

About this homework: *We are doing something different for this assignment. Instead of a set of problems, you will prepare a report about symmetry of patterns in the plane. The details are given below. This homework will count for 40 points in your homework grade, about twice as many points as each of the previous assignments. You'll get a letter grade for the assignment rather than a numerical grade. The homework is due next Friday, April 4, with a possible extension to the following Monday if it seems warranted.*

Symmetry on paper. In class on Friday, March 28, you will work with a partner on finding symmetries of plane patterns. You will have a sheet showing three “rosette” patterns, three “frieze” patterns, and six “wallpaper” patterns. (The meaning of the three types of patterns will be explained in class.) You will also have transparencies with copies of the patterns to help you find the symmetries.

You should examine the patterns for each possible type of symmetry: reflection, translation, glide reflection, and rotation. You should note some of these symmetries on the patterns. How much you do is up to you, but remember that you will include your work as part of your report on symmetry, and what you do will influence your grade.

For a reflection symmetry, you can draw the line through which the pattern reflects. For translation and glide reflection symmetry, you can draw an arrow that shows what direction the pattern moves and how far it moves. For rotation symmetry, you can mark the center of the rotation and indicate the size of the angle through which the pattern rotates. (Examples will be demonstrated in class before you start working.)

Symmetry on the computer: Class will meet in a computer lab, Gulick 208, on Monday, March 31, to work with some symmetry web apps. When you get to the lab, sign in to Windows as usual. Start up the Firefox web browser. (The apps won't work in the version of Internet Explorer in the lab. They will work in Chrome, but only Firefox will allow you to save the pictures that you make.) The easy way to start Firefox is to click the Start menu, then start typing “firefox” until it shows up in the list of matching applications. The three web apps are at the following URLs. You can type them directly into the browser Location box, or you can find links to these pages on the course web page:

<http://math.hws.edu/eck/jsdemo/rosette.html>

<http://math.hws.edu/eck/jsdemo/frieze.html>

<http://math.hws.edu/eck/jsdemo/wallpaper.html>

The apps allow you to make rosette, frieze, and wallpaper patterns. It should be pretty clear how to use them, but they will also be demonstrated in class on March 28. In the *rosette* app, you can choose the number of rotations symmetries in the pattern, and you can check a box to specify whether you also want reflection symmetries. In the other two

apps, you get to choose from a list of “symmetry groups.” Each symmetry group has its own set of symmetries. Each of the apps has a “Show Grid” option that adds some lines to the pattern. The lines and their intersection points can mark important features of the symmetries.

Your goal is to create some beautiful and/or interesting patterns. When you get a pattern that you like, you can save a copy of the image. Just right-click the picture and choose “Save Image As...” (This only works in Firefox.) You will then be able to print the image later. Alternatively, select “View Image” from the popup menu, and then print the image directly from Firefox. (Note: You probably want to save and print images with the “Show Grid” option turned off.)

Part of the reason for using these apps is to get some hands-on experience working with symmetry. You should **take some notes** on your experience as you work with the web apps! You will be asked to talk about the experience as part of your report. Maybe you can talk about things that you find confusing or particularly interesting. Maybe you can report on some interesting technique that you have found for making patterns. (For example, you might consider wallpaper patterns that can be created by drawing a single line segment.)

Symmetry in the world: People find symmetry attractive. You can tell this because they surround themselves with symmetric patterns. For the last segment of the assignment, you should look for examples of symmetry in the world. You should either draw the examples that you find, or take photos and print them. There are lots of places to look; for example: floor tiles, wall tiles, carpets, textiles, brick walls, hubcaps, tire treads, company logos. Keep a record of where you find each pattern. Try to find examples using a variety of symmetries.

Your report: Your report should include an essay plus your collection of patterns from class, from the computer, and from the world. You can staple the images to the essay. Alternatively, if you prefer, and if you know how to do it, you might incorporate the images into the body of the essay. Two to four pages, not counting pictures, should be long enough for the essay.

Your essay should begin with an introduction where you explain in your own words what symmetry means. You should then discuss your experience using the symmetry web apps and the patterns that you made with them. Pick one or two of your favorite patterns, and discuss their symmetry in some detail. Finally, you should talk about your search for symmetry in the world. Discuss where you looked for patterns and the patterns that you found. Did you find examples of all three kinds of pattern (rosette, frieze, and wallpaper)? Was it easy to find examples? Hopefully, you will write some kind of conclusion for your essay as well. You might speculate about why people find symmetry attractive or why symmetry was used in the places where you found it.

You don’t have to talk about Friday’s in-class work in your essay. Just turn in the printed patterns marked up with indications of some of the symmetries that they display.