

Math 1118: First Project

Due: Friday, November 2nd

In this project we will use what we have learned to make a design. Along the way we will make sketches and do computations that you will hand in with your final design.

1 Directions

Draft

1) Imagine the attached 10×10 grid as having coordinates $(0, 0)$ through $(10, 10)$. Choose 5 points that are intersections of grid lines such that:

- (1) At least one point is on a corner $(0, 0)$, $(0, 10)$, $(10, 0)$, or $(10, 10)$.
- (2) Each line $y = 0$, $y = 10$, $x = 0$ and $x = 10$ has exactly 1 point on it. Note a corner point is on two lines.
- (3) No three points are in a line.

2) Now your design will begin to take shape:

- (1) Connect each of your points to every other point.

3) Now we'll add some color:

- (1) Choose 4 colors. Label them *Color 1*, *Color 2*, *Color 3*, and *Color 4*.
- (2) Shade the **entire** 10×10 square using only these 4 colors so that any two regions that share a side have different colors. If the two regions merely share a point, then they can be the same color.

Computations

Consider the following matrix:

$$M = \begin{bmatrix} 0 & \frac{\sqrt{5}-1}{2} & 10 \\ \frac{1-\sqrt{5}}{2} & 0 & 10 \\ 0 & 0 & 1 \end{bmatrix}$$

- 4) Compute M^2 and simplify your answer—do not round.
- 5) Compute M^3 and simplify your answer—do not round.
- 6) Compute M^4 and simplify your answer—do not round.
- 7) Round M , M^2 , M^3 , and M^4 to three decimal places.

8) For each of the five points you chose in Problem 1, copy and fill-out the following charts. Your work should be neat and organized.

p	Mp

p	M ² p

p	M ³ p

p	M ⁴ p

Final Design

Using 18×24 drawing paper, use a light pencil to construct a 10×17 grid of squares that are 3 centimeters per side. Imagine this grid as having coordinates $(0, 0)$ through $(17, 10)$.

- (1) Transfer your design from your draft (complete with color) to the 10×10 grid spanned by the points $(0, 0)$ through $(10, 10)$.
- (2) Transfer the points found in Table A. Find your original design (somehow!) in these points, add lines and color.
- (3) Transfer the points found in Table B. Find your original design (somehow!) in these points, add lines and color.
- (4) Transfer the points found in Table C. Find your original design (somehow!) in these points, add lines and color.
- (5) Transfer the points found in Table D. Find your original design (somehow!) in these points, add lines and color.
- (6) Hopefully, a pattern has formed. Use your artistic talents to **continue the pattern**.

2 Questions

- 9) Look up what a *complete graph* is and briefly **explain what this has to do with what you have done.**
- 10) Look up the *Four Color Theorem* and briefly **explain what it has to do with what you have done.**
- 11) Look up the *Golden rectangle* and briefly **explain what it has to do with what you have done.**
- 12) Look up the *Golden spiral* and briefly **explain what it has to do with what you have done.**

Attach the answers to these questions, tables from part 8, draft, and final design with a paper clip. Write your name at each of the four corners on the back of your final design.

3 Grading Rubric

This assignment is worth 35 points.

Draft (5 pts)

- Did you address all of the criteria listed?

Computations (10 pts)

- Are they correct?

Final Design (12 pts)

- (5 pts) For addressing the listed criteria 1–5.
- (3 pts) for continuing the pattern.
- (4 pts) For neatness.

Questions (8 pts)

- (2 pts) For each question.

Bonus Point For pizazz—this will be a **difficult** point to earn.