# Connections to other courses

For this project, related the content of this course to projects or assignments from another course or a job related to your major. Discuss the project contents with Dr. Merriman to make sure your idea is suitable for a final project.

Describe how the material from your other course is related to at least 3 topics from this class. Provide the details and solutions for at least one example for each topic as it relates to the course.

## Individual Project Rubric—Final Due December 16

* (3 pts) Details of the project for your other course or work, including documentation of the final product,
* (3 pts) Explanation in your own words of how the project relates to this course’s material,
* (12 pts) At least 3 examples of problems you needed to solve during the project, and how they use the content from this course,
* (4 pts) How the content of this course helped you to complete the project or how it gives you a better understanding of the process,
* (3 pts) Any sources consulted in the process, including Wikipedia, YouTube videos, or other people.
* (5 pts) Incorporating feedback from the Draft due November 23. This does not need to be a separate section.

## Group Project Rubric—Final Due December 16

* (2 pts) Details of the project for your other course or work, including documentation of the final product,
* (3 pts) Explanation in your own words of how the project relates to this course’s material,
* (9 pts) At least 3 examples of problems you needed to solve during the project, and how they use the content from this course,
* (3 pts) Any sources consulted in the process, including Wikipedia, YouTube videos, or other people.
* (5 pts) Incorporating feedback from the Draft due November 23. This does not need to be a separate section.
* (8 pts) Individual reflection paper of approximately one page explaining
  + Your individual contributions to the group project,
  + How the group process worked and how that affected the final project,
  + How the content of this course helped you to complete the project for your other course or how it gave you a better understanding of the design process.

# Make a hyperbolic plane

For this project, follow the instructions to create a paper or crochet hyperbolic plane to Crocheting Adventures with Hyperbolic Planes by Daina Taimina, available [through the OSU library.](https://library.ohio-state.edu/record=b8355835~S7)

A bunch of different models are available in <https://doi.org/10.3792/euclid/9781429799850-30>

## Individual Project Rubric—Final Due December 16

* (5 pts) Look up triangles on a sphere and explain why the sum of the angles is always more than 180 degrees. Explanation must be in your own words. You must include your sources you consulted, including Wikipedia, YouTube videos, or other people.
* (10 pts) The physical model with straight lines, parallel lines, and a hyperbolic triangle
* (7 pts) Explanation in your own words of how the physical model helped you find more than one parallel line through the point. Also show that hyperbolic triangles have angle sum less that 180.
* (3 pts) Any sources consulted in the process, including Wikipedia, YouTube videos, or other people.
* (5 pts) Incorporating feedback from the Draft due November 23. This does not need to be a separate section.

# Rep-tiles

You are handed 21 L-shaped tiles and one square. All of the L-shaped tiles are identical, and fit together with the square to form a larger square, like this:

## Individual Project Rubric—Final Due December 16

* (5 pts) How can you make a larger square using 5 of the L-tiles and the one square? What about 21 squares? Can you figure out a general pattern?

Look up the definition of a math rep-tile. Here are some questions to answer about rep-tiles:

* (4 pts) Using construction or other thick paper, cut out four copies of the same triangle. Will your triangle fit together to form a larger triangle? Is the larger triangle similar to the smaller triangles? Is your triangle a rep-tile? Explain your answer.
* (4 pts) Repeat this process for parallelograms
* (4 pts) How does the L-tile puzzle related to rep-tiles? How do rep-tiles relate to other topics in the course?
* (5 pts) Design your own rep-tile puzzle similar to the L-tiles puzzle.
* (3 pts) Any sources consulted in the process, including Wikipedia, YouTube videos, or other people.
* (5 pts) Incorporating feedback from the Draft due November 23. This does not need to be a separate section.

## Group Project Rubric—Final Due December 16

* (4 pts) How can you make a larger square using 5 of the L-tiles and the one square? What about 21 squares? Can you figure out a general pattern?

Look up the definition of a math rep-tile. Here are some questions to answer about rep-tiles:

* (3 pts) Using construction or other thick paper, cut out four copies of the same triangle. Will your triangle fit together to form a larger triangle? Is the larger triangle similar to the smaller triangles? Is your triangle a rep-tile? Explain your answer.
* (3 pts) Repeat this process for parallelograms
* (4 pts) Design your own rep-tile puzzle similar to the L-tiles puzzle.
* (3 pts) Any sources consulted in the process, including Wikipedia, YouTube videos, or other people.
* (5 pts) Incorporating feedback from the Draft due November 23. This does not need to be a separate section.
* (8 pts) Individual reflection paper of approximately one page explaining
  + Your individual contributions to the group project,
  + How the group process worked and how that affected the final project,
  + How the L-tile puzzle relates to rep-tiles, and how rep-tiles relate to other topics in the course.

# Mondrian Tiles

Piet Mondrian was a Dutch painter known for his abstract paintings, especially those made from primary-colored rectangles. These works have inspired puzzles, where each rectangle must have different dimensions.

The puzzle goes as follows: draw square with integer side lengths. Fill the square with rectangles, so that every rectangle has integer side lengths, but no two rectangles have the same dimensions. Switching length and width counts as the same dimensions, so a 4x6 rectangle and a 6x4 rectangle count as the same rectangle. The score for the solution is the difference between the area of the largest rectangle and the area of the smallest rectangle. The goal is to find the smallest possible score.

A second step is to then color the rectangles using the fewest possible colors so that no two rectangles that share a side are the same color. For some examples, see: <http://sigmaa.maa.org/mcst/documents/MONDRIANPUZZLES.pdf>

## Individual Project Rubric—Final Due December 16

* (5 pts) Solutions with the smallest possible score for 3x3 and 4x4 and, colored with the fewest number of colors.
* (5 pts) An explanation of how you know these are the smallest possible scores and of how you know it is not possible to color the puzzle with fewer colors (for 3x3 and 4x4 puzzles)
* (4 pts) Solutions with the smallest possible score for 5x5 colored with the fewest number of colors. Including an explanation of how you know these are the smallest possible scores and of how you know it is not possible to color the puzzle with fewer colors
* (4 pts) Solutions with the smallest possible score for 6x6 colored with the fewest number of colors. Including an explanation of how you know these are the smallest possible scores and of how you know it is not possible to color the puzzle with fewer colors
* (4 pts) Look up the Four-Color theorem. Explain how this project relates to the Four-Color theorem.
* (3 pts) Any sources consulted in the process, including Wikipedia, YouTube videos, or other people.
* (5 pts) Incorporating feedback from the Draft due November 23. This does not need to be a separate section.

## Group Project Rubric—Final Due December 16

* (4 pts) Solutions with the smallest possible score for 3x3 and 4x4 and, colored with the fewest number of colors.
* (4 pts) An explanation of how you know these are the smallest possible scores and of how you know it is not possible to color the puzzle with fewer colors (for 3x3 and 4x4 puzzles)
* (3 pts) Solutions with the smallest possible score for 5x5 colored with the fewest number of colors. Including an explanation of how you know these are the smallest possible scores and of how you know it is not possible to color the puzzle with fewer colors
* (3 pts) Solutions with the smallest possible score for 6x6 colored with the fewest number of colors. Including an explanation of how you know these are the smallest possible scores and of how you know it is not possible to color the puzzle with fewer colors
* (3 pts) Any sources consulted in the process, including Wikipedia, YouTube videos, or other people.
* (5 pts) Incorporating feedback from the Draft due November 23. This does not need to be a separate section.
* (8 pts) Individual reflection paper of approximately one page explaining
  + Your individual contributions to the group project,
  + How the group process worked and how that affected the final project,
  + How this project relates to the Four-Color theorem.