

# Math 109 – Math for Design

Kevin Hartshorn – Spring 2006

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## Vital Information

### Class Meeting

MW 8:50am – 10:00am  
Day House

F 8:50am – 10:00am  
Graphics Lab (lower level)

### Required Text

Visualization of Quantitative Information, by Edward Tufte

### Computer Application

Geometer's Sketchpad will be used extensively in this course

### Other Materials

You will need a calculator.  
You will also need a folder for keeping journal and culture point assignments together.

## Contact Information

### Office

PPHAC 222

### Office hours

Mon 2:30–4:00pm  
Tue 8:30–10:00am  
Thu 1:30–3:00pm

### e-mail

[hartshorn@moravian.edu](mailto:hartshorn@moravian.edu)

### Class Web-page

<http://www.math.moravian.edu/hartshorn/math190>

### On-line resources

MathArt.org – artwork inspired by and for illuminating mathematics  
<http://emsh.calarts.edu/~mathart/>

The homepage for Tufte  
<https://www.edwardtufte.com:443/tufte/>

Artwork from the joint MAA/AMS meetings in January, 2006  
<http://myweb.cwpost.liu.edu/aburns/jmm06/jmm06.htm>

Two math for design courses online:  
<http://www.math.dartmouth.edu/~matc/math5.geometry/>

<http://www.math.nus.edu.sg/aslaksen/teaching/math-art-arch.shtml>

## Description of Course

Although it is not always recognized by the general population, there is a strong connection between mathematics and art. Mathematics searches for constructions, theorems, and proofs that are logical, consistent, important, and – perhaps most importantly – elegant. The tools of mathematics are useful not only as applied structures (such as the geometric symmetries of frieze patterns), but also as analytic tools useful in any field of academic study.

The intent of this course is twofold: one is to provide some basic mathematical tools and techniques that I hope you will find useful throughout your career; the other is to provide some perspective on the nature and history of mathematics, particularly as it relates to the artistic world.

I have the following goals in the design of this course:

- To provide a basic level of numeracy
  - To provide a mathematical perspective to design by understanding the geometric underpinnings of symmetry, similarity, congruence
  - To develop an awareness of the importance of clear and unambiguous presentation of information
  - To foster an appreciation and understanding of the role of mathematics in the world of art
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## Course Content

This is not an outline of the course. Rather, it is a sampling of the topics I hope to cover, to help provide an idea of what you might expect:

- *Numeracy and algebraic thinking*  
Topics include mental arithmetic, fractions and ratios, basic equations, irrational numbers, interesting sequences and constants
  - *Statistics and graphical literacy*  
Topics include different types of graphs, coordinate geometry and graphs of functions, mean, median, standard deviation, various ways of presenting data
  - *Geometry and symmetry*  
Topics include wallpaper and border patterns, the golden ratio, basic geometry constructions, polyhedra, fractals
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## Course Structure

The twofold nature of the course – developing mathematical content and exploring the nature of mathematics – lend themselves to two very different sorts of work.

- Developing mathematical content will be done through problem sets and in-class exams. In addition, there will be worksheets using *Geometer's Sketchpad* and two major projects that will take advantage of mathematical content.
- Exploring the nature of mathematics will take place through in-class discussion, regular journal entries responding to readings, developing the two major projects, and “culture points”

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## Homework and Quizzes

I will **not** be collecting homework, although I will provide resources for you to check your work. Homework is for your benefit, and it is your responsibility to ensure that you know how to complete all the problems in the homework. Instead, there will be quizzes at least twice a week. Quizzes may take several forms:

- Testing your reading of the text (see “Reading the Text” below)
- Testing your ability with a specific technique from class
- Checking to see that you have managed to complete the homework

Quizzes will generally take the first 10 minutes of class. ***You will not be given additional time for quizzes if you are late.*** If you miss a quiz, ***there are no make-up quizzes.***

A Quiz on your homework may take one of two forms:

- A quick look at your homework to see that you have done all problems. I will be looking so see that you have shown your work, clearly arrived at an answer, and presented your work neatly. Note I will **not** be looking at accuracy.
- Transcribe a homework problem: I will carefully grade one or two problems from the homework that you transcribe onto a clean piece of paper.

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## Reading and writing

Success in this course relies on all of us coming to class prepared. To that end, there will be regularly assigned readings both from Tufte’s text and from other texts that will be on reserve at Reeves.

I will provide worksheets guiding you through the readings, and there will regular writing assignments (journals) that will provide the opportunity to reflect and process the new information in the class.

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## Geometer’s Sketchpad

To help in the exploration of geometric ideas, we will be using a program called *Geometer’s Sketchpad*. This will give us a chance to visualize geometric constructions, transformations, symmetries and graphs in a dynamic, interactive environment.

As we work through topics using *Sketchpad*, there will be worksheets that you will need to complete and submit for grading.

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## Projects

To help develop problem-solving, team work, technical writing, and to generally make the subject more interesting, I will assign group projects during the semester. Details on the group projects will be provided later.

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## Exams

There will be three exams in addition to the final exam. The dates for the exams are Wednesday, ***February 8***, Friday, ***March 3***, and Wednesday, ***April 12***.

Details on the exams and the date of the final exam will be provided later.

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## Culture Points

A key component of this class is to provide you with a perspective of the role of mathematics in the life of an artist. For this perspective, you need to develop an understanding of what mathematics actually is and how it relates to the world around us. Over the course of the semester, you will complete a sequence of “cultural activities” to help gain an understanding and appreciation of mathematics. There are no particular assignments for culture points, rather there are opportunities for you to participate in events: conversations about mathematics, articles, colloquia, special

problems. For each event in which you participate, you will be awarded points based on the short written summary/reflection on the event.

To get a full 100% score for culture points, you will need to acquire 15 culture points over the course of the semester. Details on culture points will be provided in a separate handout.

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## Grading Policy

When assigning letter grades at the end of the course, I generally use the 4 point scale from the student handbook as a baseline for grading. This means that (generally speaking), 85% or better is an A (+ or -), 65% or better is a B (+ or -), 50% or better is a C (+ or -). Note that these are only guidelines and are subject to change. Also note that I do not assign letter grades to exams or homework, but you can get a feel for how well you did by measuring your percentage score to this scale. To determine your numeric grade at the end of the course, I will use the following distribution:

15%	Homework and quizzes (average of quiz scores)
10%	Group projects (average of project scores)
5%	Culture points
15%	First midterm (Wednesday, February 8)
15%	Second midterm (Friday, March 3)
15%	Third midterm (Wednesday, April 12)
25%	Final Exam (in-class, time and place to be announced)
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100 %	Total possible score for the class

## Attendance

Although I will not be taking attendance, you will not learn the material if you do not come to class. There is no “textbook” for learning the material – learning will take place through in-class activities and discussion. If you miss a quiz or exam, ***I do not allow make-up quizzes/exams*** as a general rule. Otherwise, you have sole responsibility for all work and information you may miss by not attending class, regardless the reason.

***If you know you will be missing class***, let me know as soon as possible in case special arrangements need to be made. If I am given sufficient notice, I might be able to indicate readings you might do to help keep up with the work in the class. ***If you miss class for an unforeseen reason*** (sudden illness, car breakdown, etc.), send me e-mail ([hartshorn@moravian.edu](mailto:hartshorn@moravian.edu)) as soon as possible. Generally if you miss a quiz for a legitimate reason, I can give you an excused miss so that you are not penalized. Otherwise, I can send you a reply e-mail with any handouts I passed out in class.

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## Academic Honesty

Students will be expected to adhere to the standard of the Academic Honesty policy as described in the Student Handbook (pages 51-53). Any violations of this will result in severe penalties on the assignment, a report to the Dean, and the very real possibility of failing the course. For specific application to this course, not the following:

- ***Honesty in Homework:*** I believe that mathematics must be a group effort. Your work with classmates will do wonders in helping you internalize the new information. Thus you are encouraged to work with your fellow students on all problem sets and general homework problems.
- ***Honesty with GSP Assignments:*** These assignments should be your own work. While you may discuss difficulties with your classmates, each person should complete the assignment on their own.
- ***Honesty on the Group Projects:*** When working on the group projects, each group will submit a single response to the problem. Obviously, you must collaborate with the other members of your group in order to complete the assignment. You may use any materials distributed in class, but you may ***not*** use any other sources or reference tools without specific permission from the instructor. You may not consult with anyone outside the group, other than the instructor.