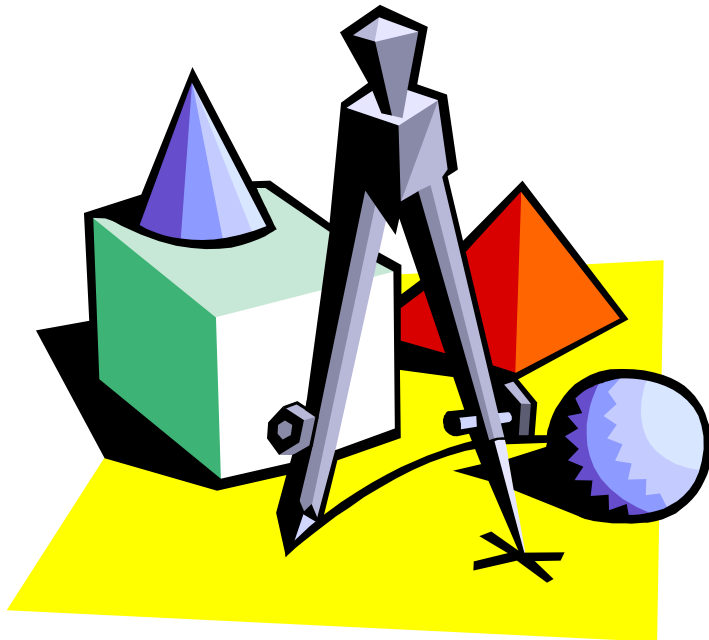


Measure IT!



By
Dr. Anne Papakonstantinou
Mr. Richard Parr
Dr. Jacqueline Sack
Rice University School Mathematics Project
<http://rusmp.rice.edu>

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OVERVIEW

Students use measurement in their daily lives. “The study of measurement is important in the mathematics curriculum from prekindergarten through high school because of the practicality and pervasiveness of measurement in so many aspects of everyday life” (NCTM 2000, p. 44).

Using materials in this kit, your students in grades 3-5 will conduct measurement activities to explore length, area, and volume while they develop vocabularies for discussing these very important concepts. “Measurement is the assignment of a numerical value to an attribute of an object, such as the *length* of a pencil” (NCTM 200, p. 44).

There is an accepted instructional sequence for developing measurement concept, such as length, area, or volume. To measure, students first must know the attribute they are measuring. They must develop an understanding of the meaning of the attribute through hands-on activities using their perceptions and by direct comparison. For example, if students are asked to measure the length of an object, they must first understand the concept of length and the accompanying vocabulary such as breadth, width, height, depth, shorter, the same length as, longer or taller. After students develop an understanding of the attribute, they should then have experiences measuring object using non-standard units of measure. Third, students should be introduced to customary units in order to learn how to use measuring instruments. Since this unit is for grades 3-5, the activities will begin at the third level of the instructional sequence, measuring using standard units. Both the customary and the metric systems will be used.

Materials List

Section 1 Investigating Length

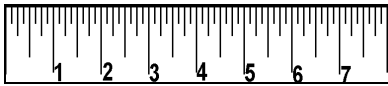
rulers with metric and customary units markings (one per pair of students)
meter sticks and yard sticks (one of each per class)
rolls of cash register tape (five per class)
fine tip markers (two per pair of students)
scissors (one per pair of students)
clear tape (one per pair of students)
5 x 5 geoboard (one per pair of students)
rubber bands
geoboard dot paper (one sheet per student)
tape measures - marked in customary and metric units (one per pair of students)
an assortment of circular objects (such as coffee can tops, yogurt cup tops,
circular lids, etc.) – have students bring these
calculators (one per pair of students)

Section 2 Investigating Area

index cards (four per person)
patty paper (one box per class)
scissors (if needed)
rulers with metric and customary units markings (one per student)
8.5 in. by 11 in. paper (one sheet per student)
5 x 5 geoboard (one per pair of students)
rubber bands
geoboard dot paper (two sheets per student)
inch grid paper (two sheets per student)
color squares (one bucket per class)

Section 3 Investigating Volume

rainbow cubes or other centimeter cubes (one bucket per class)
centimeter grid paper (four sheets per pair of students)
scissors (one pair per pair of students)
clear tape (one pair per pair of students)



Section 1 Investigating Length

Activity #1 Making Measurement Tools for Length

Teacher notes

Length is the first attribute most students measure. In this activity, students make simple measuring instruments for length - a yard stick and a meter stick. There is no student page for this activity, because students create their own measurement tools.

Materials:

- rulers with metric and customary units markings (one per pair of students)
- meter sticks and yard sticks (one of each for each class)
- rolls of cash register tape - let students **estimate** how much to tear off to make a meter stick and a yard stick (do not let them measure how much to tear off using a ruler, meter stick, or yard stick)
- fine tip markers (two per pair of students)
- scissors (one per pair of students)
- clear tape (one per pair of students)

Let pairs of students tear off enough from the roll of cash register tape to make a meter stick and a yard stick. They are to estimate how much tape they need and not measure using a ruler, meter stick, or yard stick.

Point out to students the length of an inch and the length of a centimeter on their rulers.

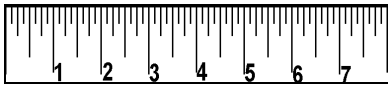
Have students, in pairs using their rulers, mark off 36 inches to make a yard stick and 100 centimeters to make a meter stick out of their cash register tapes. If their estimates of the lengths of the tape needed to make a yard stick and a meter stick are too short, they may tear off additional tape. If they estimated too much tape, students should cut the excess tape. Their yard sticks and meter sticks should be the exact lengths of 36 inches and 100 centimeters. Ask students to write their names on the backs of their meter and yard sticks.

After all groups have made their yard sticks and meter sticks, have students line up their yard sticks together and compare the lengths. Are they all the same length? Are some shorter? Are some longer? Let students examine the ones that are of different lengths and explain why they are different. Let them compare their yard sticks to the actual yard stick. Those student-made yard sticks that are either too short or too long should be corrected.

Students now line up their meter sticks and repeat the above procedures.

Finally have pairs of students compare the meter and yard sticks they made. Which is longer, a yard stick or a meter stick? Is this difference the same for all pairs of students?

Discuss the conversion between metric and customary units for length. [One inch is approximately 2.54 centimeters.]



Activity #2 Using Your Measurement Tools

Teacher Notes

In this activity, students use the measurement tools that they created in Activity #1 to measure different parts of their bodies. Students work in pairs and record their data in the table provided.

Materials: measurement tools created by students in Activity #1

Activity #3 Scavenger Hunt

Teacher Notes

In this activity, students develop an intuitive understanding of customary and metric measurements. Students first attempt to identify items that have the given lengths without using any measurement tools, then measure all items to see whether the identified objects actually match the given lengths.

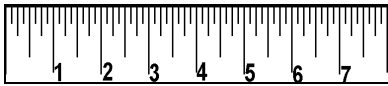
Materials: measurement tools created by students in Activity #1

Activity #4: Perimeter on a Geoboard

Teacher Notes

Students explore the concept of perimeter using geoboards in this activity. After an initial exercise to help students understand the idea of what 1 unit means, students are asked to find figures with a perimeter of 10 units. Students must clearly understand that 1 unit for this activity is the distance on the geoboard between two consecutive pegs either horizontally or vertically. The distance between two consecutive pegs lying along a diagonal is longer than 1 unit. This idea that a diagonal distance is longer than 1 unit is explored in the challenge activity.

Materials: 5 x 5 geoboard (one per pair of students)
rubber bands
geoboard dot paper (one sheet per student)



Activity #5 Further Investigations of Perimeter

Teacher Notes

In this activity, students develop the formula for the perimeter of a rectangle. Students measure the lengths of all four sides of several items that are rectangular in shape. After measuring these items, students observe that measuring two perpendicular sides is sufficient for calculating the perimeter, and develop, on their own if possible, the formula for the perimeter of a rectangle, $P = 2l + 2w$ or alternately, $P = l + w + l + w = l + l + w + w = 2(l + w) = (l+w) + (l+w)$.

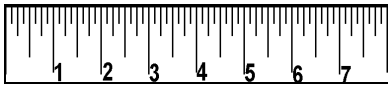
Materials: measurement tools created by students in Activity #1 or a ruler, yard stick or meter stick

Activity #6 Investigating Circumference

Teacher Notes

Students investigate the circumference of a circle and its relationship to its diameter in this activity. Students may need assistance in correctly identifying and measuring the diameter of the circular objects. They also may need assistance in using a tape measure to determine the length of the circumference of the circles. After measuring, students discover that the quotient of the length of the circumference divided by the length of a diameter should be approximately 3.14 regardless of the size of the circle. Older students may understand that a quotient is also called a ratio. If students' quotients are not approximately 3.14, they should re-check their measurements and calculations.

Materials: tape measures - marked in customary and metric units (one per pair of students)
an assortment of circular objects (such as coffee can tops, yogurt cup tops, circular lids, etc.) - have students bring these
calculator (one per pair of students)

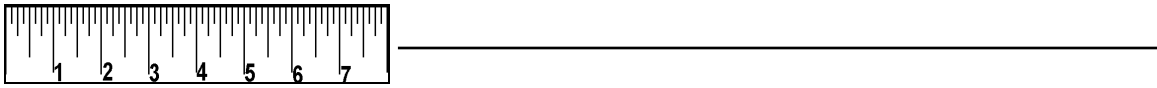


Activity #2 Using Your Measurement Tools

Using the measurement tools you made in the first activity, find the length of the following in inches and in centimeters with a partner.

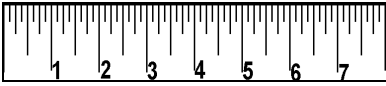
Object	Partner #1	Partner #2	Partner #1	Partner #2
	Length (in inches)	Length (in inches)	Length (in centimeters)	Length (in centimeters)
Your foot				
Your nose				
Your height				
Your arm span (the distance between your outstretched fingertips)				
Your “pinkie” finger				
Your thumb				

1.
 - a. Compare your height to your arm span in inches.
 - b. Compare your height to your arm span in centimeters.
2. A person whose height and arm span are the same or about the same is called a “square.” Are you a square? Explain.



3. Compare your measurements with your partner's.

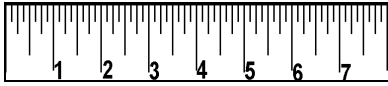
4. What did you discover from taking the measurements?



Activity #3 Scavenger Hunt

Find objects that are approximately the following lengths without using the measurement tools you made in the first activity. Identify each object and draw its picture.

1. less than 12 inches
2. more than 30 inches
3. about 10 inches
4. between 5 and 9 inches
5. about 4 inches longer than your foot
6. between 12 and 24 inches



7. about 16 inches

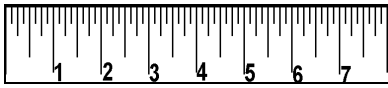
8. less than 10 centimeters

9. more than 50 centimeters

10. between 5 and 9 centimeters

11. about 24 centimeters

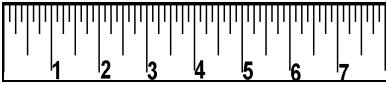
12. about 4 centimeters longer than your foot



13. between 60 and 70 centimeters

14. about 16 centimeters

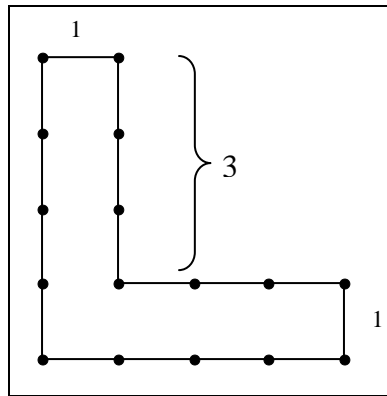
Measure each of the objects. How accurate were your estimates?



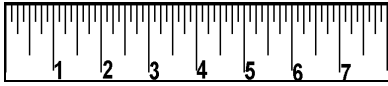
Activity #4 Perimeter on a Geoboard

The distance around a closed figure is called its *perimeter*.

1. The following figure has a perimeter of 16 units. What are the lengths of the unlabelled sides? Explain how you found the missing lengths.

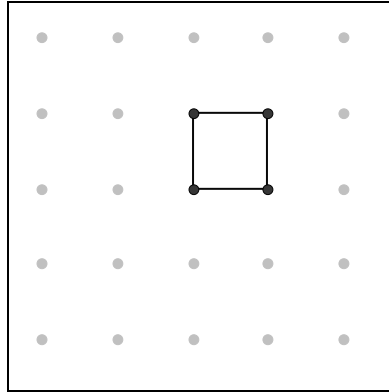


2. On a 5 x 5 geoboard, make all the different figures that have a perimeter of 10 units with your partner. The figures do not all have to be rectangles. Record your figures on geoboard dot paper. Carefully label the length of each side of your figures and calculate the perimeter of each figure to confirm that the perimeter is 10 units in length.

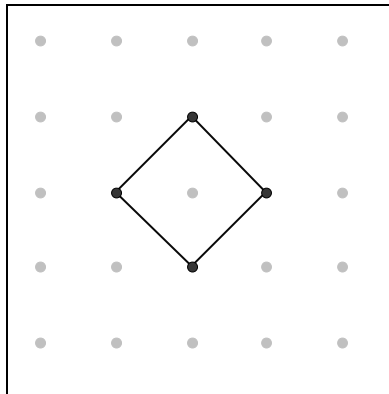


3. Challenge:

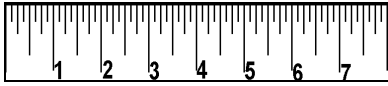
The following figure has a perimeter of 4 units.



The following figure does not.



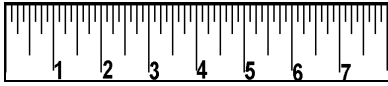
Explain why.



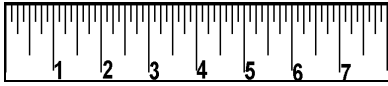
Activity #5 Further Investigations of Perimeter

With a partner, complete the following table. Use the measurement tools you made in the first activity or a ruler, yard stick or meter stick.

Object	Drawing	Lengths of Sides	Perimeter
Sheet of notebook paper			
Door			
Window			
Face of a computer monitor			
Chalkboard			
Top of the filing cabinet			



1. Describe the shapes whose perimeters you found.
2. Can you find the perimeter without measuring all four sides? How?



Activity #6 Investigating Circumference

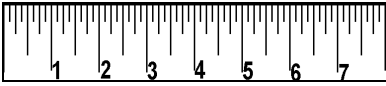
The distance around a circle is called its *circumference*.

The *diameter* of a circle is a line segment that connects two points of a circle and contains the center of the circle.

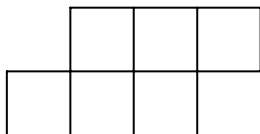
Using tape measures, you and your partner should each carefully measure the length of the circumference and the length of a diameter of each of your objects. Each of you should get the same measurement for the circumference and the same measurement for the diameter. If your measurements do not match, measure again until you agree. After you have completed the measurements, divide the length of the circumference by the length of the diameter for each of your objects and record the quotient in the third column in the table below. Use a calculator to perform the division.

Length of the Circumference	Length of the Diameter	(Length of Circumference)/ (Length of Diameter)

1. What do you observe about the quotients recorded in the third column of the table above?



2. How many diameter lengths fit along the circumference for each of your objects?
3. Describe the relationship between the circumference and the diameter of a circle.



Section 2 Investigating Area

Activity #1 What Is Area?

Teacher Notes

In this activity, students use arrays to determine how many unit squares are necessary to tile a given rectangle. The unit square can be used as a tracing template. Students repeatedly trace the square using a patty paper copy or a copy of the square cut from an index card. Students fill the rectangle until there are no gaps or spaces left in the rectangle and the figure is covered. Alternately they may, using another method, determine the number of squares that fit in the rectangle. In the second exercise of the activity, the unit square is smaller so the number of squares needed to cover the figure is greater. Students, from their previous work with arrays in multiplication, should recognize that the area can be computed by determining the number of unit squares that fit along the length and width of the rectangle and that the area is the product of these two numbers.

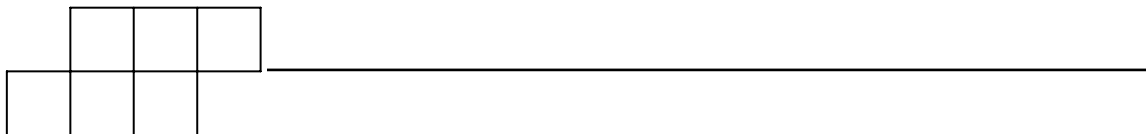
Materials: index cards (two per person)
 patty paper (one box per class)
 ruler - to be used as a straightedge (one per pair of students)
 scissors (if needed)

Activity #2 Area of Irregular Shapes

Teacher Notes

In this activity, students determine the approximate areas of their hands and feet. They may use the given square unit to determine the area - using either a tracing on patty paper or a cutout from an index card as in Activity #1. Encourage students to share different strategies for determining area.

Materials: 8.5 in. by 11 in. paper (one sheet per student)
 index cards (two per person)
 patty paper (one box per class)
 scissors (if needed)



Activity #3 Area on a Geoboard

Teacher Notes

Students investigate area on a geoboard in this activity. They create several figures with given areas. Though students may first only create rectangles, they may also explore other polygons such as triangles, trapezoids or composite figures using triangles (a diagonal of a unit square divides the unit square into two triangles each with an area of $\frac{1}{2}$ square unit).

Materials: 5 x 5 geoboard (one per pair of students)
rubber bands
geoboard dot paper (one sheet per student)

Activity #4 Areas of Rectangles

Teacher notes

Students explore the area of rectangles by creating rectangles and then dividing the rectangle into a grid of square units. In the first exercise the students are given the marked off units on the length and width of the rectangle, for the others the students will have to mark their own units. Students re-enforce the formula for area of a rectangle, $A = lw$.

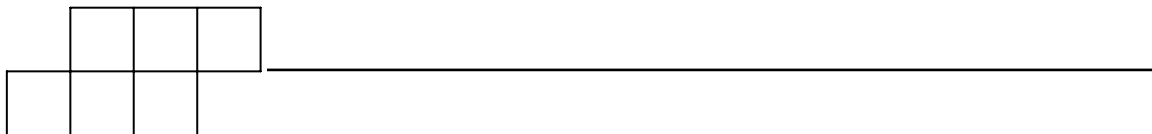
Materials: ruler - to be used as a straightedge (one per student)

Activity #5 Exploring Area and Perimeter

Teacher notes

In this activity, students explore the relationship between perimeter and area. Specifically they discover that several figures with the same perimeter length can have different areas. From the starting figure, students can add from 3 to 14 additional tiles to make a figure with a perimeter of 18 units. Thus the area of figure with perimeter of 18 units can vary from 9 square units to 20 square units. Students also discover that adding a tile may not change the perimeter length or may even decrease it.

Materials: color squares (one bucket per class)
inch grid paper (one sheet per student)



Activity #6 Rectangle Investigation

Teacher Notes

Students explore the relationship between perimeter and area for rectangles. When determining how many rectangles with a perimeter of 18 units can be created using color squares, consensus has to be reached on what constitutes a “different” rectangle. Some students may see a 2 unit by 7 unit rectangle as being different from a 7 unit by 2 unit rectangle. If that is the case, they will find 8 rectangles. If they see a 2 unit by 7 unit rectangle as the same as a 7 unit by 2 unit rectangle, they will find 4 rectangles. The greatest area that can be enclosed with a perimeter of 18 units is 20 square units, while the smallest area is 8 square units.

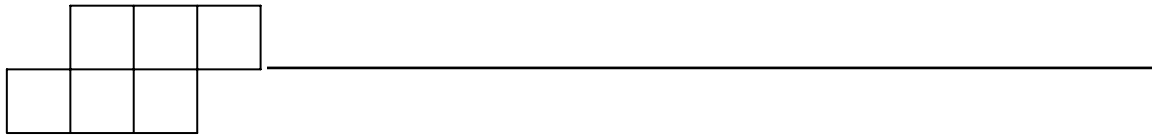
Materials: color squares (one bucket per class)
 inch grid paper (one sheet per student)

Activity #7 Geoboard Perimeter and Area

Teacher Notes

In a previous activity, students looked at a fixed perimeter and explored the different possibilities for area associated with that perimeter. In this activity, students construct all rectangles with a given area on the geoboard and then determine the different perimeters that these rectangles can have.

Materials: 5 x 5 geoboards (one per pair of students)
 rubber bands
 geoboard dot paper (one sheet per student)

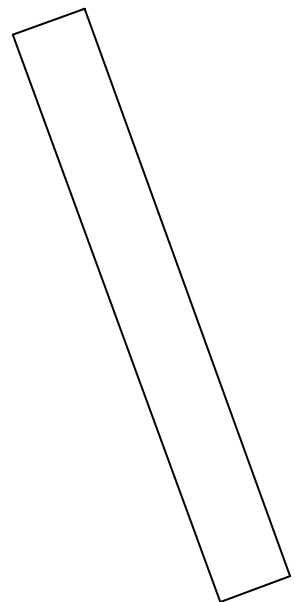
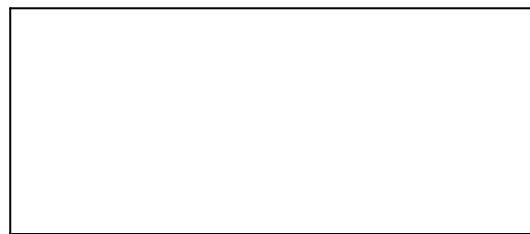
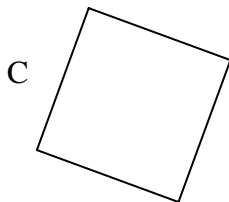
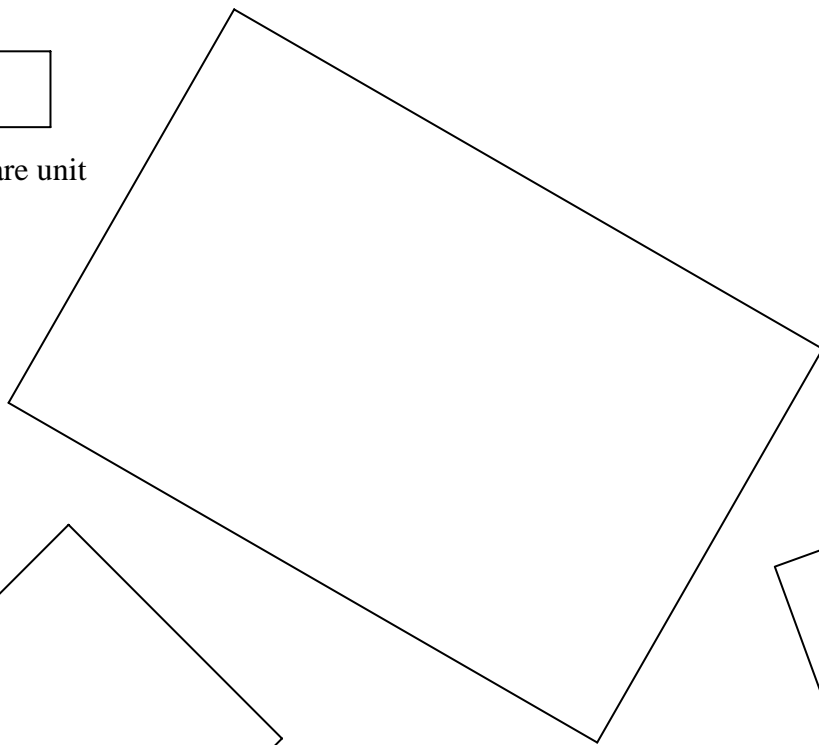


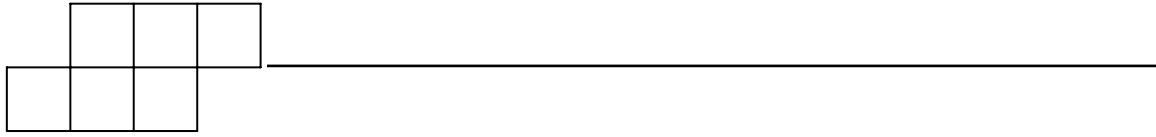
Activity #1 What is Area?

1. Determine the number of square units needed to cover each of these rectangular regions.

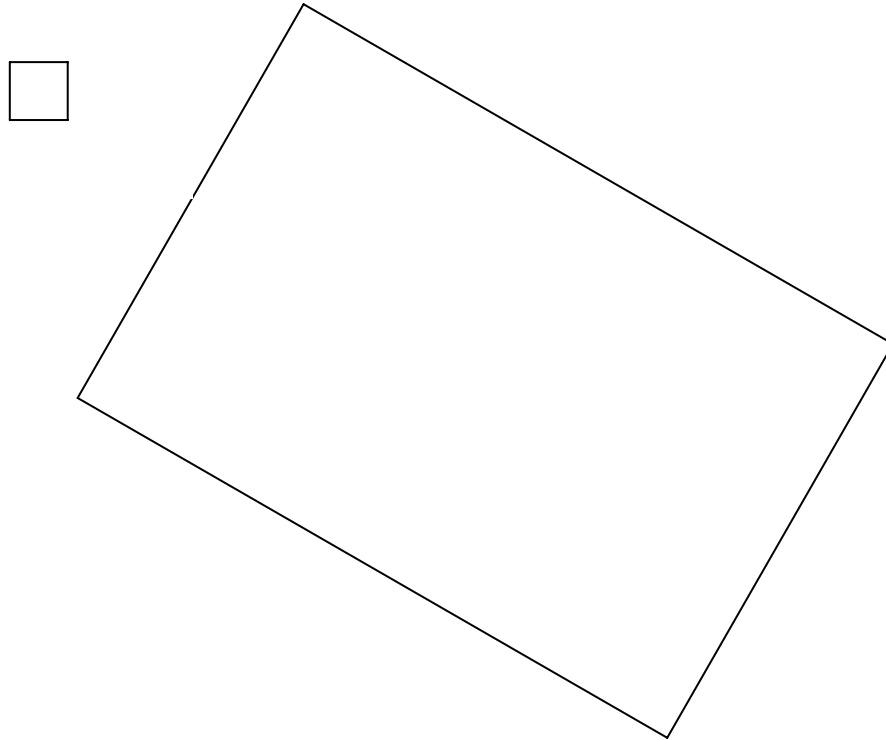


1 square unit

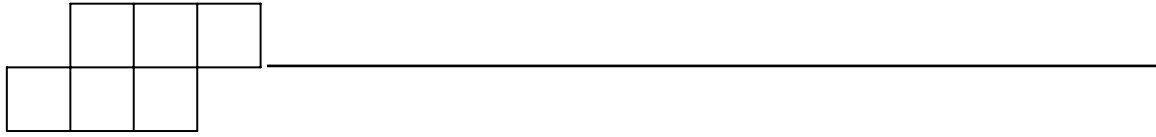




2. Determine the number of square units needed to cover this rectangular region.

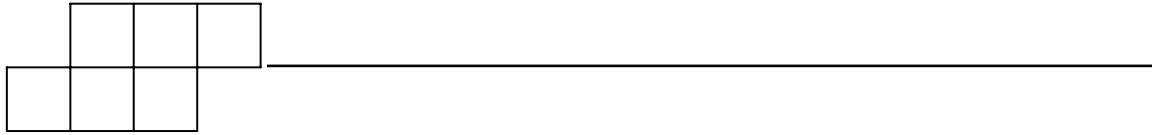


3. Using the new square unit from # 2, estimate the area of rectangles B, C, D and E in # 1.



4. Is it necessary to draw all the square units to determine the number of square units that cover the rectangular region? Explain.

5. How is finding the area of a rectangle related to the process of multiplication? Explain.



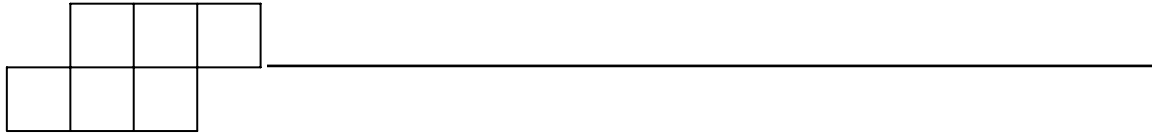
Activity #2 Area of Irregular Shapes

1. Trace your hand in the space below.

2. Using the given unit square, what is the area of your hand? Explain how you calculated it.



1 square unit



3. Compare your results with your other class members.

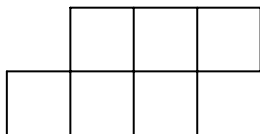
4. Now trace your foot on a sheet of 8.5 in. by 11 in. paper.

5. What is the area of your foot? Explain how you calculated it.

6. Compare your results with your other class members.

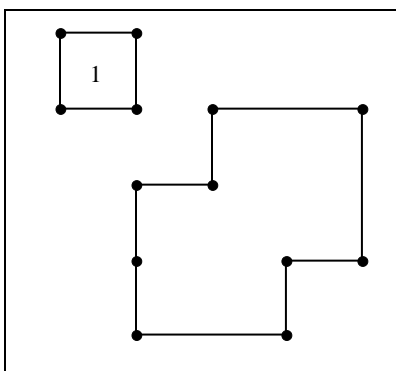
7. Which class member has the hand with the greatest area? The smallest area?

8. Which class member has the foot with the greatest area? The smallest area?



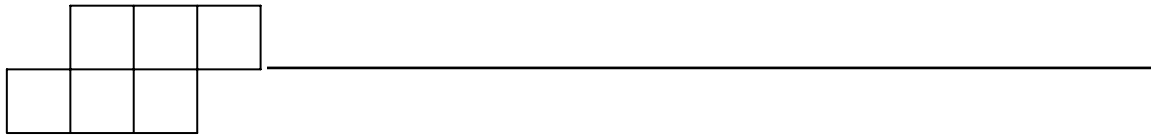
Activity #3 Area on a Geoboard

1. Make the figure below on your 5 x 5 geoboard. One square unit is shown.
What is the area of the larger figure?



2. How did you find the area of the larger figure in #1?
3. Find the perimeter of each of the figures in #1.

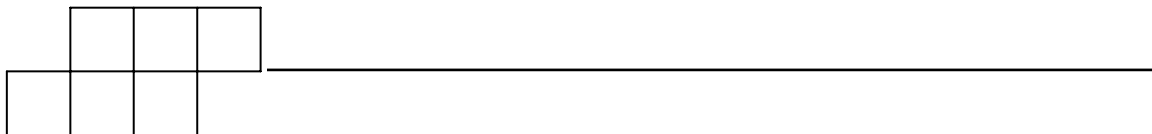
On your geoboard, enclose figures with areas of 2, 3, 6, 9, and 10 square units. The figures do not all have to be rectangles. Record your figures on geoboard dot paper. Carefully label the lengths of the sides of your figures and calculate the areas of the figures to confirm their areas.



4. Describe two ways to calculate the areas of the figures that you made.

5. How many different figures can you make that have an area of 6 square units?

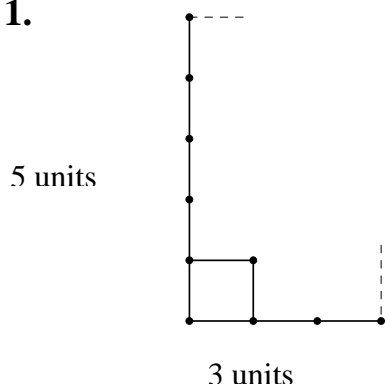
6. Record all your different figures from #5 on geoboard dot paper and explain why each figure has an area of 6 square units.



Activity #4 Areas of Rectangles

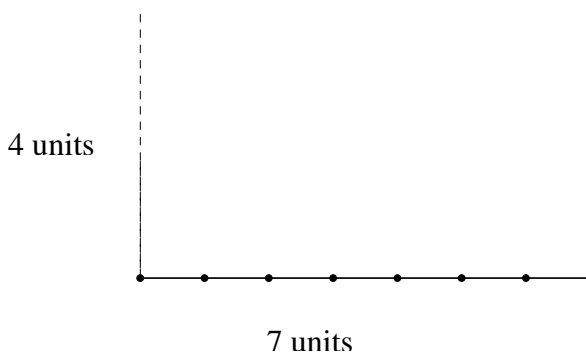
For each of the following, create a rectangle with the given dimensions, marking off each unit on the sides of the rectangle as shown in # 1, Then create a grid of square units in each rectangle to determine the area. The first square unit in the grid for # 1 is shown.

1.



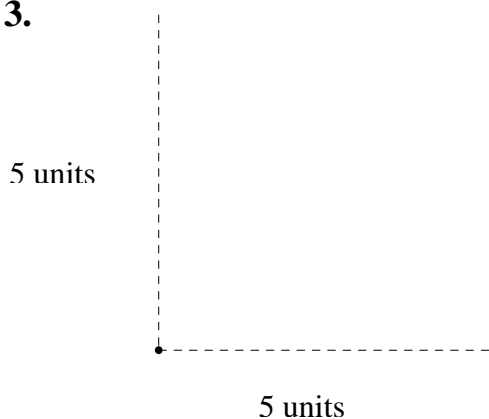
Area = _____

2.



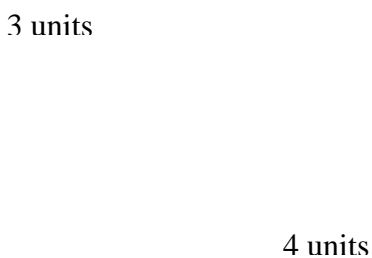
Area = _____

3.

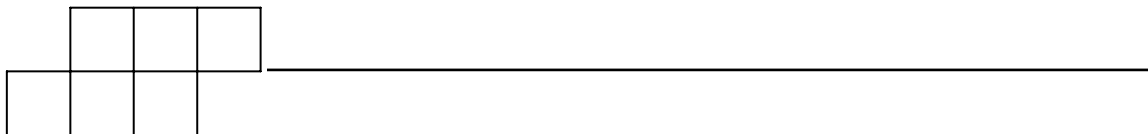


Area = _____

4.

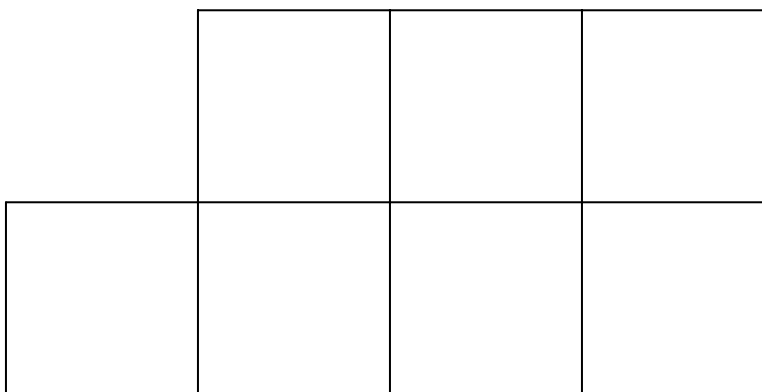


Area = _____



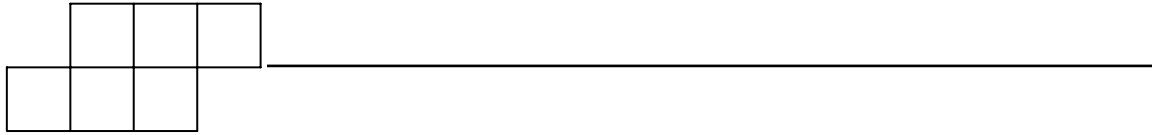
Activity #5 Exploring Area and Perimeter

Assume that the edges of the small squares in the figure below are 1 unit in length. Add squares so that the figure has a perimeter of 18 units. When squares are added, they must meet exactly along at least one edge of the figure.



Record your figure on grid paper. Can you make a different figure that has a perimeter of 18 units? Make several. Record your answers to the following questions.

1. Are any figures more interesting than the others? Which ones?
2. Which figure used the fewest number of squares?
3. What is the fewest number of squares that must be added to make a perimeter of 18 units?

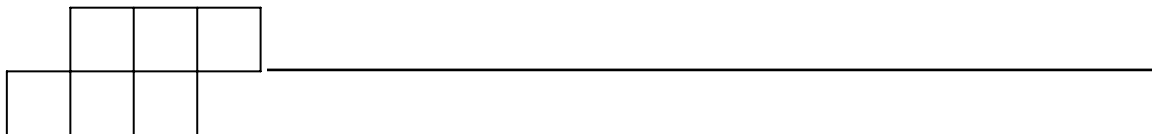


4. What is the greatest number of squares that you can add and keep the perimeter 18 units?

5. Can the perimeter remain the same when a square is added? Explain.

6. Can the perimeter increase by one unit (or by two units, or by three units) when a square is added? Explain.

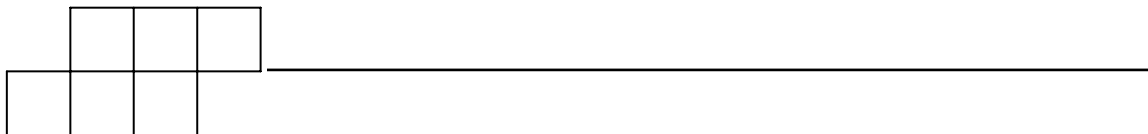
7. Can the perimeter decrease when a square is added? Explain.



Activity #6 Rectangle Investigation

Assume that the edges of the color squares are 1 unit in length.

1. Make all the rectangles that have a perimeter of 18 units. Record them on your grid paper.
2. How many rectangles with perimeters of 18 units are there?
3. Which rectangles used the fewest number of squares?
4. Which rectangle has the smallest area?
5. Which rectangles used the greatest number of squares?
6. Which rectangle has the greatest area?
7. Is there a relationship between the perimeter of the rectangle and its area? Explain.



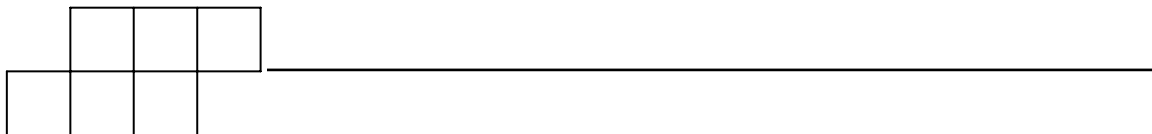
Activity #7 Geoboard Perimeter and Area

1. Construct a square with sides of 4 units. Record your figure on geoboard dot paper.
 - a. What is its perimeter?
 - b. What is its area?

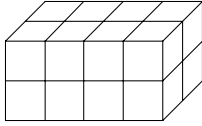
2. Construct a square of 4 square units. Record your figure on geoboard dot paper. What is its perimeter?

3. Construct a rectangle of 3 square units. Record your figure on geoboard dot paper.
 - a. What are the lengths of the sides?
 - b. What is its perimeter?

4. Construct a rectangle, 2 units on one side and 3 units on the other side. Record your figure on geoboard dot paper.
 - a. What is the perimeter of the rectangle?
 - b. What is the area of the rectangle?



5. Construct a rectangle whose area is 12 square units. Record your figure on geoboard dot paper.
 - a. What is the perimeter of the rectangle?
 - b. What is the area of the rectangle?
 - c. Make a different rectangle whose area is 12 square units. Record your results.



Section 3 Investigating Volume

Activity #1 What is Volume?

Volume is the measure of space inside a closed three-dimensional object.

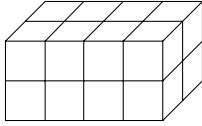
In this activity, students create rectangular prisms to develop the concept of volume. Students determine that the number of cubes necessary to create a prism is the product of the three dimensions of the figure, specifically the length, width and height ($V = lwh$).

Materials: rainbow cubes or other centimeter cubes (one bucket per class)

Activity #2 Exploring Volume with Nets

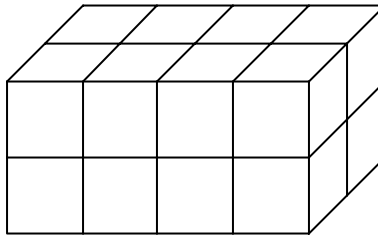
Students explore volume by creating rectangular prisms from nets (two-dimensional representations of three dimensional objects) in this activity. They use what they learned about creating prisms from centimeter cubes in the previous activity to completely fill the folded nets with the appropriate number of cubes. This activity reinforces the idea that volume is the product of length, width, and height.

Materials: centimeter grid paper (one sheet per student)
 scissors (one pair per pair of students)
 clear tape (one per pair of students)
 rainbow cubes or other centimeter cubes (one bucket per class)

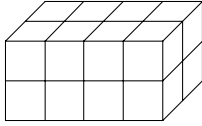


Activity #1 What is Volume?

1. Use the rainbow or centimeter cubes to build the box pictured below.



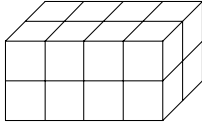
2. How many cubes did it take to build the box?
3. What is the volume of the box?
4. Explain the relationship between the number of cubes it took to build the box and the volume of the box.



5. Build other boxes using the cubes. In the table below, draw a picture of each box, record its length, width, and height, and calculate its volume.

Drawing of the Box	Length	Width	Height	Volume

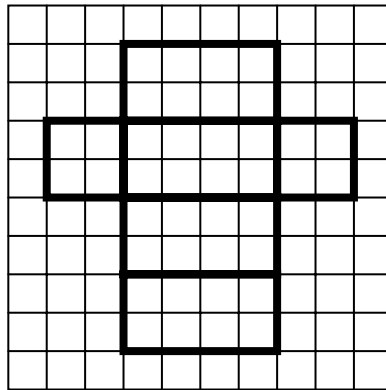
6. Without building a box, explain how you can find its volume.



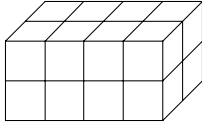
Activity #2 Exploring Volume with Nets

You will explore volume using nets which are two-dimensional patterns that can be folded to form solids.

1. Using centimeter grid paper, build the box from the net below.



2. Predict how many cubes will fit into the box.
3. Check your prediction by filling the box with centimeter cubes.
4. What is the volume of the box, i.e., what is the total number of cubes necessary to fill the box?



5. Re-create each of the following nets on centimeter paper then cut out the net and create the box. Then complete the table below.

Net	Drawing of Your Box	Volume of Your Box



Section 4 Measurement Tour of the Rice University Campus

Materials: tape measure
 yard stick or meter stick
 calculator
 blank paper for recording and drawing

Begin the tour at Lovett Hall under the Sallyport

Freshmen enter the academic quadrangle through the Sallyport from the outside world and graduate from within into the world through the Sallyport. This is a very symbolic place on campus. Lovett Hall was the first campus building. Its cornerstone was laid in 1911. Note the Roman numeral indicating the date that the cornerstone was laid. MDCCCXI is normally written MCMXI. The former is more architecturally attractive.

The Greek inscription (Democritus) translates to "Rather would I discover the cause of one fact than become the king of the Persians." At the time of Democritus, to be king of the Persians was to rule the world. Observe the faces of the freshman, sophomore, junior, and senior: the senior with his mortar board (outside south (left)), the stern junior (outside north (right)), the mature sophomore (inside south (left)), and the giddy freshman (inside north (right)).

The 1990 Economic Summit was held three days in July at Rice. The world leaders walked through the Sallyport into the academic quadrangle. In the Founders Room of Lovett Hall, there is a conference table with the names of those who attended.

Look down the cloisters. Find one of the two large circles on the ground (one at each of Entrances B and C of Lovett Hall). Each is actually a set of concentric circles. Can you see them?

1. Measure the diameter and the circumference of the inner circle. Record the lengths.
2. Using a calculator, divide the length of the circumference by the length of the diameter. What is the quotient?
3. Now measure the diameter and the circumference of the outer circle. Record the lengths.



4. Again using a calculator, divide the length of the circumference by the length of the diameter. What is the quotient?
5. What do you notice about the calculations of #2 and #4?

Find one of the large pillars in front of the Lovett Hall. Measure the circumference (distance around) of the pillar with a tape measure.

1. Compare the length of your circumference to the lengths of the circumferences of others in the group. Are they the same length?
2. If not, why do you think the measurements are different?
3. Where would you have to measure to get the largest circumference? the smallest circumference?

Find the design in the ground of a large square with a small square at each vertex. Can you walk around this shape without retracing your steps?

1. On your paper, draw the path that you took, labeling it with arrows.
2. How far did you walk? (Count your steps.)



3. Can you find a different path that also works? If so, draw it as well.

Architecture of the Rice Campus

Ralph Adams Cram, a Boston architect, was selected by Lovett to design the university. The architecture that was selected was appropriate to Houston's Mediterranean climate, Italian Romanesque. Materials used were marble, stone with small areas of brick. These materials are evident in Venice and elsewhere in Italy today. There is a general plan for all construction on campus. Note the uniformity of the structures. Note the beautiful symmetry and the different geometric shapes. The original landscape was provided by Teas Nursery.

A German marble cutter, Oswald Lassig, came to Houston in 1910 to do the carving on Lovett Hall. He also did the work on the Chemistry Building and Cohen House.

The Owl is the Rice mascot. You'll see them everywhere. Try counting them.

The History of the Founding of Rice University

On March 13, 1891, Massachusetts-born businessman, William Marsh Rice, chartered Rice Institute in Houston, the city where he made his fortune (cotton processing, real estate and railroads). He had been approached by Houston business associates to contribute to the local public school system. However, Rice wanted to endow a university.

William Marsh Rice was murdered on September 23, 1900 by his valet, Charles Jones, who conspired with an unscrupulous lawyer, Albert Patrick, to kill Rice and to claim his estate by using a forged will. Rice's attorney, Captain James A. Baker, ordered an autopsy that revealed poisoning. Jones agreed to provide state's evidence against Patrick in exchange for immunity from prosecution. Patrick was convicted of murder and sent to Sing Sing prison. Captain Baker's quick action cleared the way for the charter to be fulfilled.

Mathematics has been at the center of the university since its beginning. Edgar Odell Lovett, a mathematician from Princeton University, was named the first president in 1907. He was recommended by Woodrow Wilson who was president of Princeton at the time. Lovett visited 78 institutions of higher learning in America, Europe, and Asia from the summer of 1908 until the spring of 1909 to gather ideas to shape the new institution. Rice University opened its doors in September 1912. The academic program emphasized



mathematics and science supported by humanities. In fact, the very first Ph. D. that was awarded was in mathematics to Hubert Bray who remained to become a mathematics professor at Rice.

The Physics Building (walk from Lovett Hall south, stand in front of the Physics Building)

The Physics Building was built in 1914. Look at the arches.

1. How many are there at the front of the building?
2. Which arch is the tallest?

Now walk to the entrance of the Physics Building. At the front of the entrance, you will find a black tile on the ground consisting of two squares (one inside the other).

3. Draw the two squares in the space below.
4. Find the side length of each square.
5. Calculate the perimeter of each square.



The Main Quadrangle and William Marsh Rice's Statue

The Rice campus is the largest private cemetery in the world. The tall, skinny trees around the quadrangle are Cypress trees, which are used to mark cemeteries in Europe. How many Cypress trees are there in the quadrangle?

The ashes of the founder of Rice, William Marsh Rice, are encased at the base of his statue. Rice's statue was dedicated on June 8, 1930.

There are several manholes in this area.

1. How are the manholes the same?

2. How are they different?

Select one of the circular manholes in the main quadrangle.

3. Measure the length of its diameter and the length of its circumference. Record those lengths below.

4. Divide the length of the circumference of the manhole by the length of its diameter using a calculator. What is the quotient?



Sketch a map of the main quadrangle. Label each of the six buildings: Lovett Hall, the Physics building, Anderson Hall, Fondren Library, Rayzor Hall, and Sewall Hall. Place Willy's statue in the middle facing the correct way. Can you find a line of symmetry for the entire quadrangle?

Anderson Hall

Note the decorative frieze cut into the marble. Run your finger rapidly over the vertical row of holes. Some people call this the frog wall. The architect wanted to achieve sound in architecture.

1. Estimate the number of holes on the frog wall. How did you arrive at your estimate?
2. What is the length of a diameter of each hole?
3. Calculate the height in centimeters of each step at the entrance of Anderson Hall that has the frog wall.
4. Locate and draw the cone on the other side of this building.
5. Count the number of windows located on the quadrangle side of the building.



6. Are they all the same size and shape? Explain.

Fondren Library

Count the number of arches in front of this building. Count the number of stars on one of the arches. What is the total number of stars on all the arches?

There are two very large stone vertical panels on either side of the main entrance.

1. What is the width of one of the panels?

2. Estimate the height of one of the panels, and then find the perimeter of the panel.

There is a handicap ramp to the left of the entrance of the library.

3. Sketch a picture of the ramp below. Measure the height and the length of the handicap ramp. Record your measurements in your picture.

4. Divide the height of the ramp by the length of the ramp. Express the quotient as a decimal.



5. How would the quotient from #4 change if you increased the height of the ramp but kept the length of the ramp the same length?

There are brickwork “crosses” on the ground on either side of the entrance down the cloisters.

6. Draw one of the “crosses” and find its perimeter.
7. Count the number of bricks that make up the “cross.”

Rayzor Hall

1. Measure the length of your step in centimeters.
2. How many steps is it from the nearest entrance of Rayzor Hall to Willy’s statue? How far is it in centimeters? in meters?

There are two benches located between Rayzor Hall and Sewall Hall.

3. Describe the shapes of the stone that make the benches.
4. What are the dimensions of the seat? What is the perimeter? What is the area?



Engineering Quadrangle

The 45° , 90° , 180° sculpture by Michael Heizer was added to the campus in 1984. Which slab is 45° ? Which slab is 90° ? Which slab is 180° ? Why?

In front is the Mechanical Laboratory built originally in 1912. Its tower was struck by lightning in 1930 and then remodeled. Campaniles are bell towers. Rice's is a beautiful smokestack which is now non-polluting.

Look around the Rice campus. What other mathematics do you see?