

MATH 109: MATHEMATICS FOR DESIGN

Spring 2011 Course Syllabus

In our contemporary culture the dialogue between math and art, while sometimes strained by misunderstandings, is a dynamic and living one. Art continues to inspire and inform mathematical thinking, and mathematics helps artists qualify abstract reasoning about the content and structure of their work. The tools of mathematics also aid in the construction of conceptual frameworks that artists can use to develop critical thinking.

This course will introduce students to ideas in mathematical thinking that are related to artistic considerations. Students will need to show proficiency with some mathematical ideas and then apply those ideas in creating their own works of art. In the process, students will also be called to analyze existing artwork with a mathematical eye. In this way, students will be provided a new tool to use in their approach to art and aesthetics.

Course details

Time: MWF 10:20 – 11:30am

Place: PPHAC 235 (Mon, Wed)
PPHAC 113 (Fri)

Instructor: Kevin Hartshorn

Office: PPHAC 215

Hours: TuWTh 9–10am,
or by appointment

e-mail: hartshorn@math.moravian.edu

Web: <http://math.moravian.edu/hartshorn/109/>

Text: *Squaring the Circle: Geometry in Art and Architecture*, by Paul Calter

COURSE GOALS

As an F2 course, students are expected to gain a sense of how mathematics can be used for presenting and interpreting data. In this course specifically, I propose the following goals:

1. Students will be able to create an effective representation of data – this may be graphical, verbal, or numerical, depending on the data. Students will be able to effectively choose the appropriate method for presenting data, and will be able to create a presentation that is both useful and aesthetic.
2. Students will be able to recognize and discuss relevant mathematical content in new artwork. They will be able to discuss the intentionality of the mathematical content.
3. Students be able to create an original piece of art utilizing and/or illustrating mathematical concepts. Concepts students should be able to incorporate in their artwork will include fractals, the geometry of perspective, Euclidean objects (polygons, polyhedra, circles, etc.), and geometric transformations (rotations, translations, dilations, etc.).

MATERIALS FOR CLASS

Students are responsible for bringing materials to class. Each student should purchase the following materials for use during the course. Items in bold should be brought to class every day.

- (a) **Required text** – *Squaring the Circle: Geometry in Art and Architecture*, by Paul Calter
- (b) **Pencils** – either mechanical pencils or wood pencils with a portable blade-sharpener.
- (c) **Eraser** – the little nub on the back of your pencil is not enough. Buy a pink eraser.
- (d) Colored pencils, crayons, colored pens – some means for creating color images
- (e) **Ruler** – at least 12 inches (18 inches is even better), marked with both inches and centimeters
- (f) **Paper** – you should have 8.5 by 11 inch loose-leaf paper, both lined and blank. Do not submit work that has been ripped out of a spiral notebook.
- (g) Digital camera – you will be asked to take and share photos at several points during the semester.

In addition, if you have a computer of your own, I recommend purchasing the student's version of *Geometer's Sketchpad*, but this is not required. Further, you will need to purchase materials for completion of your projects during the semester.

ASSESSMENT

To assess your project, we need to look at your growth in computational ability, your engagement with the course, and your synthesis of mathematics and aesthetics. We will thus compute grades using the following activities:

- 20% Preparation and participation (average over all submissions)
- 20% Homework and writing (average over all submissions)
- 20% *Sketchpad* and *Excel* activities (average over eight activities)
- 20% Art projects (average of four art projects)
- 10% Midterms (average of two midterms)
- 10% Final exam

For this class, you can translate percentage grades to letter grades by this rough guide: 85% or above is an A (+ or –), 70 – 85% is a B (+ or –), 60 – 70% is a C (+ or –) and 50 – 60% is a D (+ or –). You can review the student handbook (<http://www.moravian.edu/studentLife/handbook/academic/academic.html>) for a qualitative interpretation of the grades “A,” “B,” and so on.

Remember that the final assignment of grades will be based on my judgement as professor of the course.

PREPARATION AND PARTICIPATION

To help foster a deeper discussion in class, you will be asked to read and reflect on new material before most class meetings. At the beginning of class, I will either collect a short writing response from the reading or give a short quiz about the reading (this will be made clear during the semester).

Note that these assignments are in preparation to participate in class. Thus you cannot receive credit for an assignment toward a class that you miss. If you miss a class for any reason, you will get a zero on the preparation/participation score for that day.

Attendance and classroom norms

There are no “excused” or “unexcused” absences. Missing a quiz or class preparation submission merits a “0” regardless the reason for missing class (including illness, sporting events, or family emergencies).

In addition, your preparation/participation grade may be penalized if your conduct detracts from the learning environment in the classroom. Detractions include arriving late, texting during class, interrupting/disrespecting others, or refusing to participate.

If you know that you will be missing a class, be sure to inform me as soon as possible so you may get any missed worksheets or assignments.

Missing in-class activities

Several activities depend on everyone attending. You can find a complete list of important dates on the last page of this syllabus. *Inform me in advance if you know you will miss a class*. Sometimes special arrangements can be made.

- *Sketchpad/Excel projects*: It is your responsibility to complete the project by the deadline. The due date for these projects will not be postponed because you missed a class.
- *Homework and Art projects*: If you cannot attend class, it is your responsibility to get any work due submitted. Work that is up to 48 hours late will be accepted, but with a 20% penalty. Work more than 48 hours late will receive a zero.

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- “*Barn-raising*” activities: If you miss one of these activities, it is your responsibility to meet with me to determine the appropriate make-up assignment.
- *Midterms*: Missing a midterm will merit a score of zero. There are no make-up midterms.

New York trip

Attendance will not be taken on the day of the art trip to New York City.

HOMEWORK AND WRITING

There will be regular problem sets and writing assignments to help work through the ideas in the course. Unless otherwise specified, all assignments are due by the end of the class period of the date due and will be scored on a 10 point scale.

SKETCHPAD AND EXCEL PROJECTS

Geometer's Sketchpad and *Excel* are available on all campus computers – both Mac and Windows machines. In addition, you can purchase a student version of *Sketchpad* if you wish to install it on your own computer (<http://www.keypress.com/x24119.xml>).

Computer assignments will be completed and submitted electronically. Details will be provided with the first assignment.

ART PROJECTS

There will be four projects assigned through the semester that will have you create a piece of artwork based on given parameters (often specified mathematical ideas) and write a short description of the artwork, including the role that mathematics played in your creation.

The projects for this semester will be:

1. Sketch a perspective drawing of a building or architectural feature in town.
2. Create a representation exploring or illuminating an idea in planar geometry.
3. Make a three-dimensional representation of a polyhedral object.
4. Create a piece of art on any topic connected to the course.

A rubric and complete description for these activities will be provided during the semester.

MIDTERMS & FINAL EXAM

There will be two midterms: **Wednesday, February 23** and **Wednesday, April 6**. Be sure to mark these dates on your calendar, as make-up exams are generally not given. The final exam will be on **Wednesday, May 4 at 8:30am**.

Details will be provided preceding each exam.

ACADEMIC HONESTY

Everyone is expected to adhere to Moravian College's Academic Honesty policy, as described in the Student Handbook (<http://www.moravian.edu/studentLife/handbook/academic/academic2.html>).

With each activity, particular notes on how the policy applies will be explained. Please ask if you have questions about the policy in this class.

LEARNING SERVICES

This course asks for communication in class – both written and oral. You will be asked to do a significant amount of reading, take timed exams, and complete homework based on work done in class.

If you have a documented disability that may impact any of these activities, please see Learning Services as soon as possible so that arrangements can be made.

Last updated: January 18, 2011

FINAL REMARKS AND DISCLAIMERS

- If you have any questions, concerns, or comments about the course, please feel free to contact me in my office or by e-mail (hartshorn@math.moravian.edu).
- This syllabus is subject to change. The latest version of this syllabus can be found on the class website (<http://math.moravian.edu/hartshorn/109>).
- Final determination of your grade will be based on my judgement as professor.

Key dates for the semester

Keep in mind that the topics are subject to change, and date may need to be adjusted. Please see the class web page (<http://math.moravian.edu/hartshorn/109>) for the latest version of the syllabus.

- Friday, January 21** *Excel* activity: Sequences and Ratios
- Friday, January 28** *Sketchpad* activity: Introduction to the software, basic constructions
- Friday, February 4** Taping activity (there will be a room change for this activity)
- Friday, February 11** *Excel* activity: Perspective by the numbers
- Friday, February 18** *Sketchpad* activity: Polygons and polygrams
- Monday, February 21** Art project: Perspective sketches
- Wednesday, February 23** Midterm 1
- Friday, February 25** *Sketchpad* activity: Tilings
- Wednesday, March 2** Results of symmetry scavenger hunt
- Friday, March 4** Class tiling activity (Islamic tilings)
- Friday, March 18** *Sketchpad* activity: Circular geometry
- Monday, March 21** Art project: Planar geometry
- Friday, March 25** *Sketchpad* activity: Gothic architecture and round design
- Friday, April 8** Barn raising project: Polyhedra
- Wednesday, April 6** Midterm 2
- Friday, April 8** ~~Barn-raising project: Polyhedra~~ New York City Art Trip
- ~~**Monday, April 11** Art project: Polyhedra~~
- Wednesday, April 13** Art project: Polyhedra
- Friday, April 15** *Sketchpad* activity: Generating fractals
- Wednesday, April 20** Class discussion: Facts and myths about the golden ratio
- Wednesday, April 27** Barn-raising project: Menger sponge
- Friday, April 29** Art project: Open choice
- Wednesday, May 6** Final exam (8:30am)