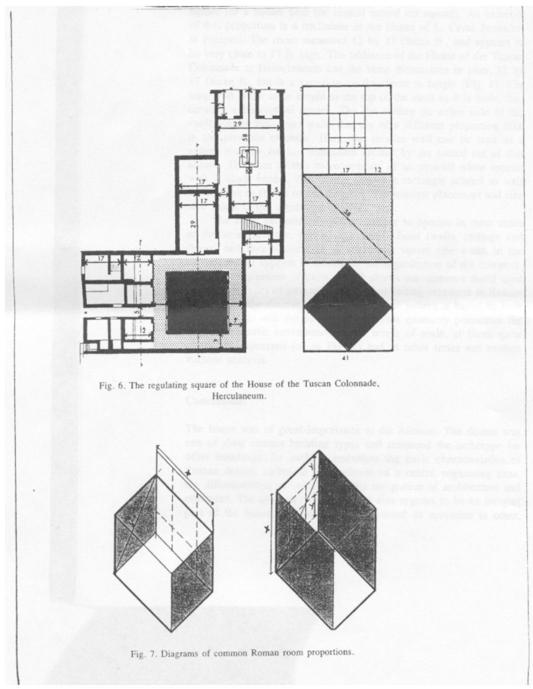
1. Consider a single house in Herculaneum, *The House of the Tuscan Colonnade*, also analyzed by the Watts. The floor plan is shown below.



The Watts measure the dimensions in Oscan feet [1] As you may or may not be able to see in the floor plan, the Watts found the following dimensions:

5 12 17 29 41

Find all ratios of these numbers that fall within the acceptance ranges of the Sacred Cut ratios that we developed in class.

These acceptance ranges can be found on the web: *OnCourse-Slides Displayed In Class-Systems of Proportion - Acceptance ranges for the Sacred Cut*. Remember, they assume that the measurements are no more than 2% away from what the architects intended, which lead to the ratios being no more than 4% off from the intended ratios.

[1]The Oscans were an early Italic people who built the original walls and towers of Pompeii, and may have founded Herculaneum.

2. Suppose you are going to be testing several works of art and architecture to see whether your favorite ratio appears. You are assuming that your measurements will be within 1% of the actual lengths, and so, as we found in class, the ratios will be off from the actual ratio of the lengths by (roughly) no more than 2%. Find the *acceptance range* for your ratio, if your favorite ratio is:

   (a) The Golden Ratio, $(1 + \sqrt{5})/2$.

   (b) $(\sqrt{7} - \sqrt{5})/3$.

3. A Golden Ratio fanatic measures her box of Good Earth Vanilla Chai one morning and finds that the height of the box is 13 cm and the width is 7.9 cm. Is the ratio of the height to the width within the acceptance range for the Golden Ratio found in the previous problem?

4. You have read, in the excerpts from *The DaVinci Code*, that "my friends, each of you is a walking tribute to the Divine Proportion." In this exercise, you will explore whether *you* are a such a tribute to the Golden Ratio.

   Note: In order to make this problem less cumbersome, we will assume that your measurements are accurate to within 1%, so that you can use the Acceptance Range for the Golden Ratio that you developed in Problem 2. A margin of error of only 1% is probably too small, if you are using a ruler rather than a measuring tape, so you may end up concluding some ratios are out of the acceptance range when with a more realistic margin of error they would in fact be within it.

   (a) Measure the following, and label your measurements very clearly. Centimeters would an easier choice.

      i. your height

      ii. the distance from your navel to the floor

      iii. the distance from your shoulder to your fingertips

iv. the distance from your elbow to your fingertips

v. the distance from your hip to the floor

vi. the distance from your knee to the floor

(b) *Height to belly button height:*

i. Calculate the ratio of your measured height to the measured height of your belly button.

ii. Does this ratio fall within the Acceptance Range for the Golden Ratio?

(c) *Arm length to fore-arm length:*

i. Calculate the ratio of your measured arm length to your measured fore-arm length.

ii. Does this ratio fall within the Acceptance Range for the Golden Ratio?

(d) *Leg length to height of knee:*

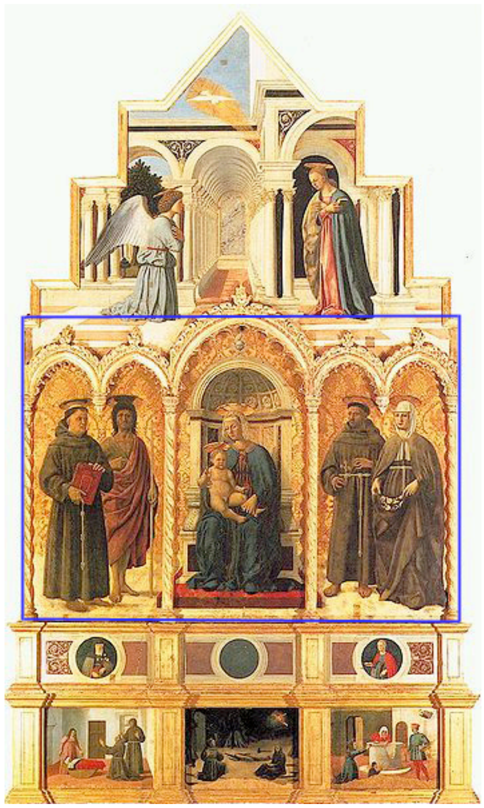
i. Calculate the ratio of your measured leg length to the measured height of your knee.

ii. Does this ratio fall within the Acceptance Range for the Golden Ratio?

(e) Draw some conclusions as to whether you believe *you* are the tribute to the Divine Proportion that Dan Brown's Robert Langdon claims you are.

5. Rectangles in which the ratio of the longer side to the shorter side is the square root of an integer ($\sqrt{2}$, $\sqrt{3}$, $\sqrt{4}$, $\sqrt{5}$, etc) are called *root rectangles*. Some people feel that "they're harmoniously linked to each other and can have a powerful effect on viewers" [2]. The goal of this problem is to decide whether the Polyptych of St. Anthony by Piero della Francesca shown below contains a $\sqrt{2}$ rectangle.

[2] Michael S. Schneider, *Constructing the Universe - Dynamic Rectangles*



(a) What are the dimensions of the rectangle outlined in blue containing the three largest panels of the polyptych? (For consistency, please measure in centimeters, and measure very carefully.)

(b) Find the ratio of the long side to the short side.

(c) Assuming that your margin of error in each measurement is 1%, find an acceptance range for the "target ratio" $\sqrt{2}$.

(d) Based on your measurements of this reproduction, conclude whether these three panels may have been constructed to be a $\sqrt{2}$ rectangle.

6. Suppose you have a line segment AB. The following problems deal with cutting this line segment into two pieces by placing a point C somewhere between A and B.

   (a) Where on AB would you put the point C so that the ratio $\frac{\overline{AB}}{\overline{AC}}$ is 2? When C is in this location, what is the value of the ratio $\frac{\overline{AC}}{\overline{BC}}$? (Don't make this harder than it is: experiment by drawing some examples, and look at them. I'm not looking for a fancy proof or anything.)

   (b) Where on AB would you put the point C so that the ratio $\frac{\overline{AB}}{\overline{AC}}$ is 1? (Again, don't make this harder than it is!) When C is in this location, can you find the value of the ratio $\frac{\overline{AC}}{\overline{BC}}$? If not, why not?

   (c) Based on your responses to Exercises 6a and 6b, what are the smallest and largest possible values for the ratio $\frac{\text{length of the whole}}{\text{length of the greater}}$?

Even without calculating the Extreme and Mean ratio, this gives us a range that we know the Extreme and Mean ratio falls within.

7. For each of the following, you'll be drawing a line that is cut in Extreme and Mean ratio (i.e. the Golden Ratio). Use what we have shown in class about $\frac{\text{whole}}{\text{greater}}$ and $\frac{\text{greater}}{\text{lesser}}$.

   (a) Suppose we want to draw a line cut in Extreme and Mean Ratio, and we want the short segment to be 3 units long. How long should the long segment be? Draw such a line as carefully as possible.

   (b) Suppose we want to draw a line of length 6 that is cut in Extreme and Mean ratio. Where should we place the cut? Draw such a line, as carefully as possible.

   Look at the two lines with cuts that you've drawn. Do they look the same or different? (You don't necessarily have to address this in what you turn in, I just want you to pay attention to the big picture!)

8. Suppose we don't happen to agree with the ancient Greeks about balance between extremes. So we define our own standard of beauty and all that, beginning with the ideal way to cut a line. Here's ours:

   *A line is said to be cut in the **Very Cool Ratio** when the greater segment is to the lesser segment as **twice** the whole is to the greater.*

   (a) Set up the proportion described in the definition of the Very Cool Ratio.

   (b) What *is* this Very Cool Ratio? (By this I mean, *find* the number it equals!)

   (c) Suppose we want to draw a line cut in the Very Cool Ratio, and we want the short segment to be 3 units long. How long should the long segment be? Draw such a line as carefully as possible.

(d) Suppose we want to draw a line of length 6 that is cut in the Very Cool ratio. Where should we place the cut? Draw such a line as carefully as possible.

(e) How do these cuts compare to those you found in the previous problem?