

INSTRUCTOR: Janice Sklensky

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PUBLIC COURSE WEB PAGE (links to publicly available course information, such as these course policies and the syllabus, homework, projects, and study guides): Go to my public home page at

<http://acunix.wheatonma.edu/jsklensk/home.html>

and click on the link for this course.

ONCOURSE PAGE (where I post less public course information, such as all the displays and in-class work that I show during class, my daily schedule, additional course readings): the OnCourse page for this course

MEETING TIMES: MWF 11:30-12:20 in Mars Science 1141

OFFICE HOURS: Posted on-line: go to OnCourse page for this course - click on *My Daily Schedule*. You will see my office hours, and will also see times when I might be free to make an appointment with you if necessary.

COURSE MATERIALS:

Required: Various chapters that I have gathered together into a binder for you, available from me for the cost of the materials and labor. Also, a ruler, graph paper, a small calculator, and some art supplies, to start with; if I think of more, I'll let you know. The ruler and the calculator must be brought to class every day.

Additional materials will be on-line. Most "handouts" for this class will in fact not be handed out, but instead will be posted on the web, in an effort to use less paper.

CONNECTION: This course in combination with any one of Art History 102, 111, 202, or 211 forms a 2-course connection.

OVERVIEW

In this course, we will explore several math topics that are connected to visual art. The topics we will study will include (but may not be limited to):

- *Systems of Proportions*: we will begin by reviewing the concepts of proportionality and ratios. We will then investigate how artists and architects can use proportion in their work, and learn about several specific systems of proportionality that have been used by artists or architects through the millennia. We will also develop standards for judging whether it is reasonable to conclude that a specific system of proportions was used in building a temple or creating a work of art.
- *The Golden Ratio*: we will learn Euclid's definition of the Mean and Extreme Ratio and investigate how this leads to the famous constant  $\varphi$ , the Golden Ratio. We will investigate whether it appears in the Great Pyramid, and through projects you may investigate various other works. We will also investigate the connection between the Golden Ratio and the sequence of numbers 1, 1, 2, 3, 5, 8, 13, 21, . . . . After reviewing the

concept of similar shapes from geometry, we will see how the Golden Ratio answers a question posed by the Greeks involving similar rectangles.

- *Perspective*: we will learn the 3-dimensional coordinate system, and learn how we can combine this idea with geometry to develop some very precise rules for drawing with depth. We will use our ideas both to do some drawing and to investigate the perspective in classic art works.
- *Fractals*: we will learn about self-similarity, fractional dimension, iteration, and complex numbers. We will then see how these ideas lead to some very cool pictures, and create some ourselves. We will also see some pictures from hundreds of years ago that appear remarkably fractal in nature, and discuss how mathematicians and computer scientists use the idea of fractals to create very realistic looking clouds, mountains, and trees, and other natural objects that can be used in graphics.
- *The Fourth Dimension and Non-Euclidean Geometry*: we will learn about the concept of a fourth spatial dimension and, if time, a type of geometry that does *not* assume that parallel lines never meet; we will also explore . We will discuss how the cubists were inspired by these ideas.

#### COURSE STRUCTURE, GOALS, AND EXPECTATIONS:

The main goals for this class are to

- use your interest in art to motivate learning mathematics that can be used to create, analyze, or understand various works of art, thus honing your logical abilities,
- help you gain an appreciation for how beautiful math can be by actually being able to *see* some of what it can do,
- begin to give you a feel for how universal a language math is, rather than the isolated field many people believe it to be.
- give you a deeper and more layered appreciation for some of the art you see.

In this class, as with all others, how much you actually learn is entirely up to you. Math is a subject you can only learn by doing—observing me (and others) may give you a start, but it is certainly not enough. The course is structured to give you repeated opportunities to work with the material, in varying forms and levels of depth and complexity.

The lecture format for classes was developed at a time when books were scarce – lecture consisted of the teacher dictating the textbook and students copying it down. That is certainly not necessary in this day and age – what *is* increasingly needed is an ability to process technical writing. Your initial exposure to the material will therefore come through your reading of the text before each class. Class time will be devoted not to my presenting the information to you for the first time, but to me helping you to work your way to a deeper understanding of the material. More and more studies of how students best learn indicate

that watching a professor lecture for 50 minutes at a time 3 or 4 times a week is in fact not a very good way for students to learn: students benefit immensely from an opportunity to both practice what they've learned and to discuss the concepts with fellow students. Class itself will therefore often combine lecture with opportunities for in-class work in small groups on introductory problems so that you may *do and discuss* what I've just shared. These efforts should help crystallize your understanding of the material, *or* to help you identify where some confusion is arising. This initial exposure is followed by weekly homework problem sets consisting of a combination of drill problems (where feasible and helpful) and more conceptual questions. For a greater variety of opportunities to understand the material, and to see how it relates to art, there will be several projects for you to choose among. Finally, there will of course be exams, which encourage you to look at the big picture and fit the material into its place in the course, as well as to re-visit the material after you've learned the basics and to see it more clearly.

The expectation for all classes taught at Wheaton is that you spend 2 to 3 hours of work outside of class for every hour in class. Since this class meets for 3 hours a week, no matter what your experience has been in other classes,

Plan to spend *at least* 6 hours a week on this class outside of class!

Some students may be able to succeed with fewer hours per week, many students will require an average of 9 hours a week or more. Of course, some weeks you may spend more than 9 hours on this class, especially when studying for an exam or working on a project, while others you may spend less than 6, but it's best if you have the time set aside to work on this class.

#### IS THIS THE RIGHT MATH COURSE FOR YOU?

This course is intended for students who are interested in art or art history. If you are not especially interested in these topics, we may well offer a different math class better suited to your interests. The more background you have in art and/or art history, the more you will get out of this class, I believe. For that reason as well as the fact that some majors require or recommend specific math courses, it's often a good idea to wait to take this class until you are at least a sophomore. But if you're a first-year whose heart is set on taking this class now, don't worry – it's certainly accessible to you.

The only mathematical pre-requisites for this course is some basic algebra and geometry. Other than that, all that is required is a willingness to *truly* try and an interest in the material.

#### CLASSROOM ETIQUETTE:

I would like to provide a classroom atmosphere with minimal distractions for both you and me, in which all students feel comfortable asking a question or contributing to a discussion. I therefore ask that you show both me and fellow classmates respect when it is my or their turn to speak.

This not only means that I ask that you not talk or whisper while someone else is speaking,

but that you refrain from:

- texting
- using a computer during class, unless you have accommodations that encourage typing notes using a computer; if you do, please let me know and also get the accommodations letter to me as quickly as possible.

Ask me questions when you do not understand something. I know it can be uncomfortable, but I can guarantee you that 95% of the time, if you have a question, so do at least three other people in the classroom!

When we are covering material that you've seen before or which comes easily to you, please be considerate of those for whom it is new or difficult.

#### CLASS PARTICIPATION

As with any class, you will get more out of it if you actively participate. To encourage you, I am including class participation in your overall grade. This includes attendance, being on time, paying attention, asking constructive questions in and out of class, answering questions that I pose, listening respectfully to your classmates, working with classmates to investigate problems when I ask you to, giving helpful feedback to classmates when that is required, having a general aura of interest, and other similar aspects of good academic citizenship.

I plan to pay attention each day to the ebb and flow of communication and participation; active and constructive participation will earn you 1 point, lack of participation will earn you no points, and active destructive participation (repeatedly arriving late, talking while I'm talking or otherwise distracting class-mates, asking questions that essentially ask me to repeat what I already said because you weren't paying attention or weren't there, a lack of focus during in-class work times, for instance) will take away 1 point from your total. Please be aware that repeated absence will cause you to lose participation points – if you miss more than three classes, each subsequent absence will result in an increasingly large number of lost points.

#### PROBLEM SETS

While a portion of this course will focus on how math has appeared in art, most of the focus will be on learning the math itself – and to help you with this, I will be collecting homework. There are numerous reasons to collect and grade problem sets: so that your grade does not rest solely on exams and a few projects; to give you feedback as to whether you're understanding the material; to give me feedback as to whether anyone is having trouble, and to let me know whether I need to spend more (or less) time on material.

I have found that collecting homework every day is overwhelming to you, to me, and to the homework grader if we have one. For that reason, you will have *weekly* problem sets, due Wednesdays *at the beginning of class*. Let me emphasize, however, that the problem sets do reflect an entire week's worth of material, and should be worked on steadily throughout the week.

Late problem sets will have points deducted!

If turned in on Wednesday from the time I collect it to 3:30, I will deduct 0-15% depending on the situation. Problem sets turned in after 3:30 pm Wednesday and before 3:30pm Thursday will have 30% deducted. I can not accept any problem sets after 3:30pm Thursday of the week the problem set is due.

#### PROJECTS:

As this is a course that covers mathematics as it connects to art, creating some art work using the mathematical ideas you've learned is a fun and challenging way to put the material you've been learning into action. There will be many opportunities throughout the semester for you to do just this! There will also be projects that do not involve creating artwork, for those of you who feel your talents lie elsewhere.

Here's how the projects work. This portion of the class will be worth 20% of your final grade. To get the full 20%, you need to receive 100 points on projects –just as, to receive the full 25% on homework, you must get full credit on every problem set. How do you get those points? I have 12 projects for you to choose among. This does not mean that you will *do* 12 projects but that you will choose 4-7 that either appeal to your interests or best fit your schedule. No **single** project will earn you the full 100 points that is your goal. Different projects can earn different maximum amount of points, and how much *you* earn on your projects will depend upon the extent to which you incorporated math in the work, the correctness and the sophistication of the math you used, the clarity of your explanation, and (if the project involves creating art) the creativity and effort you put in to the art, and to a lesser extent (as this is not an art class) the quality of the art. Just keep doing projects until you reach 100 points. For more details, see the link on my public course web page.

Several projects consist of using mathematical ideas to construct a work of art, and of writing a description of the math involved that could be easily read and understood by your friends in the class. Others will consist of analyzing a work of art, or reading books or articles and analyzing them. In order to give you the opportunity to (to some extent) choose those projects which most appeal to you, best into your schedule, and have a chance of adding up to 100 points, I have listed the 12 projects, along with their due dates, on the web. Follow the links from the public course web page. Just be aware that the points listed are the *maximum* possible – how many I would give to a very strong work that fulfilled every aspect of the project's description; often times projects end up earning significantly less than the maximum as students didn't explain their work or incorporate the math sufficiently. Last time I taught this course, the students who successfully earned 100 or more points averaged nearly 5 projects apiece, and some did as many as 7.

You may also propose other ideas for projects to me, if I've missed a good possibility.

I will announce in class when a project is within 2 weeks of being due. Most projects will be due on Fridays at 2:30pm.

Late projects will have points deducted!

If turned in on Friday after 2:30pm but before 5:00pm, I will deduct 0-15% depending on the situation. Projects turned in after 5:00 pm Friday and before 9:00pm Monday will have 30% deducted. Projects turned in after 9:00am Monday will have between 30% and 50% deducted, but if you are prepared to earn only half-credit, you may turn a late project in anytime up until the last day of class.

#### EXTRA CREDIT:

There are a few ways to earn extra credit in this class:

- (The most reliable way) If you earn more than 100 points on the projects, the extra points will count as extra credit.
- If you have suggestions on how to improve the chapters I have written for this course – the introduction, Chapter 1, Chapter 2, and (if I finish it in time) Chapter 5 – you can earn extra credit for those as well. This will range from a few points for a non-math related typo to a few more points for a math related type to still more for clarification of a mathematical explanation.
- Depending on what sort of seminars are given this term, there *may* be extra credit available for attending one and writing a brief description of it for me.

#### EXAMS AND FINAL:

During the semester, I will give three midterm exams to make sure that you are putting together the concepts and skills we have covered. The primary emphasis of the exams will be for you to show me how well you've mastered the underlying mathematical ideas. The dates of all exams are fairly firmly scheduled, and are listed on the course syllabus. The timing of the midterm exams, however, is not yet determined: I will be giving them outside of class, either in the afternoons or evenings. The final will be cumulative and will be 3 hours long. Remember that finals can not easily rescheduled, and make your travel plans accordingly.

**Notify me in advance** if you will be missing a midterm exam. If your reason for missing is acceptable, we will arrange that you take the exam **early**. If you miss an exam without notifying me in advance, I reserve the right not to give you a make-up exam. I will not give any student more than one make-up exam during the semester, without extensive documentation of a significant reason backed up by the advising office.

#### ATTENDANCE:

While you do have some reading sources, much of this course is only available through the classes. Thus missing this class is clearly not a wise idea. If you **do** miss class, you are responsible for the material that was covered. *Warning:* – I can only keep one day's worth

of events in my head and may not remember something important, so ask your friends as well as me.

Also, as I mentioned earlier, once you miss three classes, your absences will begin to count against your participation grade: the more classes you miss, the more points you will lose.

#### ACCOMMODATIONS:

In compliance with the Wheaton College policy and equal access laws, Dean Wilhelm is available to discuss appropriate accommodations that may be recommended for students with disabilities. Requests for accommodations are to be made during the first two weeks of the semester so that timely and appropriate arrangements can be made.

Students are required to register with Denyse Wilhelm, Assistant Dean of Academic Resources and Disability Services, ADA/504 Coordinator, whose office is located in Kollett Hall, first floor at the Filene Center for Academic Advising and Career Services. Contact ext. 8215 to schedule an appointment, or email Dean Wilhelm at [wilhelm\\_denyse@wheatoncollege.edu](mailto:wilhelm_denyse@wheatoncollege.edu).

#### EVALUATION

I expect to use the weights below, although I reserve the right to shift the balance around some if the semester does not go as expected.

Class Participation	5%
Problem Sets	25%
Projects	20%
Midterm Exams	30%
Final Exam	20%

If you question the fairness of any grade, bring it to me **within a week** of receiving it.

#### HONOR CODE

You are expected to abide by the Honor Code in all your work at Wheaton.

As part of the honor code, you are required to write *I have abided by the Wheaton College Honor Code in this work*, followed by your signature, on all written assignments.

Below, I detail how the Honor Code relates to the various assignments and exams in this course.

- **If you see a violation of the Honor Code occurring that relates to this course, you are bound by the Honor Code to report it.** If you do not feel comfortable reporting it to me, the chair of the department or Dean Kuszaj are other resources.
- **For all assignments and projects:** You may discuss the work with classmates, and you may use references that help you figure out how to do a problem on your own, but you may not use any references (people, other people's projects or assignments, books, the web) which either give you the answer or lead you directly to the solution.

- **When you do use references** (as described above), you *must* cite them. For instance, if you work with friends on an individual problem set, or if you get help from a tutor, write something like *I worked with Joe Friend on this assignment*, or *I received help from Jane Tutor on Problems 3, 4, and 7*.
- **Group Problem Sets:** Groups may only consist of 2 or 3 people. You must understand all the work that is being submitted under your name. This means:
  - You must make every effort to meet with your group at all meetings. You may not purposely exclude any member from a meeting.
  - **You may not divide the work!**
  - You must make every effort to participate and aid in finding the solutions. If you don't understand what someone else is saying, you must ask them to explain it. If someone asks you to explain your ideas, you must take the time to explain them.
  - **Do not put your name on, or allow your name to be put on, any assignment to which you did not substantially contribute mathematically.** If for whatever reason you do *not* participate in the development of the solutions, your name may not appear on the group's work. So if you can't find your group's meeting, work on it on your own and let me know. Sometimes you can manage to merge solutions at a later meeting; other times you'll have to turn in your own version (but that's only acceptable if I've given permission ahead of time). If on the other hand, you feel lost at the beginning of the assignment, do not just sit back and let others do the work or let people explain to you without your understanding it: make every effort to learn the material and to understand it by the time the assignment is turned in. Asking others to explain their thought process can serve as a significant contribution.
  - **Similarly, do not allow anyone else's name to be put on an assignment unless they worked hard with you to understand the material involved.** Do not allow a sympathetic understanding of how difficult that person's week was to overcome this – a student who has had a difficult week should come speak to me, and I will make a note of it on my gradesheet.
- **Individual Problem Sets:** You must write the results on your own, in your own words.
- **Projects:** Both the art work and the explanation of it must represent your own work.
- **Midterm and Final Exams:** You may not have your phone, or any device with access to the internet or phone lines, out at any time during the exam. You may not use any notes, books, friend or colleague. You may not look at anybody's exam until after all exams have been returned. You may not use a calculator unless I specify that you may, and you may not use a calculator that is part of a phone or MP3 player.