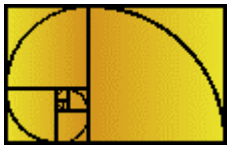
Algebra II

The Golden Ratio

Throughout history, the ratio for length to width of rectangles of the Golden Ratio has been considered the most pleasing to the eye. This ratio was named the golden ratio by the Greeks. In the world of mathematics, the numeric value is called "phi" named for the Greek sculptor Phidias. Notice that the space between the columns shown below form golden rectangles. There are golden rectangles throughout this structure that is located in Athens, Greece.

In this investigation you will collect the measures of the width and length of seven rectangles ranging from small to large and determine the prevalence of the Golden Ratio in these rectangles and your life.



1. Locate and measure seven rectangles that are pleasing to your eye. Pick some that are small (lengths and widths less than 50 cm), medium (50 to 150 cm) and large (more than 150 cm). Record these measures in the table below. Use the tall side as the length and the other as the width when viewed as the object was intended (see below). The units that you measure should be consistent for each measure, but may vary between objects. In this case try to use centimeters.

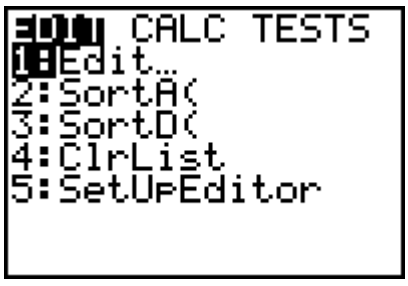
Algebra II

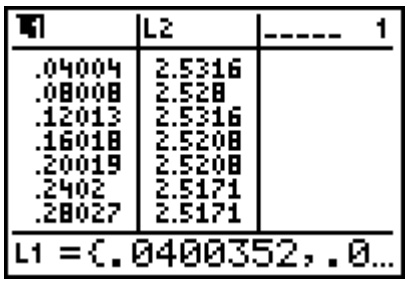
Correct

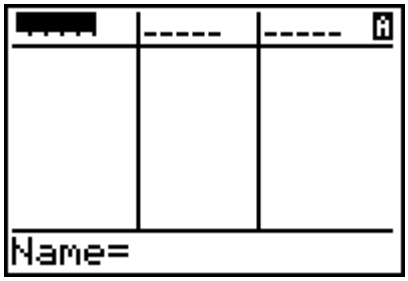
Incorrect

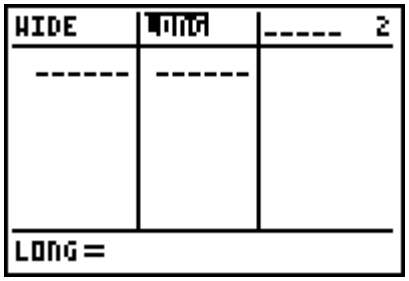
Object	Width	Length

2. Place these values in your calculator, using the list name of WIDE for the widths and LONG for the lengths. Press [STAT] and select *1:Edit* to get to the List Editor. Move to the Header of the first list (indicated by the 1 in the upper right hand corner of the screen) and press [DEL] until all list have been moved to the background. Now key in the names of the lists as shown.









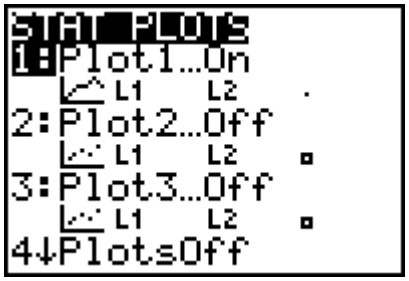
Algebra II

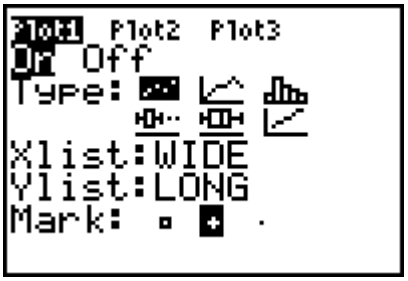
3. Once you have entered your 7 data pairs, locate two more sets of data from others in the class. Enter their data with yours so that your list will contain 21 data pairs. Provide the complete set of data and identify who provided you with the extra data.

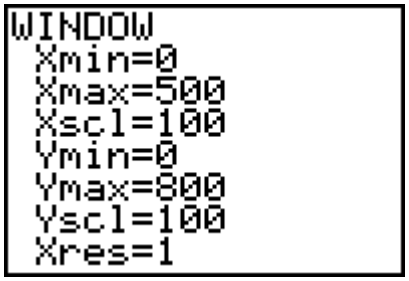
_____ 2nd set of 7

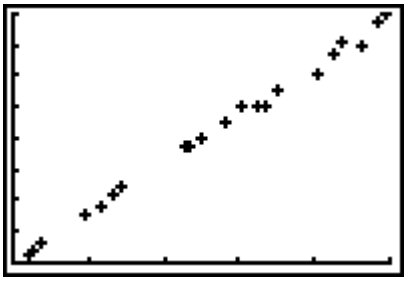
_____ 3rd set of 7.

4. Set up a Scatter Plot using the widths (WIDE) as the independent variable and the lengths (LONG) as the dependent. Press [2nd] [STAT PLOT] [1] to set up as shown below. Get the list names from the List of List by pressing [2nd] [LIST] and moving to the list name. Press [WINDOW] to set an appropriate graph screen, and then [GRAPH] to see the graph. Provide the Window and Graph. What pattern do you see in the plot?





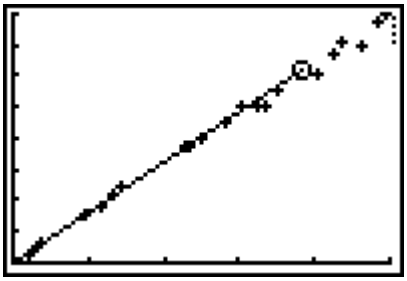




5. Determine the best-fit line that matches the data. In this case it should be linear. Use Guess and Test, Linear Regression, or the Median-Median calculation. Produce a graph showing the line and report the name of the function.

$f(x)$ = _____

Algebra II



6. Since the Golden Ratio is approximately 1.618, calculated by looking at the ration of the Length to the Width, our slope should be this value. The True calculation is $\frac{Length}{Width} = \frac{\sqrt{5}+1}{2}$. Compare this to the slope in the equation of best fit you determined.

7. Your method used in comparing to get the answer to question 6 might be on point, but often we want a statistical analysis of the values. In this case, since the y-Intercept of the function should be zero, we can look at the individual slopes for each pair (when compared with (0,0)). This set of values should not vary from 1.618 by much, if the prevalence of the Golden Ratio in our life is major. Create a list that we will call Slope and fill it with the change in Y divide by the change in X ($_{L}$LONG/$_{L}$WIDE).

WIDE	LONG	[redacted] 3
233	370	
284	450	
134	220	
349	560	
435	710	
426	670	
403	600	

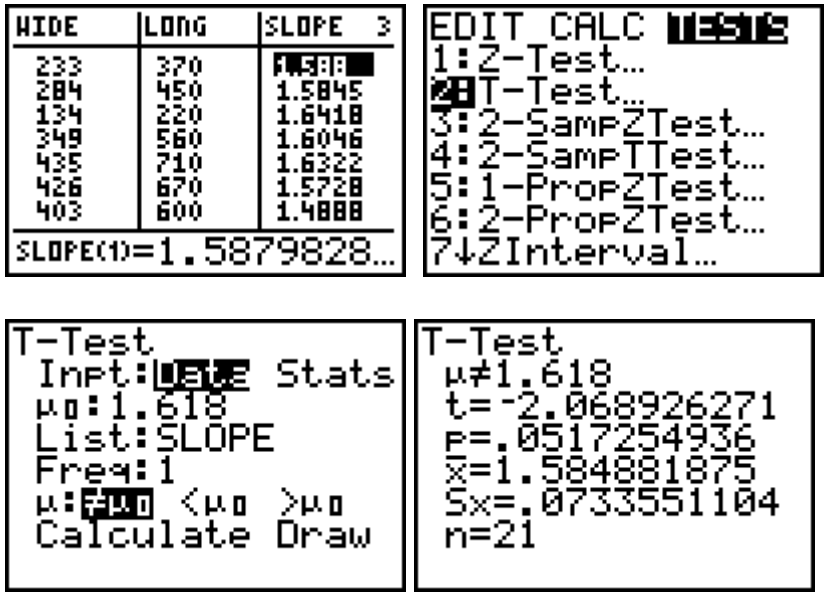
Name=SLOPE

WIDE	LONG	SLOPE 3
233	370	------
284	450	
134	220	
349	560	
435	710	
426	670	
403	600	

SLOPE = LLONG/LWIDE

8. We can now do a T-Test at the 0.10 level to determine if our collection of rectangles have a ratio that is statistically the same as the Golden Ratio. Press [STAT] and arrow over to the *TESTS* menu. Select *2:T-Test…* from that menu and set it up as shown below. Do both Calculate and Draw and report your results. Write a bit about these results to indicate how your data results (ratios) are close, or far from the Golden one.

In my example, I have a p value of about 0.05 (5%), which means that at the 0.10 level my data are not significantly different from the Golden Ratio (1.618).



9. Document all your results, calculations, and answers. Place your name, Date, and Period on the work and turn it in.