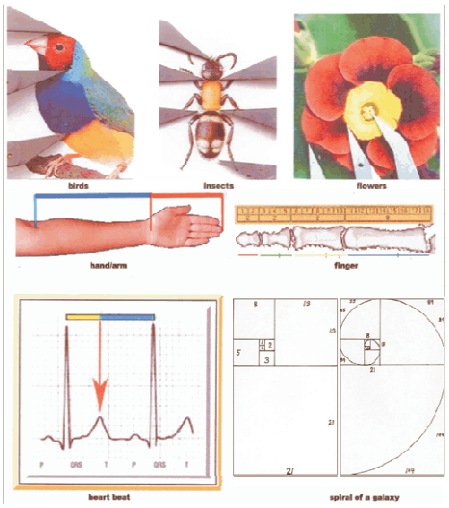
Algebra/Geometry Institute Summer 2006

The Golden Ratio



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School: Grenada Middle School
Grenada, MS
Grade Level: 7th

1 Teaching objective(s)

2007 Mississippi Curriculum Framework

4 b. Measure the dimensions of given items using standard (English and metric) measurements.

Institute Content Based on MS Framework

Develop measurement concepts.
Gather, Organize, and display data in appropriate chart.

2 Instructional Activities

During this activity, the student will explore the ratios of several rectangles found in art, architecture, and the human body as well as body parts in relation to one another. By doing so, students will discover a constant ratio known as the Golden Ratio that can be found throughout nature and the human body. This ratio is also said to be the most pleasing ratio to the human eye. Hence, it can be found in art and architecture through out history.

The teacher will:

- Introduce students to several instruments used for measuring length of items.
- Have students look at the different units that can be used to measure with such instruments.
- Illustrate measuring to the tenths place when appropriate.

- Have students draw a rectangle that they like and measure both the length and the width of the rectangle.
- Brief students on finding ratios when comparing two items.

The student will:

- Draw a rectangle, measure the length and the width of the rectangle and then find the ratio of length to width.
- Use various measuring devices to measure several items as outlined in the activity handout on measurement and ratios.
- Compare the length to width in some items and compare the length of some items to the length of related items.
- Record findings in table format.
- Find ratio of items being compared and then average the ratios of items in similar categories.

3 Materials and Resources

- blank paper
- calculator
- index cards
- notebook paper
- measuring tapes
- meter stick
- rulers
- handout on Measurement and Ratios
- Working papers for the students to record measurements and ratios
- Overhead projector and transparencies
- Print of *Composition with Gray and Light Brown* by Piet Mondrian which can be found at the site: http://www.bexley.k12.oh.us/hslib/art/artistlinks/artist47.htm
- Scaled floor plan of the Parthenon which can be

found at the site:
http://facultystaff.vwc.edu/~trfanney/golden- mean-WOWslides/gm9b.html

- Print of *Mona Lisa* by Leonardo DaVinci which can be found at the site:
http://www.digitalart.ab.ca/art/ren/mona-lisa.htm

4 Assessment

Students will be assessed using observation and anecdotal notes regarding the completion of the working papers. Students will also be questioned regarding their findings in a group setting.

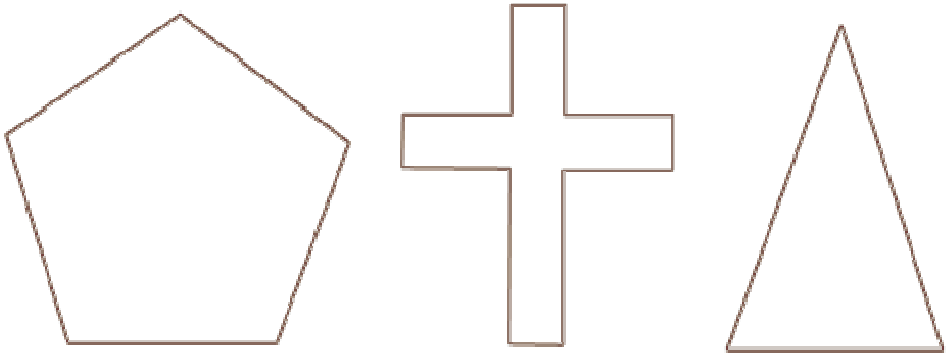
Measurement and Ratios

adapted from http://www.geom.uiuc.edu/~demo5337/s97b/discover.htm
The Geometry Center at the University of Minnesota

1. Measure the length and width of the following items and record the results in the corresponding table.

   a. Draw a rectangle. It can be any size that you please. Measure the length and the width and record the results in the table.
   b. an index card
   c. a piece of notebook paper
   d. Fold your left index finger in on itself. The knuckle on your hand to the middle knuckle form the length of a rectangle, and between the middle and top knuckle the width of the rectangle is formed.
   e. any rectangle that you choose from *Composition with Gray and Light Brown* by Piet Mondrian
   f. choose 3 other items in the room that are shaped like rectangles

2. Complete the table by finding the ratio of length to width. What do you notice about all of the ratios? Average the ratios.



3. Measure the length of a diagonal of the pentagon and measure the length of one side of the pentagon and find the ratio of the diagonal to the side.

4. Measure the upper and lower portions of the main stem of the cross which is cut by the crossbar. What is the ratio of the length of the lower portion to the length of the upper portion?

5. Measure the length of the shorter side and the two legs, which of course have the same length since this is an isosceles triangle. What is the ratio of the length of the leg to the base?

6. Use this scaled floor plan drawing of the Parthenon to experiment with the rectangles. Do you find any ratios that look familiar?

7. Draw a rectangle around Mona Lisa's face. What do you find here?

Next we will look at the human body.

8. Measure from the tip of your middle finger to your wrist. Next, measure your forearm from your wrist to your elbow. What is the ratio of your forearm to your hand?

9. Measure your arm, starting from the shoulder down to the end of your hand. Let this length equal to a.

   Then measure the length of the lower part of your arm: from the elbow to the end of the arm. Let this length equal to b.

   Find the ratio of the two measurements in the following way: Ratio = (full length of arm) / (length of lower arm) = a/b

Working Paper

Rectangle	Length	Width	Ratio of length to width
your favorite			
Index card			
Notebook paper			
Finger rectangle			
From painting			
Other A			
Other B			
Other C			
Average of ratios			

Ratio of one side of a regular pentagon to a diagonal of the pentagon _____

Ratio of lower to upper sections of the cross _____

Ratio of leg of triangle to the base of the triangle _____

Ratios found in the Parthenon _____

_____

_____

Ratio of rectangle length to width
surrounding Mona Lisa's face _____

Average of these ratios _____

Person	**a** - length of full arm	**b**- length from elbow to end of hand	Ratio of **a** to **b**
Average ratio			

Congratulations……you have been finding the Golden Ratio otherwise know as Phi.