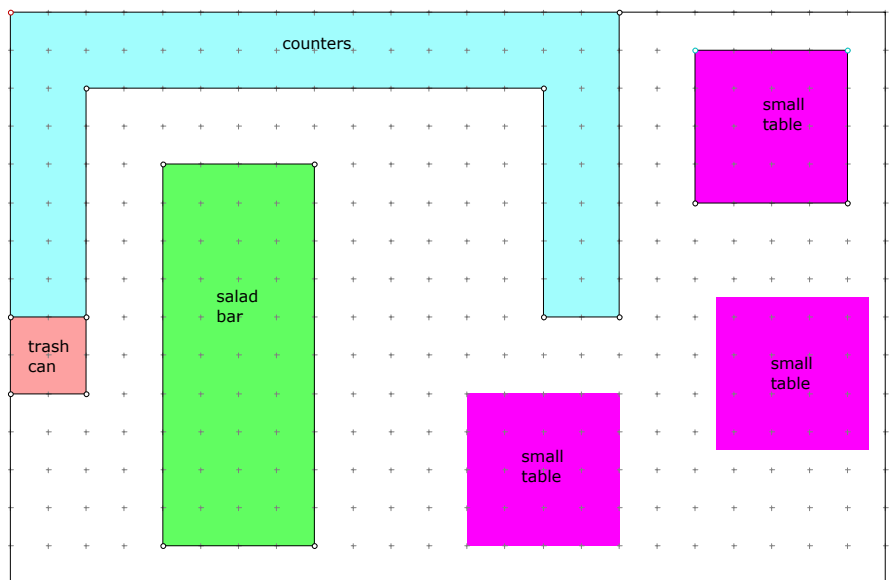
What is the total area of all the trash cans? \_\_\_\_\_

What are the dimensions of your pizza parlor? \_\_\_\_\_

What is the area of your dining area?  
\_\_\_\_\_

How many people could be eating in your pizza parlor? \_\_\_\_\_

**At the right is an example of a partially completed floor plan. It includes only a few of the required items.**





M2T2

## Instructor Page

The teacher should circulate around the room to make sure that students are following directions and address any questions/problems that occur.

A square is a special kind of rectangle so the length times width rule for finding the area of a rectangle is also valid for squares. The length and width of a square are equal. So, to find the area of a square multiply the length by itself. Multiplying a number by itself is called *squaring* the number. If one side of a square is 3 cm, then the area of the square is  $3 \times 3 = 9$  sq cm.

### Materials

- geoboards
- rubber bands
- geoboard grid paper
- crayons or markers

### Extension:

When limited to squares with sides parallel to the side of the geoboard, the only squares that can be made have sides of 1, 2, 3, and 4 and areas of 1, 4, 9, and 16. If sides that are not parallel to the geoboard are allowed, squares with areas of 2, 5, 8, and 10 can be formed.

### Literature Connections

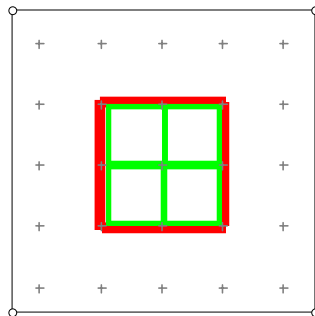
Burns, Marilyn. [Spaghetti and Meatballs for All: A Mathematical Story](#). Scholastic Press. 1997.

## Squares on the Geoboard

The teacher demonstrates placing the rubber bands on the geoboard and shows what one unit square on the geoboard looks like. (A geoboard for the overhead projector is especially helpful but the teacher may also demonstrate by holding up a regular geoboard.) Depending on the quantity of available geoboards, students may work independently or in pairs.

Teacher directs the students to:

1. Use a rubber band to make a square.
2. Each of the sides of the square must be parallel with an edge of the geoboard.
3. On the geoboard grid (more grids in Appendix D), sketch the square that you made.
4. Record the length of each side.
5. On the sketch draw the outlines of the unit squares that are inside the square made by your rubber band.
6. Count the number of unit squares in each row and record.
7. Count the number of rows of unit squares and record.
8. The total number of unit squares is the area. Record this.



The red rubber band outlines a square that has a side length of 2 units. There are two green unit squares in each row and two rows for a total area of 4 unit squares.

Side length =   2   units

  2   row(s) of   2   unit square(s)

Area =   4   unit squares

Participant Page

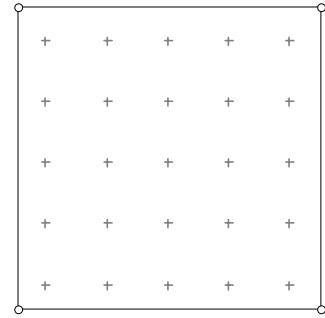
**Journal activity:**

Write three things that you have learned about area. How is area different from perimeter?

What other squares can be made on the geoboard? Try to enclose a square that has edges that are not parallel to the edges of the geoboard

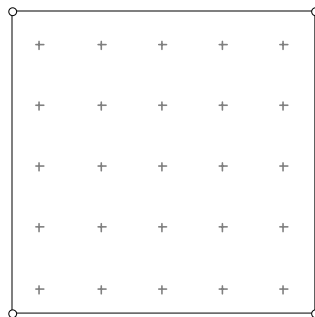
**Squares on the Geoboard**

Use the rubber band to make a square on your geoboard. Each of the sides of the square must be parallel with an edge of the geoboard. Sketch the square and record its side length and area.



Side length = \_\_\_\_\_ units  
 \_\_\_\_\_ row(s) of \_\_\_\_\_ unit square(s)  
 Area = \_\_\_\_\_ square units

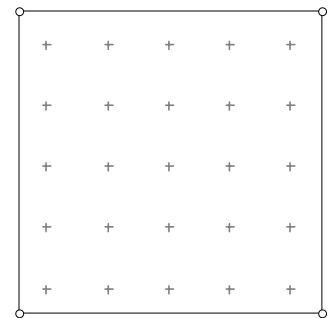
Use the rubber band to make a different size square on your geoboard. Each of the sides of the square must be parallel with an edge of the geoboard.



Sketch the square and record its side length and area.

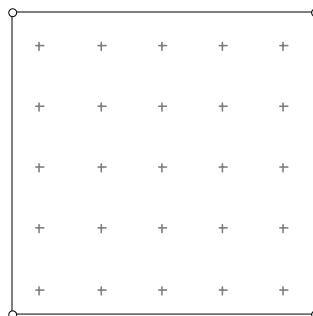
Side length = \_\_\_\_\_ units  
 Area = \_\_\_\_\_ square units

Use the rubber band to make another size square on your geoboard. Each of the sides of the square must be parallel with an edge of the geoboard. Sketch the square and record its side length and area.



Side length = \_\_\_\_\_ units  
 Area = \_\_\_\_\_ square units

Use the rubber band to make a fourth different size square on your geoboard. Each of the sides of the square must be parallel with an edge of the geoboard. Sketch the square and record its side length and area.



Side length = \_\_\_\_\_ units  
 Area = \_\_\_\_\_ square units

M2T2

## Instructor Page

Rectangles may have the same areas but different length and width.

Our initial definition of area involved counting the number of unit squares that fit into a given figure. But, that definition doesn't work for finding the area of a triangle because you can't "cover" a triangle with squares. To find the area of a triangle uses an idea based on two axioms.

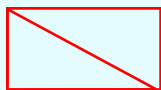
- Congruent figures have the same area
- If you cut up a figure into parts, the area of the figure is the sum of the areas of all the parts.

If a rectangle has been cut into two congruent triangles, the area of the rectangle is two times the area of one of the triangles. So, the area of each of the triangles is one-half the area of the rectangle.

The diagonal of a unit square separates it into two congruent triangles. Each triangle has an area of one-half square unit.



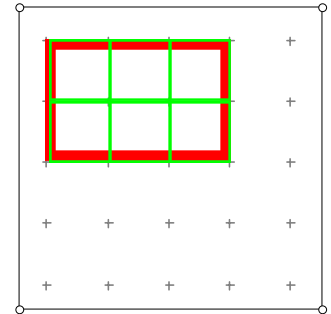
This idea can be extended to all squares and rectangles. If a rectangle is 2 by 4 units, its area is 8 unit squares. The diagonal cuts it into two congruent triangles so each must have the same area and that area must be half of 8 sq. units or 4 sq. units.



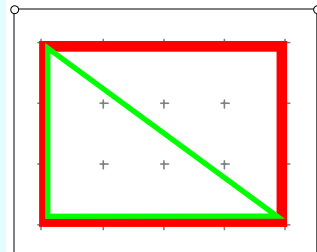
## More Geoboard Area Activities

There are many possible correct responses for these exercises. Encourage students to use small rubber bands to outline the unit squares of each the figure and experiment until they are able to generalize a method for finding the area of a rectangle.

The figure at the right shows how small rubber bands can be used to outline the unit squares

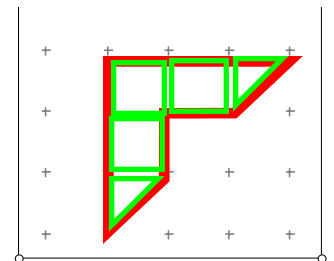


Length =   3   units  
 Width =   2   units  
  2   row(s) of   3   unit square(s)  
 Area =   6   square units



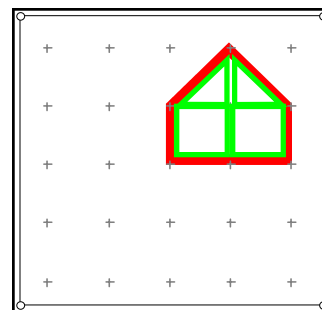
The rectangle outlined by the red rubber band has an area of 12 square units. The green rubber band separates it into two congruent triangles. Each triangle has an area of 6 square units,

In the figure there are three whole unit squares and two half squares. The total area of the figure is 4 square units.



Students may also experiment with figures that are not rectangles.

In the figure at the right, there are two unit squares and two triangles that can be put together to make one more



### Online Resources:

To access virtual geoboards (and other virtual manipulatives), go to Utah State University's Library of Virtual Manipulatives. <http://nlvm.usu.edu/>

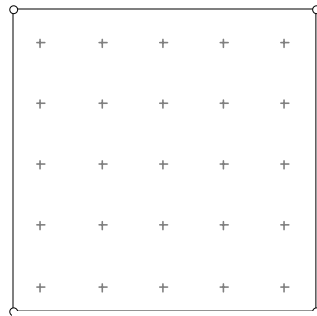
More Geoboard Area Activities

Participant Page

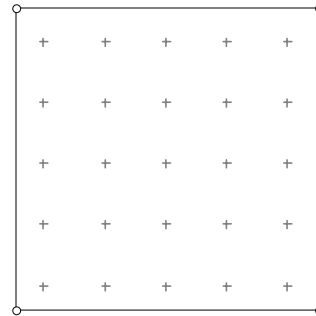
Remember that area is a measure of the number of unit squares inside a figure.

It's possible to have a fractional part of a unit square or to put two half squares together to make an area of one unit square.

1. Make two different rectangles on your geoboard. Sketch each and record the width, length and area.

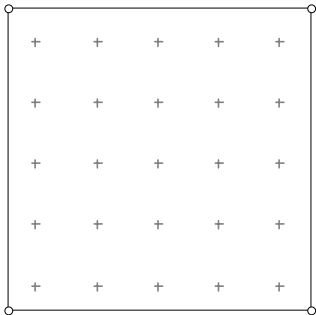


Length = \_\_\_\_\_ units  
 Width = \_\_\_\_\_ units  
 \_\_\_\_\_ row(s) of \_\_\_\_\_ unit square(s)  
 Area = \_\_\_\_\_ square units



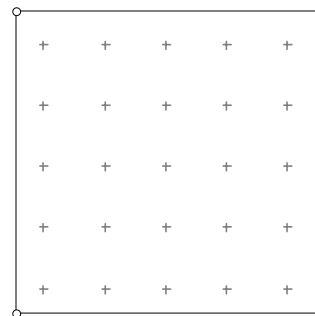
Length = \_\_\_\_\_ units  
 Width = \_\_\_\_\_ units  
 \_\_\_\_\_ row(s) of \_\_\_\_\_ unit square(s)  
 Area = \_\_\_\_\_ square units

2. Make a rectangle with an area of 8 sq. units.



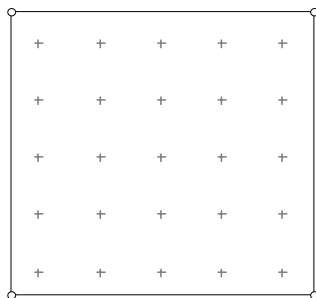
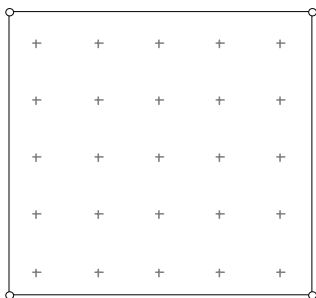
Length = \_\_\_\_\_ units  
 Width = \_\_\_\_\_ units  
 \_\_\_\_\_ row(s) of \_\_\_\_\_ unit square(s)  
 Area = \_\_\_\_\_ square units

3. Make a 2 x 5 rectangle.



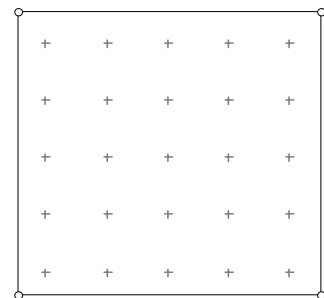
Length = \_\_\_\_\_ units  
 Width = \_\_\_\_\_ units  
 \_\_\_\_\_ row(s) of \_\_\_\_\_ unit square(s)  
 Area = \_\_\_\_\_ square units

4. Make two non-congruent figures on the geoboard that have the same area, (They don't have to be rectangles.)



Area of each = \_\_\_\_\_ square units

5. Make a figure on the geoboard with the largest possible area.



Area = \_\_\_\_\_ square units

## M2T2

Instructor  
Page

One way to find the area of non-rectangular shapes is to partition the figure into squares, rectangles and triangles and find the area of each. Then add to find the area of the larger non-rectangular figure.

To estimate the area of curved shapes, use a square unit grid overlay. Count the covered squares and estimate the partially covered squares. Combine the covered areas. Another method is to find the area of the overlay rectangle. Then count the squares that are not covered and subtract. To show that we are estimating and **not** finding exact areas, we use the symbol  $\approx$  for "approximately equal to"

**Extension:**

Each of these methods for finding the area of the L-shape leads to an addition or subtraction problem:

$$9 + 40 = 24 + 25 = 64 - 15.$$

We could think about this the other way around, every addition or subtraction could be represented by an L-shaped figure.

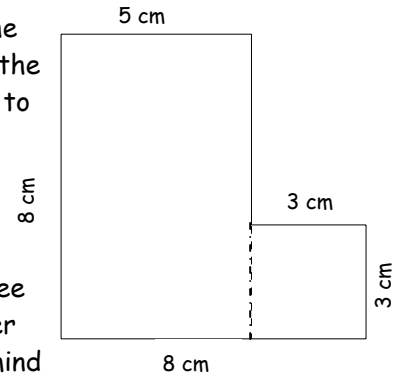
For example, draw an L-shaped figure that corresponds to  $15 + 12$ . A solution might be a  $3 \times 5$  rectangle with a  $3 \times 4$  rectangle = 27 sq. units. This same L-shape could be represented by a  $6 \times 5$  rectangle -  $3 \times 1$  rectangle = 27 sq. units.

**Areas of Non-rectangular Shapes**

Even after students have learned to find the area of rectangular shapes by multiplying the length times the width, they often have difficulty finding the area of non-rectangular shapes.

See the appendix for a transparency master for the L-shape figure. Discuss the steps for partitioning the non-rectangular figure into squares and rectangles to find the area.

- ▷ Use a dotted line to divide the figure into a square and a rectangle.
- ▷ Find the area of the square. It would take three rows with three cm squares in each row to cover this square so the area is nine square cm. (Remind students that area is always expressed in square units.)
- ▷ Find the area of the rectangle. The length is eight and the width is five so if you covered the rectangle with cm squares there would be eight rows of five cm each or 40 square cm.
- ▷ Add the areas of the square and the rectangle together to find the area of the non-rectangular figure.  $9\text{cm}^2 + 40\text{cm}^2 = 49\text{cm}^2$ .
- ▷ Another partition of the L-shape is possible. If the figure is cut into an 8 cm by 3 cm rectangle and a 5 cm by 5 cm square, the sum of these two areas is still  $49\text{cm}^2$ . ( $24\text{cm}^2 + 25\text{cm}^2 = 49\text{cm}^2$ ).



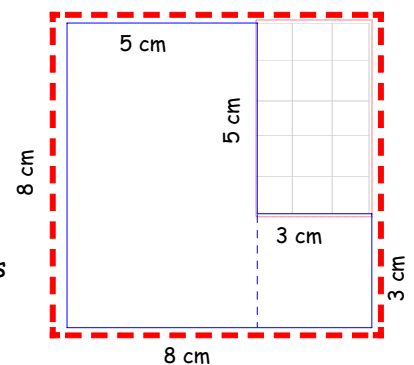
It could also be helpful to demonstrate another method for finding the area of non-rectangular figures.

- ▷ Using the same figure, demonstrate that you can draw a dotted rectangle around the figure.
- ▷ Find the area of the large dotted rectangle.
- ▷ Count the unit squares outside the L-shaped figure and inside the dotted rectangle.
- ▷ Subtract to find the area of the L-shape. (Appendix F)

Area of the dotted rectangle:  
 $8 \times 8 = 64$  square cm.

5 rows of 3 cm squares outside the L-shaped figure:  
 $5 \times 3 = 15$  square cm.

$64 - 15 = 49$  square centimeters inside the L-shape.

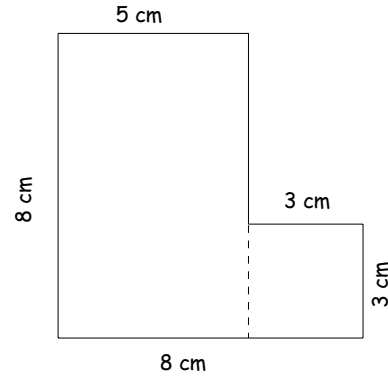


### Areas of Non-rectangular Shapes

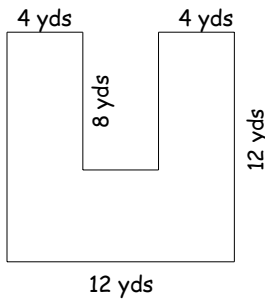
Participant Page

One way to find the area of non-rectangular shapes is to partition the figure into squares, rectangles and triangles and find the area of each. Then add to find the area of the larger irregular figure.

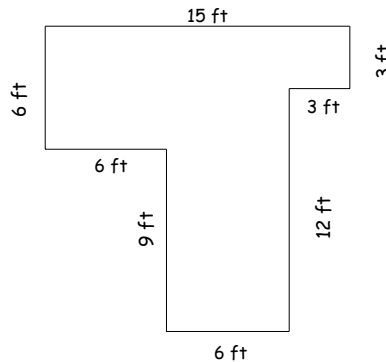
- Use a dotted line to divide the figure into a square and a rectangle.
- Find the area of the square. \_\_\_\_\_sq. cm
- Find the area of the rectangle. \_\_\_\_\_sq. cm
- Add the area of the square and the rectangle together. \_\_\_\_\_ sq. cm



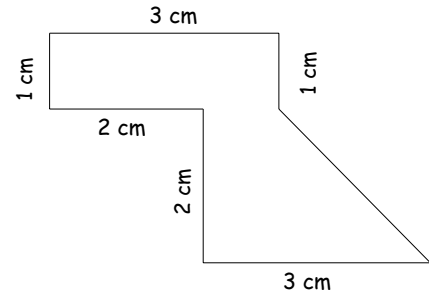
Find the areas of these non-rectangular shapes.



Area = \_\_\_\_\_

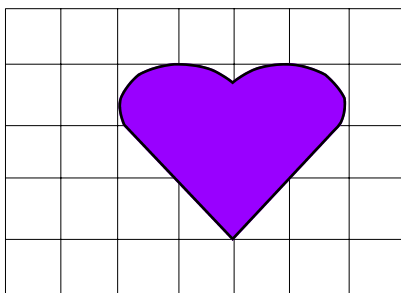


Area = \_\_\_\_\_

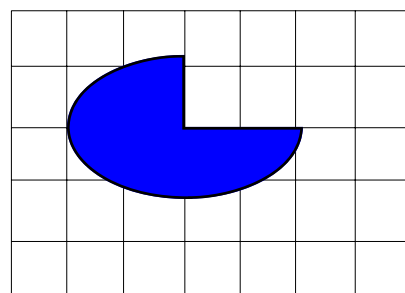


Area = \_\_\_\_\_

To estimate the area of curved shapes, count the squares and combine the areas that are partially covered or find the area of the background rectangle and count and subtract the squares that are not covered. Find the area of the following shapes:



Area  $\approx$  \_\_\_\_\_



Area  $\approx$  \_\_\_\_\_

**M2T2****Instructor  
Page**

Objects can have the same perimeter but different areas.

In this string activity, the students will discover that the string will be in the shape of a square when the largest number of students will fit inside.

Objects can have the same area but different perimeters.

**Materials:**

9 yards of heavy string

geoboards

rubber bands for geoboards

dot paper or geoboard paper

**Constant Perimeter and Different Areas****Activity 1: Area Inside the String**

- ▷ Using a piece of string approximately 9 yards long, four students hold it to make the 4 corners of a very long very narrow rectangle.
- ▷ Ask how many students could stand inside this rectangle. The answer should be zero.
- ▷ Students gradually make the rectangle shorter and wider. How many students can stand inside?
- ▷ The four students continue to enlarge the area until the largest number of students can stand inside the rectangle.
- ▷ The students should see that the area increases as the rectangle becomes more and more like a square.

**Activity 2: Area & Perimeter with Geoboards**

Depending on the quantity of available geoboards, student may work independently or in pairs.

1. Make a figure with a perimeter of 16 units. Draw it on your geoboard paper. What is the area of this figure? \_\_\_\_\_
2. Can you make another figure with a perimeter of 16 units that has a larger area? \_\_\_\_\_, or a smaller area? \_\_\_\_\_
3. Make three different figures, each with a perimeter of 24 units. Draw each on your geoboard paper. Find the area of each. Which figure has the larger area?

**Mathematical Background and Comments**

Students can tie knots in smaller pieces of string to show constant perimeter, then change the shape of the space inside the string to show that figures can have the same perimeter and different areas.

It is also possible for figures to have the same area and different perimeters. Students can use a constant number of square tiles to show several different figures with a variety of perimeters.

Students can also use their geoboards or dot paper to show shapes that have equal areas and different perimeters.

Reminder: a diagonal on the geoboard or grid paper is not a unit length. The diagonal of a rectangle or square is always longer than the length of one of its sides.



### Constant Perimeter and Different Areas

**Participant Page**

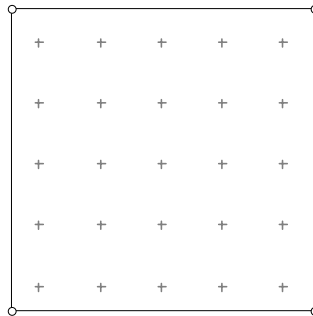
Make each of these figures on your geoboard. Sketch your figure on the geo-grid.

**Journal Activities:**

Explain what happens to the shape of the string rectangle as the area increases.

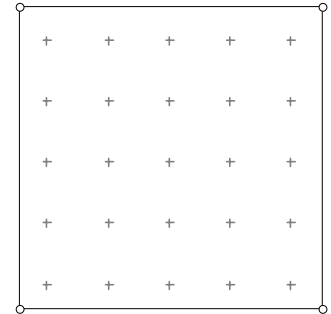
Is it possible for two rectangles to have the same area but different perimeters? Make a sketch to show what you think about this.

1. Make a rectangle with a **perimeter of 16** units



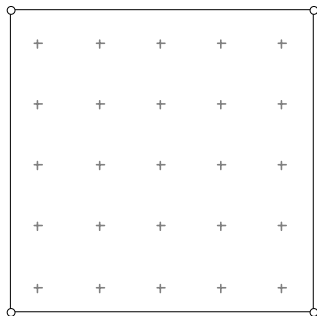
Length \_\_\_\_\_ units  
Width \_\_\_\_\_ units  
Area \_\_\_\_\_ square units

2. Make another rectangle with **perimeter of 16** units that has a larger area.



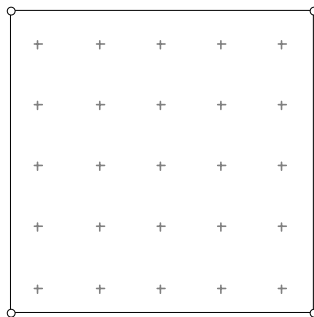
Length \_\_\_\_\_ units  
Width \_\_\_\_\_ units  
Area \_\_\_\_\_ square units

3. Make one more rectangle with a **perimeter of 16** units that has an area that is smaller than the other two,

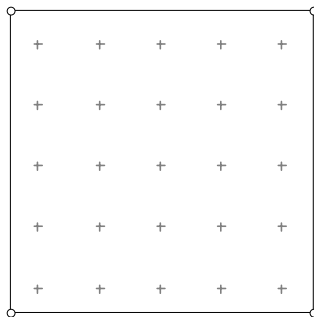


Length \_\_\_\_\_ units  
Width \_\_\_\_\_ units  
Area \_\_\_\_\_ square units

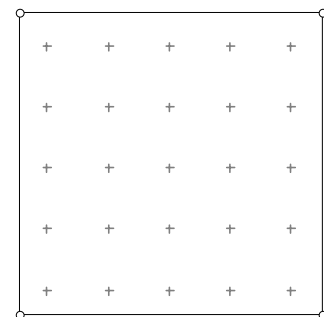
4. Make three different rectangles that each have a **perimeter of 24** units. Then find the area of each.



Length \_\_\_\_\_ units  
Width \_\_\_\_\_ units  
Area \_\_\_\_\_ square units



Length \_\_\_\_\_ units  
Width \_\_\_\_\_ units  
Area \_\_\_\_\_ square units



Length \_\_\_\_\_ units  
Width \_\_\_\_\_ units  
Area \_\_\_\_\_ square units

M2T2

## Instructor Page

The table and graph in this activity show rectangles with widths and lengths that are whole numbers. It is, of course, possible to draw a rectangle with width of .5 cm, length of 11.5 cm. Then the area found by multiplying (.5)(11.5) to get an area of 5.75 square cm. The number of possible rectangles with rational dimensions is infinite. This data results from measures and the relationship is continuous.

One rectangle with perimeter of 24 has an area of 36. This rectangle is a square and is the largest possible (maximum) area for this perimeter.

Grid paper with axes is available in the appendix.

### Mathematical Background and Comments

Points plotted from data may suggest a relationship. If the points can be lined up with a ruler or the edge of an index card (or any straight edge), the relationship is a **linear function**. The relationship may be almost linear or it may be **nonlinear**.

A nonlinear relationship may curve **upward** or **downward**.

We may also describe a relationship as **increasing** or **decreasing**. We might be interested highpoints (**maximums**) or lows (**minimums**).

The graph may increase or decrease at a **constant rate**. It may be **symmetrical**.

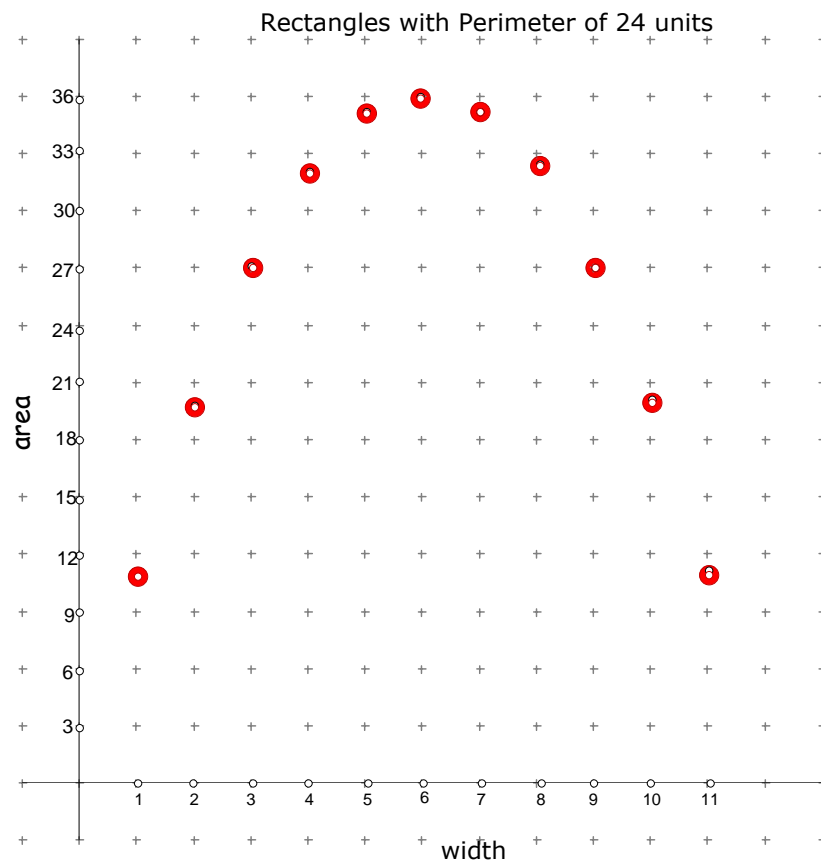
This graph is nonlinear. It curves downward. It is symmetrical. It increases, reaches a maximum, and then decreases. The relationship is a quadratic function and the graph is a parabola. The value of the maximum is  $6 \times 6$  or 36, which is a square number.

## Constant Perimeter and Changing Area Graph

Students use grid paper to draw rectangles with perimeter 24 cm. Look for as many different areas as possible.

### Activity Instructions:

- ▷ Discuss the rectangle drawn on the grid. It is 11 cm long and 1 cm wide. Its perimeter is 24 cm and its area is 11 square cm.
- ▷ Working individually, students draw several more rectangles that also have perimeters of 24 cm. and find the area of each.
- ▷ Each student uses his/her drawings to complete the information in the chart at the bottom of the page.
- ▷ Discuss the information in the charts. Are there rectangles on the grid paper that are not shown in the chart? Could we include more widths than are listed on the page?
- ▷ Working together complete the scatter graph of the rectangle width and the area.
- ▷ Do the points suggest a relationship? Is it possible to connect the points with a line or curve? Discuss the shape of the curve that fits this data.
- ▷ Discuss the rectangle with the largest possible area.
- ▷ Draw the rectangle with the largest area.
- ▷ Repeat this activity with rectangles with perimeter of 36 cm or 60 cm. See appendix.

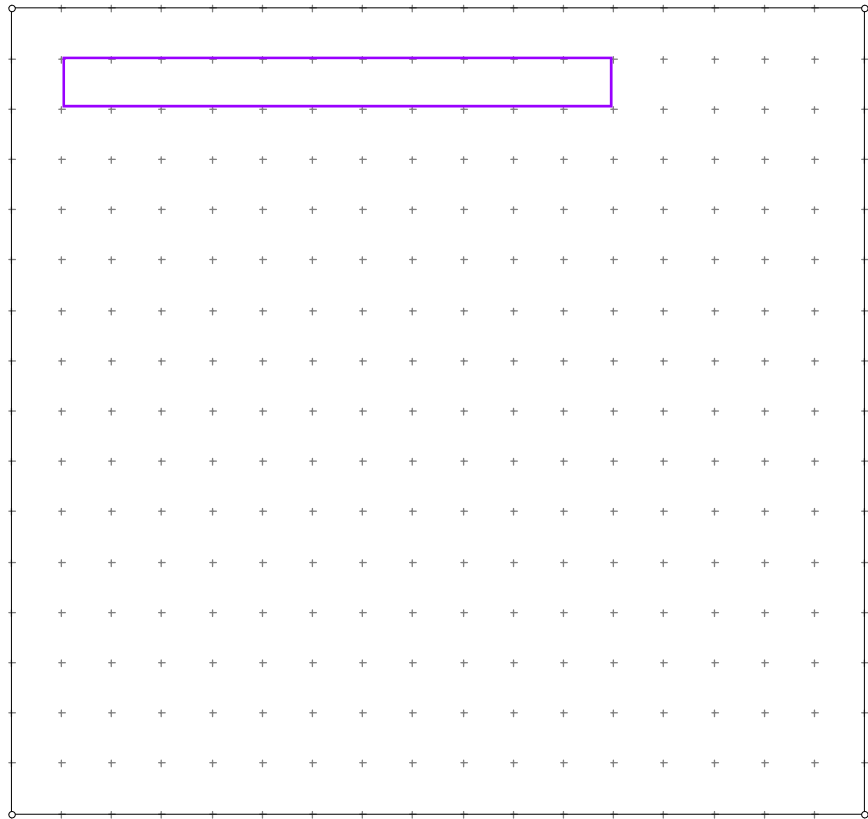


### Constant Perimeter and Changing Area Graph

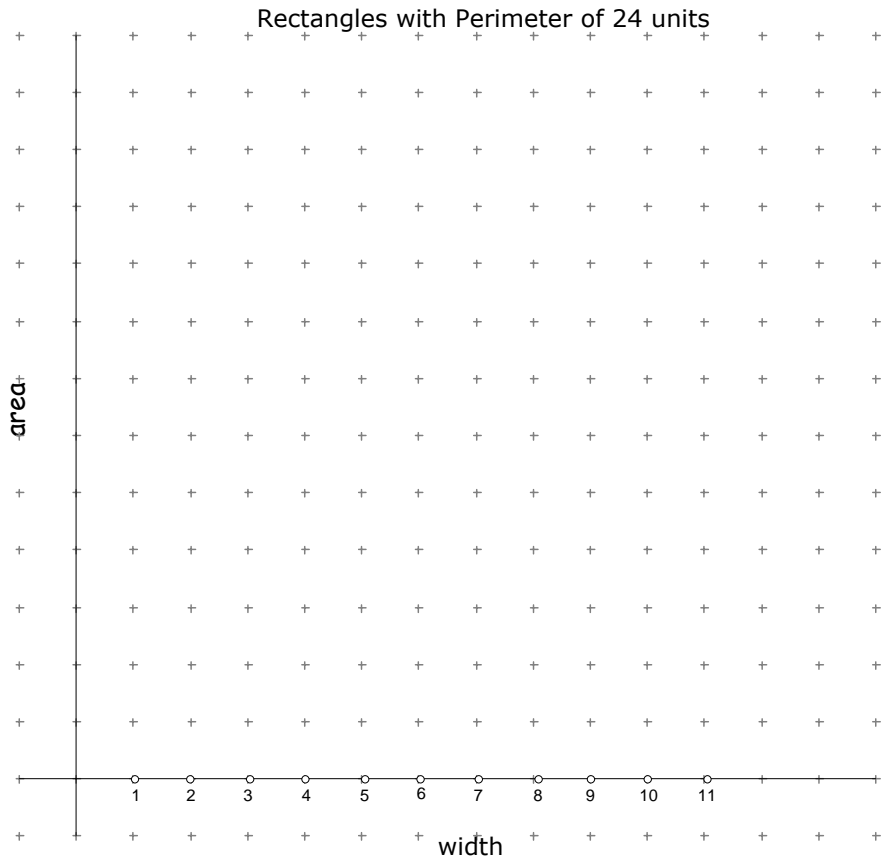
Use the grid to draw rectangles with a perimeter of 24 units. Record the width, length and area in the chart.

**Journal Activity:**

What does the graph show? Include answers to these questions in your description. Is it linear or nonlinear? Is it increasing or decreasing? Is there a maximum or



Rectangles with Perimeter of 24 units		
width	length	area
1	11	11
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		



M2T2

## Instructor Page

Mass is most often measured in grams and kilograms.

One large paper clip or two small paper clips weigh approximately one gram.

A nickel weighs five grams.

One liter of water weighs one kilogram.

1000 grams equals one kilogram.

## Estimating and Measuring Mass

To begin this activity, the teacher announces that the class will be measuring the mass of pieces of fruit. It is necessary to find out what the students know about the concept of mass.

### Activity 1: Mass/Weight

- ▷ The teacher divides the class into groups of 5 or 6 students. Groups brainstorm their ideas of the meaning of mass. Using words, drawings, symbols etc, the students each put their ideas/understandings of mass on chart paper or the chalkboard.
- ▷ Each group then shares and explains what they have written. The teacher may need to facilitate and guide this discussion so that the class comes to an agreement on the meaning of mass.
- ▷ If the subject doesn't come up, the teacher should initiate the discussion of mass and weight. Are they the same or different?

### Mathematical Background and Comments

Mass and weight are similar but they are not the same. Mass is the amount of matter in an object. It is usually measured by comparing with an object of known mass. Weight is a measure of how heavy an object is. While gravity influences weight, it does not affect mass. On Earth, your mass and your weight are the same but out in space and on other planets your weight would be different. There is still the same amount of you no matter where you are so your mass remains the same.

#### Materials:

- chart paper or chalk board
- tape
- colored markers

#### Literature Connections:

Cobb, Vicki. *Why Doesn't The Earth Fall Up?* Dutton Books, 1988

Skurzynski, Gloria. *Zero Gravity*. Simon & Schuster, 1994.

## Estimating and Measuring Mass

First, estimate and then measure and record the mass of each of these objects in grams and in ounces.

### Journal Activity:

After listening to the group discussion, write what you know about mass. Describe a situation where the difference between mass and weight becomes important.

OBJECT	ESTIMATE (gm)	MASS (gm)	ESTIMATE (oz)	MASS (oz)
pen				
comb				
chalk eraser				
box of crayons				
key				
apple				
nickel				

Find 5 more objects in your classroom with mass less than 20 grams.

OBJECT	ESTIMATE (gm)	MASS (gm)

Find 5 more objects in your classroom whose weight is less than 16 oz.

OBJECT	ESTIMATE (oz)	MASS (oz)

M2T2

## Instructor Page

If gram weights or paper clips aren't available, 1 penny or 1 cm cube also equal approximately 1 gram.

### Materials

oranges, bananas, grapefruit & tangerines

paper towels

Balances & gram weights or paper clips

calculators

Class Data Sheet (Appendix)

## Fruit Basket

- The teacher asks each student to choose a piece of fruit from the basket and directs the students to estimate the mass. Use a balance to find the mass of the pieces of fruit in grams. Remind students that 1 paper clip is approximately equal to 1 gram.
- Ask students to record their estimates on the Student Data Sheet.
- The teacher demonstrates how to use the balance.
  1. Use gram weights or paper clips as weights.
  2. Put the piece of fruit in container on one side of the container on the other side until the containers are even with each other.
  3. Count the weights or paper clips in the container to find the mass
- Using balances and gram weights or paper clips, each student should find the mass of his/her piece of fruit and record it on the data sheet.
- Teacher directs students to peel their piece of fruit and then estimate the mass of the fruit that is not edible. Record estimate on data sheet.
- Using the balances and weights, students determine the mass of the peel and seeds (if any) and record this. (*Remind students not to throw the peel away because it will be used in Activity 3.*)
- Students record data as a fraction using the edible and then the inedible part as the numerators and the total mass as the denominator.
- Students can then use calculators to compute the percent of the piece of fruit that was edible and the part that was inedible.
- Ask students to explain what they did to find the percent and why they did what they did.

### Mathematical Background and Comments

- Discuss the mass of the edible and inedible portions of each type of fruit. Since most pieces of each type of fruit will have a different mass, compute the average mass of each fruit and record on the Class Data Sheet transparency.
- Ask students which fruit would be the best buy based on the data. Further exploration of this idea could be done if students were provided with the cost of the fruit.

### Ecology Extension:

Repeat this activity for a prepackaged snack lunch (Lunchable or similar product. Calculate the percent that is inedible (packaging that is thrown away) and the percent that is edible (food they actually eat). Make a plan for a better way to package the snack lunch with ecology and conservation in mind.

M2T2

Participant  
Page

Don't throw away any of your fruit. You will need it for the next activity.

## Fruit Basket

Choose an orange, grapefruit or banana to eat. Estimate (in grams) the mass of your piece of fruit. Record on the data sheet. Measure the mass of your piece of fruit and record. Peel the fruit. Eat and enjoy! Keep the peel and other parts that you cannot eat and estimate the mass. Weigh and record. (Don't throw the peel away yet.) What fractional part of your piece of fruit is not edible? What part is edible? What percent of your piece of fruit is not edible? What percent is edible?

## Student Data Sheet

Type of fruit	Estimated total mass	Actual total mass	Estimated mass of what you cannot eat	Actual mass of what you cannot eat	Fractional part that you cannot eat	Fractional part that you can eat	Percent that you can not eat	Percent that you can eat

What does your data tell you about your piece of fruit?

---



---



---

Record your data on the Class Data Sheet.

## HOW DID YOU DO?

- How close were your estimates?
- Look at the data on the Class Data Sheet. Which fruit has the smallest percent of inedible mass?



M2T2

## Instructor Page

These activities are good opportunities to review area of irregular shapes.

The name activity is a good review of area & perimeter and the difference between the two.

## Area of Fruit Peels

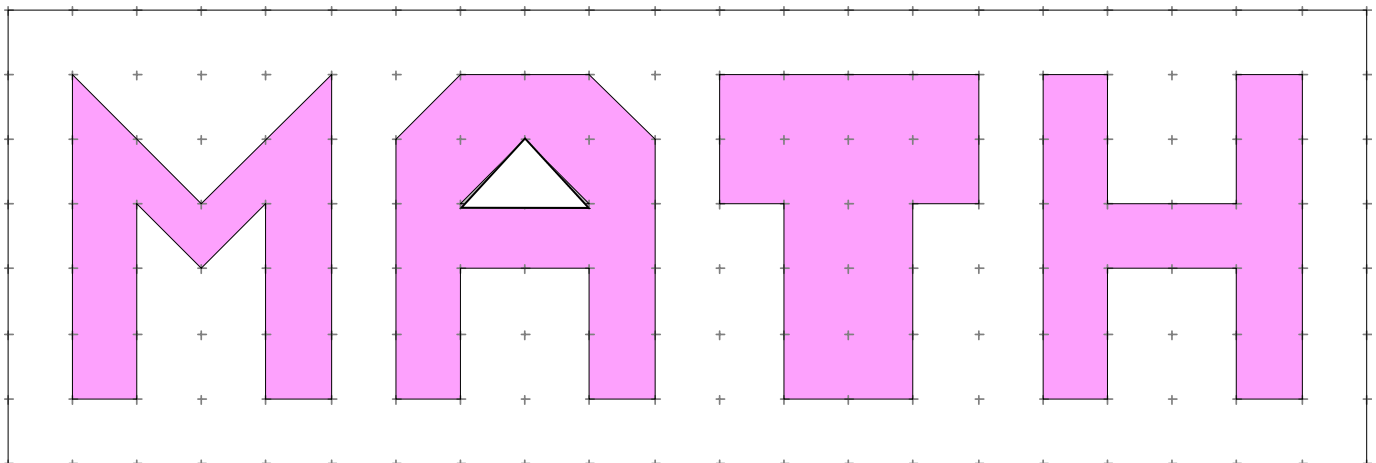
### Step by Step Instructions:

- Teacher poses the following question: Is it possible to find the area of the fruit peel? How could you do this?
- Teacher lists suggestions/ideas on overhead projector or chalkboard. Hopefully from the previous lessons on area, someone will suggest flattening the fruit peel on cm graph paper (Appendix C), tracing it and counting the square units. If necessary, discuss again what to do with partially covered squares.
- Ask students to record the area on their worksheet. Check to see if they recorded the area in square units

## Area of Student Names

On centimeter graph paper, print your first and last name in block letters 5 cm high. After you have finished, find the area of your first and last name.

- Area of first letter of first name \_\_\_\_\_
- Area of first name \_\_\_\_\_
- Area of first letter of last name \_\_\_\_\_
- Area of last name \_\_\_\_\_
- Total area of your name \_\_\_\_\_



Area of the letter "M" is 11 square cm,

Area of the letter "A" is 14 square cm.

Area of the letter "T" is 14 square cm.

Area of the letter "H" is 12 square cm.

Area of the word "MATH" is 51 square cm.

**Participant Page**

**Journal Activity:**

Describe how you found the area of the fruit peel. Tell what you did and why you did it.

Which fruit has peel with the greatest area? Were any about the same? Why?

**Area of Fruit Peels**

Find the area of the fruit peel. Use grid paper to help. Record the area here and on the class data sheet. Be sure to label the area in square units.

Type of fruit	Guess of the total area	Estimate of the total area using grid paper

**Area of Student Names**

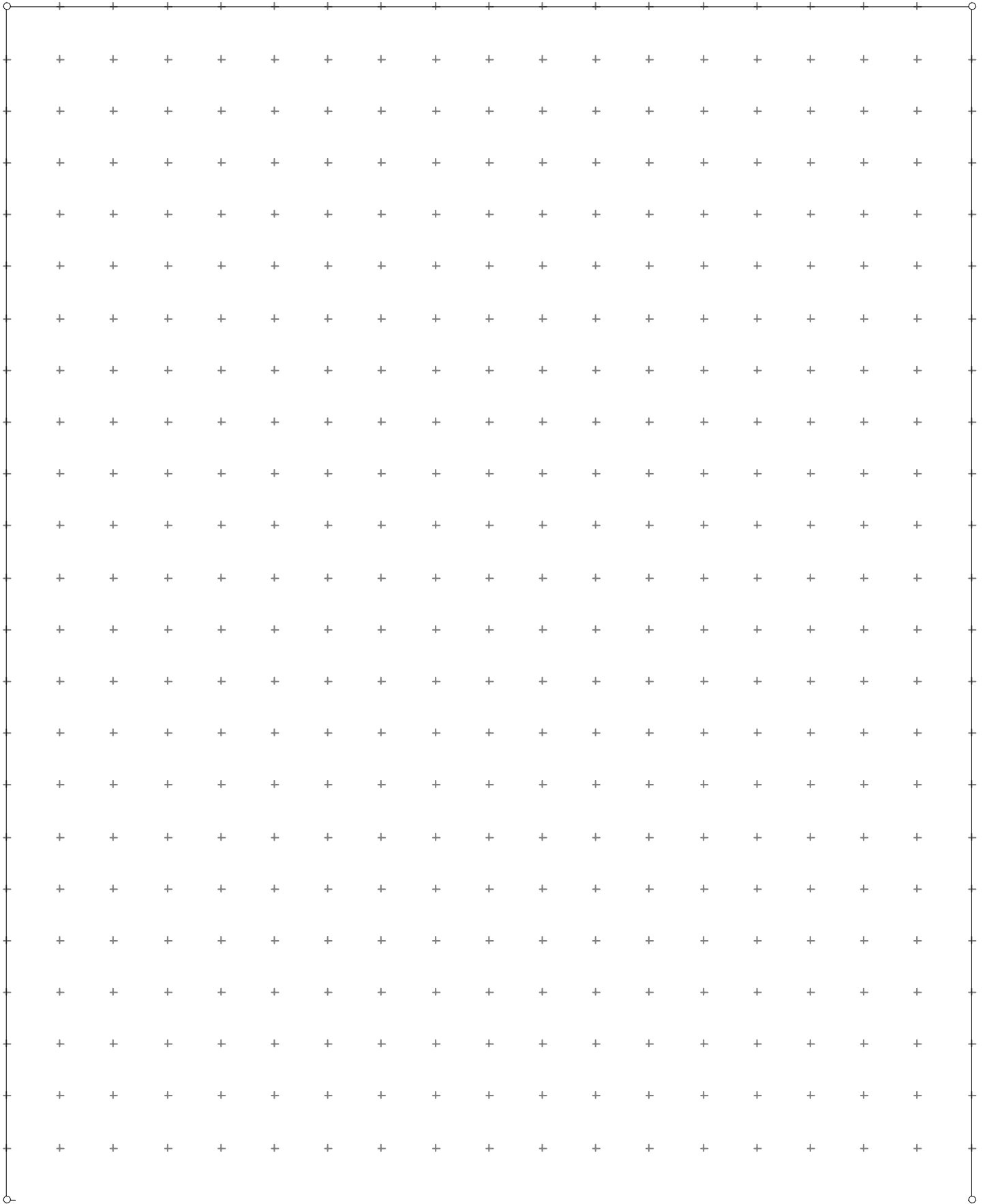
On centimeter graph paper, print your first and last name in block letters 5 cm high. Then find the area of your first and last name.

Area of first letter of first name _____
Area of first name _____
Area of first letter of last name _____
Area of last name _____
Total area of your name _____
(Empty grid for drawing names)

THIS PAGE INTENTIONALLY BLANK



Centimeter grid



THIS PAGE INTENTIONALLY BLANK



Inch grid



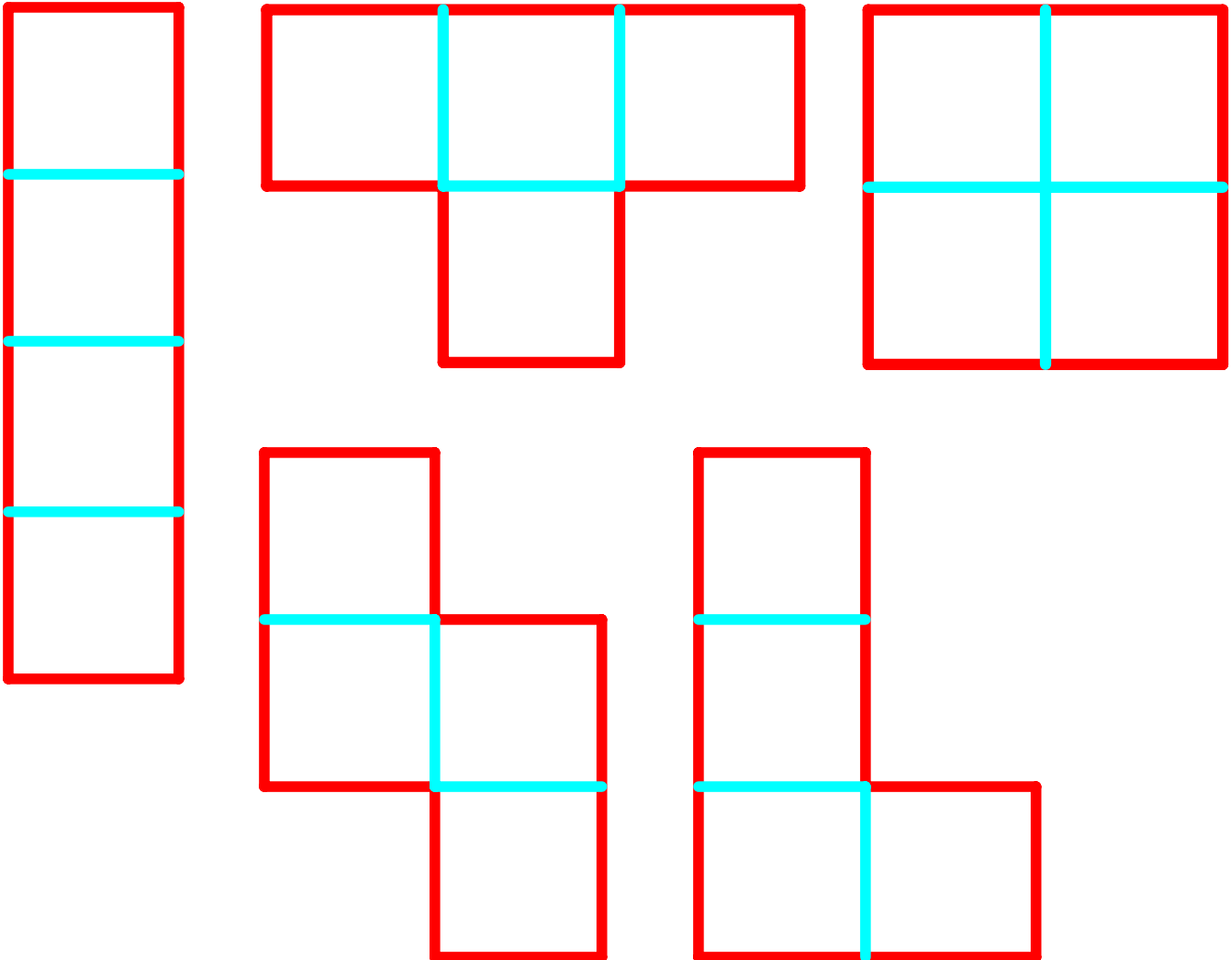
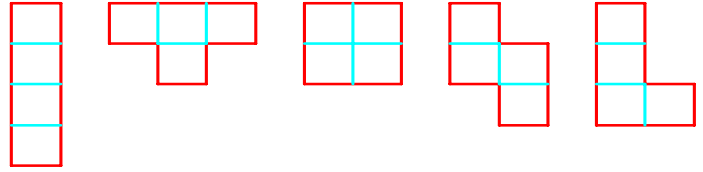
THIS PAGE INTENTIONALLY BLANK





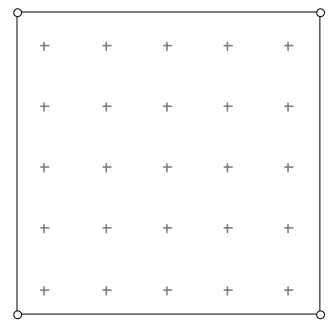
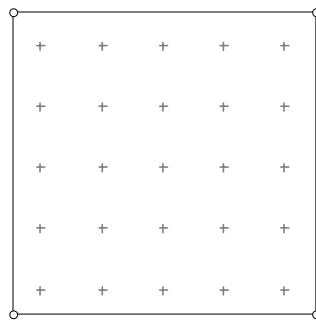
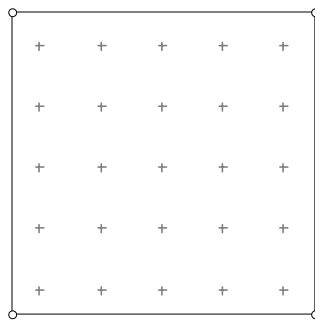
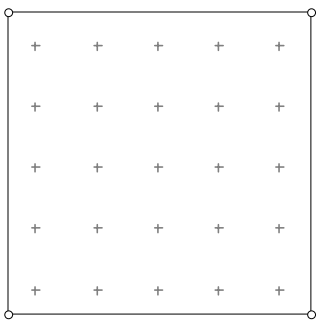
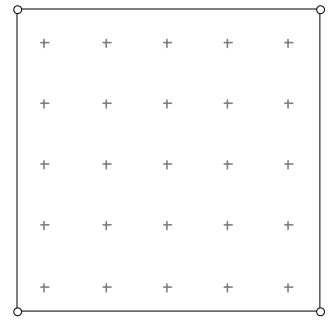
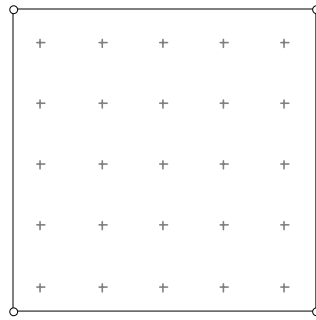
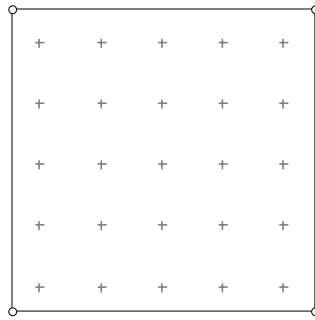
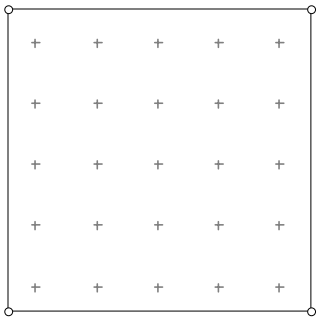
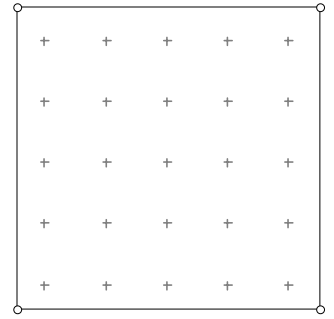
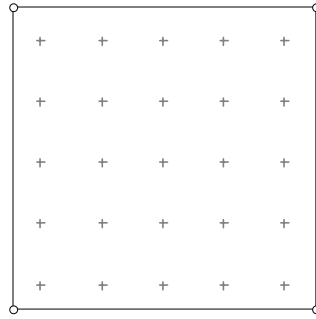
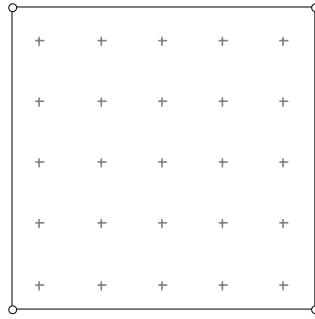
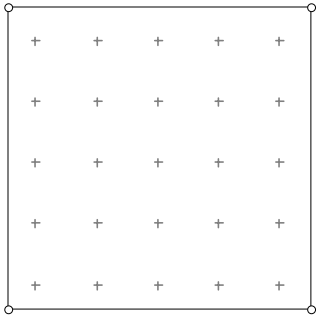
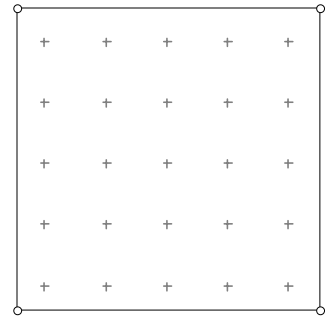
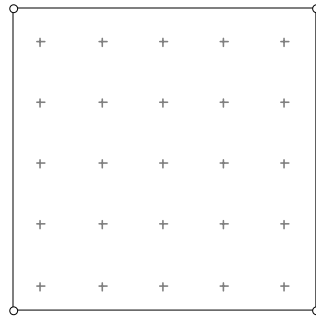
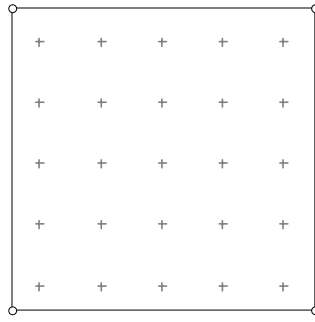
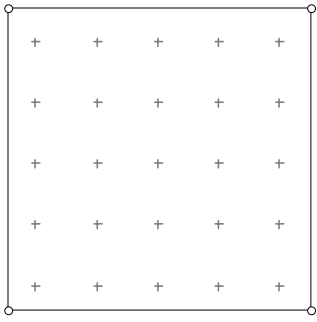
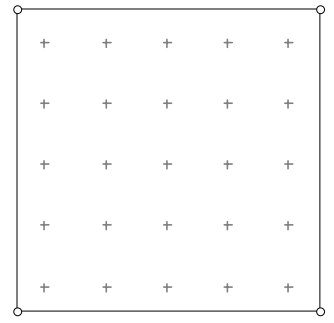
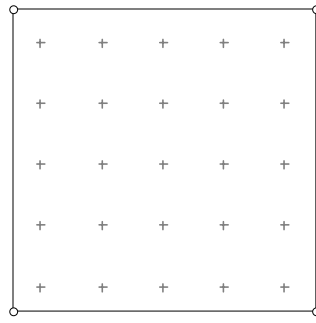
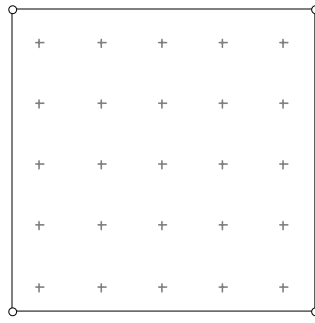
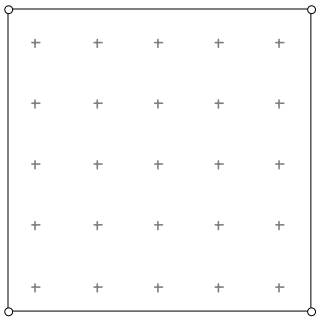
## Tetrominoes

These are the five tetromino shapes. Any shape formed by connecting four squares edge to edge is a transformation of one of these. Students may like to make puzzle pieces of the tetrominoes and try to fit them together. It is not possible to make a rectangle, but students can be challenged to make other figures.



There are instructions and materials, including a tetromino die, for a Tetrominoes Cover Up Game  
<http://www.uen.org/Lessonplan/preview.cgi?LPid=6451>

THIS PAGE INTENTIONALLY BLANK

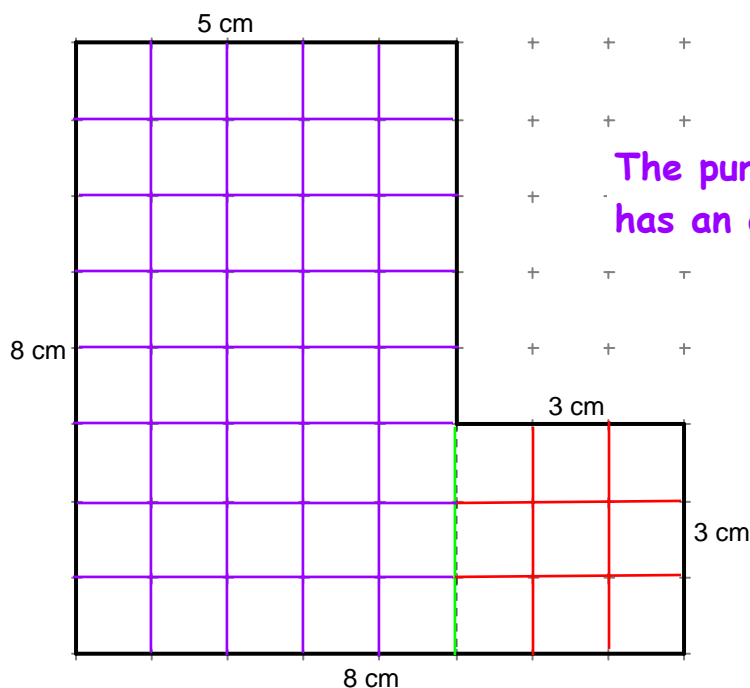


THIS PAGE INTENTIONALLY BLANK

### Area of Non-rectangular Shapes Transparency

One way to find the area of irregular shapes is to partition the figure into squares, rectangles and triangles and find the area of each. Then add to find the area of the larger irregular figure.

- Use a dotted line to divide the figure into a square and a rectangle.
- Find the area of the square. \_\_\_\_\_ sq. cm
- Find the area of the rectangle. \_\_\_\_\_ sq. cm
- Add the area of the square and the rectangle together. \_\_\_\_\_ sq. cm



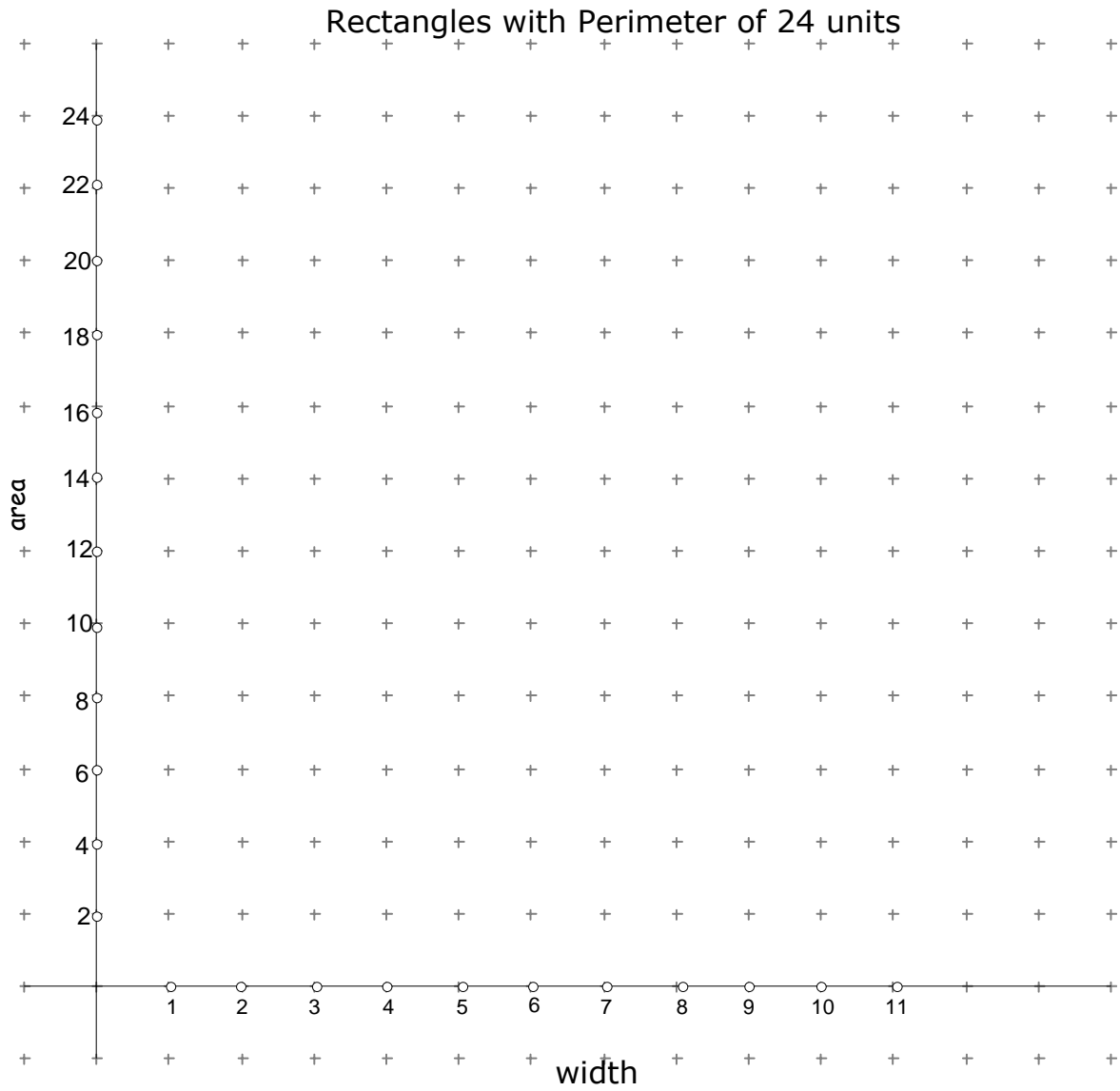
The purple lines show that the rectangle has an area of 40 sq. cm.

The red lines show that the square has an area of 9 sq. cm.

THIS PAGE INTENTIONALLY BLANK



Appendix F



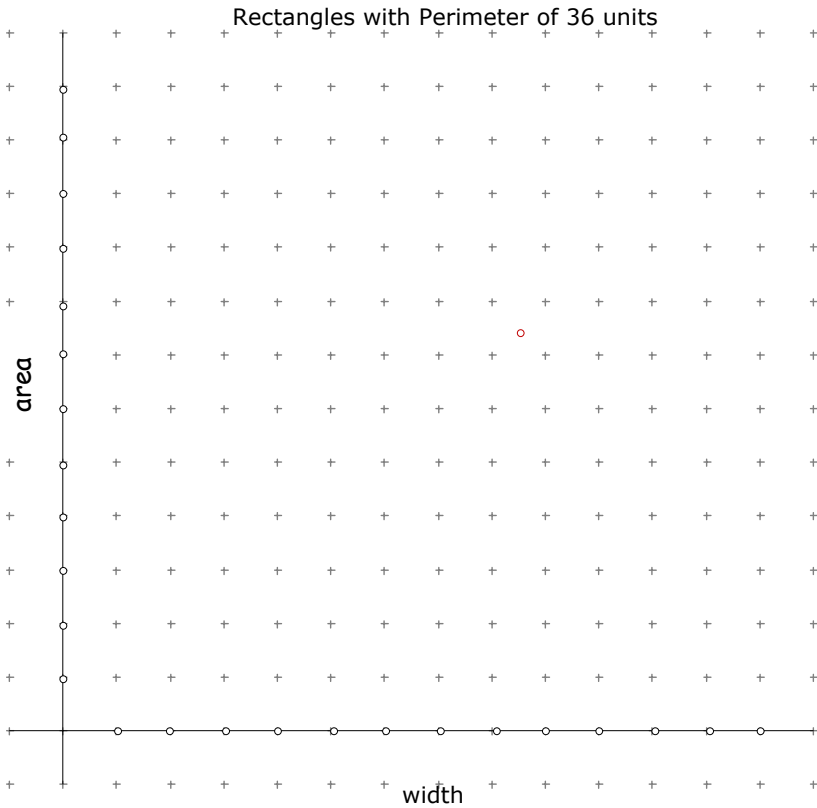
THIS PAGE INTENTIONALLY BLANK



Appendix G

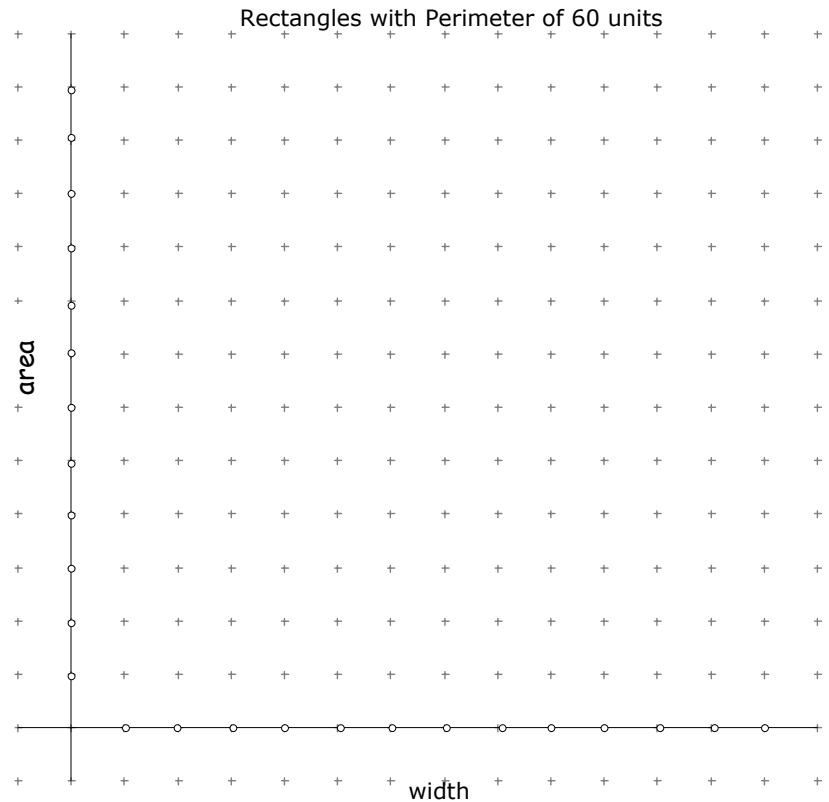
Use grid paper to draw rectangles with perimeters of 36 or 60 units. Record the width, length and area in the appropriate charts.

More Constant Perimeter and Changing Area



Rectangles with Perimeter of 36 units		
width	length	area
1		
6		
8		
12		
16		
When is this graph increasing?		
When is this graph decreasing?		
Is there a maximum or minimum?		

Rectangles with Perimeter of 60 units		
width	length	area
When is this graph increasing?		
When is this graph decreasing?		
Is there a maximum or minimum?		



THIS PAGE INTENTIONALLY BLANK



## Appendix H

### Fruit Basket Class Data Sheet for Mass

Type of fruit	Estimated total mass	Actual total mass	Estimated mass of what you cannot eat	Actual mass of what you cannot eat	Fractional part that you cannot eat	Fractional part that you can eat	Percent that you can not eat	Percent that you can eat
Orange								
Banana								
Grapefruit								
Tangerine								

THIS PAGE INTENTIONALLY BLANK



## Appendix I

**Area of Fruit Peels  
Class Data Sheet**

Type of fruit	Estimated total area	Actual total area
Orange		
Banana		
Grapefruit		
Tangerine		

Email questions and comments to  
[m2t2@mail.mste.uiuc.edu](mailto:m2t2@mail.mste.uiuc.edu)



Number Sense