

## Writing Assignment # 4: Proposal for Course Project

Due: Friday, March 19th, at the *beginning* of class.

This assignment pertains to the following, as stated in the course syllabus:

**Course project & presentation:** Instead of a final exam, you will have a final course project/paper. You will give an in-class presentation on this project towards the end of the semester. Mid-way through the semester you will submit a written abstract of your proposed topic, and we will meet to discuss your plan. The goal here is for you to take a topic covered in class and explore it more in-depth, or to weave in new material with a different topic of your choice. Your project will consist of a research paper, together with original artwork which illustrates your topic. You will present your project to the class, explaining the mathematical content and your choice of artistic rendering of it. Projects/presentations will be graded on both content, style, and originality. The project/paper will count as 25% of your grade, and the presentation will count as 10%.

For example, if your topic were Celtic knots, your paper might give an overview of the different types of Celtic knots, some of the history and uses of this art form, and some discussion of the mathematics (“knot theory”) which is exhibited in one type of Celtic knot. Your artwork might consist of illustrations of Celtic knots, done on paper or canvas, or in thread on fabric, or in a quilt.

For a second example, if your topic were kaleidoscopes, your paper might discuss the history of the kaleidoscope, the method of construction of a kaleidoscope, and the mathematics behind the images one sees when looking through a kaleidoscope. Your artwork would be an actual kaleidoscope (or more than one kind, if you like) that the class could try out!

**Timetable and Details:**

Given the size of our class, and the class time necessary for presentations, you will be doing the course project *in pairs*. I expect that each person will contribute fully to all aspects of the project. The following deadlines will apply. Your current writing assignment is to complete the first part.

- **March 19th:** Submit a brief description (no more than *1 page*) of the area you will be researching, along with a list of possible sources, and the names of both students in your project pair. Please list your sources using standard format for citations.  
**Grading:** this portion counts as 3% of your course grade and will be graded credit/no-credit. Credit will be given to a proposal containing a clear description of the area you will be researching, and at least three possible sources (with complete citations).
- **March 31st:** Submit an outline of your paper, and a proposed description of your artwork. The outline should be *1–2 pages* and should describe the order of material to be discussed, and the mathematical arguments/explanations to be given. If you are including images in your paper (other than your own original artwork), a list of these images and their sources, and a brief description for each image, should also be included. Please do your outline in the standard format (using headings I., A., a., i., etc), keeping one point to each (sub)heading.  
**Grading:** this portion counts as 4% of your course grade, and will be graded based on the clearness of your outline and artwork/image descriptions.

- April 21st: Submit a copy of your project paper, and copies or photographs of your artwork. You should keep a copy of the paper to use for making up notes for your presentation. You should also keep your original artwork, which you will turn in on the date of your presentation. **Grading:** this portion counts as 18% of your course grade, and will be graded based on the following merits:
  - Mathematical accuracy: 20%
  - Grammatical correctness (spelling, grammar, flow): 15%
  - Connections between mathematics and art/nature: 30%
  - Good use of examples to illustrate these connections: 5%
  - Original artwork (creativity and craftsmanship): 30%
- April 21st – May 3rd: Course projects will be presented to the class during our regular class meetings, and during two make-up classes (for classes cancelled on March 22nd & 24th). As the time approaches, I will bring a sign-up sheet to class and everyone will sign up for a presentation slot. Attendance during this period is still required even if your pair is not presenting on that day. (Everyone can learn something interesting from what another pair chooses to present, and you all deserve a good audience!) NOTE: You may use your choice of the chalkboard, overhead projector for transparencies, Powerpoint, etc. during your presentation. Just let me know in advance if you will be using more than the board, so I can have the appropriate things set up! **Grading:** this portion counts as 10% of your course grade, and will be graded based on participation (each student in a pair should take part in some way), clearness of explanation, and full use of allotted time.

### Possible Project Topics

This is meant to give suggestions if you have no idea what you might want to research! There are certainly other worthwhile possibilities, so if you have something different in mind, just run it by me early next week. Chances are it will be fine, and you can proceed.

- Mathematical techniques for creating artwork:
  - Further study of Pointillism, or Cubism.
  - Celtic knots [see <http://www.wallace.net/knots> for some instructions, and a list of other sources].
  - Kaleidoscopes [see <http://mathforum.org/mathed/nctm96/games/hannigan/>].
  - Curve stitching [see <http://www.public.asu.edu/~aaafp.rhythm.html> or [http://ccins.camosun.bc.ca/~jbritton/string\\_art/](http://ccins.camosun.bc.ca/~jbritton/string_art/)].
  - Penrose or other aperiodic tilings.
  - Rosette patterns [ask me for a copy of Section 5.2 from Kinsey & Moore].
  - Islamic star patterns [see <http://www.cgl.uwaterloo.ca/csk/washington/taprats/>].

- Mathematical origami [see Tom Hull’s website, or any of our other links].
  - Mathematical quilting.
  - The Mandelbrot and Julia sets (fractals) [see <http://aleph0.clark.edu/~djoyce/julia/julia.html>].
  - String art [see <http://www.geocities.com/SoHo/Workshop/9155/thread/book.html> and <http://www.mathcats.com/crafts/stringart.html>].
- Specific mathematically inspired artists:
    - The sculpture of Helaman Ferguson [see <http://www.helasculpt.com/>].
    - The sculpture of John Robinson [see <http://www.cpm.informatics.bangor.ac.uk/sculpture/sculpture.html>].
    - The polyhedral artwork of George Hart [see <http://www.georgehart.com/>].
    - Dick Termes and his six-point perspective Termespheres [see <http://termespheres.com/>].
    - The work of Tony Robbin inspired by the fourth dimension [see <http://tonyrobbin.home.att.net>].
    - The string art of Naum Gabo, and Henry Moore.
    - The geometric art of Kazimir Malevich.
    - Josef Albers and his paintings on squares.
    - (For others, see Peterson’s book.)
- Mathematical analysis of indigenous and historical artwork:
    - Ethnographic studies of frieze patterns. [see <http://www.nrich.maths.org.uk/mathsf/journalf/nov98/art1/> (frieze patterns in cast iron)].
    - The use of geometry in Native American artwork [see <http://www.earthmeasure.com/>].
    - The mathematics of mazes [see <http://www.math.sunysb.edu/~tony/mazes/index.html>].
    - Analysis of cultural tilings [see <http://mathforum.org/sum95/suzanne/historytess.html>].
    - The use of the sacred cut in classical architecture [see <http://www.dartmouth.edu/~matc/math5.geometry/unit7/unit7.html>].
    - The creation of curves by different cultures [see Ch 6 of Marcia Ashcer’s book *Mathematics Elsewhere* in the Science Library.]
- Mathematics in nature:
    - Further exploration with Fibonacci numbers, and/or the Golden Ratio.
    - Fractals and “Self-similarity” in nature: plants, coastlines, snowflakes, galaxies, DNA etc. [see <http://www.amherst.edu/~rloldershaw/nature.html> for an article and further reference].