
MATH 110-02

Math Applications: Art

J-Term 2014 · Syllabus

Class Information

Instructor: Dr. Lauren Williams

Class Meeting: Hirt M209, MTWRF 11:30 - 2:30

Office: Old Main 401 (Tower)

Office Phone: (814) 824-2226

Office Hours: Mon 10:00 - 11:15, Wed 2:45 - 4:00, Thurs 2:45 - 4:00, Fri 10:00-11:15

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Course Description

Through the analysis of a single area of mathematical application, such as art, music, or politics, we will see how fundamental and traditionally studied mathematical elements are found in the underlying structure of problems, solutions, relationships, and works of expression and creativity. Once familiar with the mathematical building blocks of a certain area of application, the students will then synthesize these into an original contribution of their own, which may be a mathematical description of a phenomenon, a solution to a problem, a work of art, etc., depending upon the particular area of application. Students will find a number of ways to be successful in the class, including through presentation, homework and quizzes, projects, and examination. Specifically, we will discuss functions, graphs, trigonometry, probability, statistics, and logic.

In each class meeting, we will discuss a different topic that showcases the connections between mathematics and art. We will

- explain the impact of a mathematical understanding of linear perspective in art
- discuss the use of symmetry and the golden section in works of art as well as in nature
- explore how artists have attempted to illustrate complex mathematical ideas in their work, leading to entirely new genres of art such as Cubism
- review some of the different types of geometries, and how artists like MC Escher have visually described them
- explore how ancient societies viewed mathematics, and its impact on their works of art
- explain how geometry is used to create large scale works, such as architecture, and how these methods have changed over time
- explain how ancient and modern societies have used mathematics and celestial navigation to create maps and better understand their world
- view some examples of how computers can be used to create art based on mathematical algorithms

Attendance and In Class Quizzes

Attendance is required for this course. As each class meeting is approximately equal to a full week of class in a typical semester, just one absence means missing a significant amount of material. At the end of each class period, you will be given a quiz on the material presented during that class. You will be permitted to use your notes. You must be present for the quiz to take it - there are no make ups. The lowest quiz grade will be dropped, so you are allowed one unexcused absence. Let me know as soon as possible if you expect to miss more than one class.

Course Paper and Presentation

You will be expected to complete one project during the semester, including a paper and a class presentation. The topic for this project is entirely up to you, and you are highly encouraged to choose a topic of interest to you. The topic must incorporate a connection between mathematics and art, and need not be based topics discussed in class.

You may choose one of two project options: research or creative based. See the next page for more information about each option.

1. Abstract or Project Proposal - Due Friday, January 10
2. First Draft of Paper (optional, but highly recommended) - Due Friday, January 17
3. Paper - Due Friday, January 24
4. Presentation - January 23-24

The last two days of class are reserved for the *Math Applications: Art Student Symposium*. A schedule for the presentations, along with all abstracts and proposals, will be posted on the course website. Each student will give a 10 minute presentation summarizing their research or explaining their creative work.

Final Grades

Grades will be calculated out of 150 points as follows:

- 10 points - Abstract or Project Proposal
- 60 points - Final Paper/Project
- 30 points - Class Presentation
- 50 points - In Class Quizzes

Grading scale:

F	D	D+	C	C+	B	B+	A
0-59	60-64	65-69	70-77	78-83	84-89	90-93	94-100

Learning Differences

In keeping with college policy, any student with a disability who needs academic accommodations must call Learning Differences Program secretary at 824-3017, to arrange a confidential appointment with the director of the Learning Differences Program during the first week of classes.

Project Requirements

Research Option Requirements

Abstract: A typed abstract of your proposed research topic will be due by the end of the first week of class. The abstract should be a one to two paragraph summary of your chosen topic. A clear connection between mathematics and art should be present. If your abstract is accepted, you may begin work on your project. Otherwise, you will need to resubmit until an acceptable abstract is submitted. At least one reference must be included with your abstract.

Paper: A final paper will be due the last day of the semester. Your final paper should be typed, two to three pages in length, double spaced, with 12 point font and 1.5" margins. The paper should clearly reflect the topic submitted in your abstract and class presentation. You should include at least one paragraph that mentions why you had interest in the chosen topic. A clear explanation of the connection between mathematics and art should be evident and supported by at least three references. The included bibliography may be in any format. The paper should be entirely original, with any facts or quotations properly cited.

Presentation: A 10 minute presentation will be scheduled near the end of the semester. Your presentation should closely reflect the material in your paper, including an explanation of the significance of the topic and its relevance to the course. You are highly encouraged to use relevant visual aids in the form of handouts, slides, overheads, board work, posters, etc.

Creative Option Requirements

Project Proposal: A typed proposal of your plan will be due by the end of the first week of class. The proposal should be a one to two paragraph summary of your chosen topic. A clear connection between mathematics and art should be present. If your proposal is accepted, you may begin work on your project. Otherwise, you will need to resubmit until an acceptable proposal is submitted.

Paper and Project: Your project and a final paper will be due the last day of the semester. Your final paper should be typed, one to two pages in length, double spaced, with 12 point font and 1.5" margins. A thorough description of your project should be given, including a list of materials, computer programs used or written, etc. Be sure to explain how your project incorporates both mathematics and art. If you create a physical work (model, drawing, etc) you will be allowed to keep it. All work should be original. If you use any references in your paper, you should include a bibliography (a bibliography is otherwise not required for the creative project option).

Presentation: A 10 minute presentation will be scheduled near the end of the semester. Your presentation should demonstrate the work you created, along with an explanation of its relevance to the course.

Course Schedule

Mon, Jan 6	Introduction to the course; projections and perspective
Tues, Jan 7	Symmetry: wallpaper groups and Frieze groups
Wed, Jan 8	Tilings and tessellations
Thur, Jan 9	The golden ratio and art
Fri, Jan 10	Symmetry and the golden ratio in the natural world
Mon, Jan 13	Polyhedra and platonic solids
Tues, Jan 14	Non-Euclidean geometries and the work of MC Escher
Wed, Jan 15	Depictions of higher dimensions in art; cubism
Thur, Jan 16	Knots and braids
Fri, Jan 17	Large scale geometric constructions
Mon, Jan 20	<i>NO CLASS</i>
Tues, Jan 21	Early cartography and navigation
Wed, Jan 22	Self similar sets; computer generated art
Thur, Jan 23	Student presentations
Fri, Jan 24	Student presentations

Abstract / Project Proposal Grading Rubric

Explanation of Topic: 4 points

- | | |
|--|---------|
| <input type="checkbox"/> Topic is clearly defined and relevant to course | 4 pts |
| <input type="checkbox"/> Topic is vaguely defined and/or somewhat irrelevant to course | 2-3 pts |
| <input type="checkbox"/> Topic is poorly defined and irrelevant to course | 1 pt |

Grammar and Mechanics: 3 points

- | | |
|--|-------|
| <input type="checkbox"/> Proposal is well written with no grammar or spelling errors | 3 pts |
| <input type="checkbox"/> Proposal is fairly well written with few errors | 2 pts |
| <input type="checkbox"/> Proposal is poorly written with several errors | 1 pt |

References (Research Project Only): 3 points

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|--|-------|
| <input type="checkbox"/> Proposal includes at least 3 references | 3 pts |
| <input type="checkbox"/> Proposal includes 2 references | 2 pts |
| <input type="checkbox"/> Proposal includes 1 reference | 1 pt |

Math/Art (Creative Project Only): 3 points

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|---|-------|
| <input type="checkbox"/> Proposal clearly explains how mathematics will be used to create original work | 3 pts |
| <input type="checkbox"/> Proposal vaguely explains how mathematics will be used to create work | 2 pts |
| <input type="checkbox"/> Proposal does not include explanation of how mathematics will be used | 1 pt |

Presentation Grading Rubric

Content: 10 points

- Clear understanding of chosen topic and connection between mathematics and art, no factual errors 8-10 pts
- Good understanding of chosen topic, some connection between mathematics and art, few factual errors 5-7 pts
- Poor understanding of chosen topic, some connection between mathematics and art, factual errors 3-4 pts
- Poor understanding of chosen topic, many factual errors 0-2 pts

Visual Aids: 10 points

- Relevant visuals which clearly support topic and enhance understanding 8-10 pts
- Relevant visuals that support topic 6-7 pts
- Irrelevant visuals that do not lead to better understanding of topic 3-5 pts

Organization: 10 points

- Excellent organization, follows logical sequence, makes good use of time 8-10 pts
- Good organization, follows logical sequence 4-7 pts
- Difficult to follow, poor use of time 1-3 pts

Research Paper Rubric (Research Project Only)

Formatting: 10 points

- | | |
|---|---------|
| <input type="checkbox"/> Meets formatting requirements (typed, 2-3 pages, size 12 font, 1.5" margins) | 10 pts |
| <input type="checkbox"/> Some length or formatting requirements not met | 3-9 pts |
| <input type="checkbox"/> Does not meet formatting or length requirement | 0-2 pts |

Content: 20 points

- | | |
|---|-----------|
| <input type="checkbox"/> Clear understanding of chosen topic. Clear connection between mathematics and art. Closely follows abstract/project proposal. No factual errors. | 18-20 pts |
| <input type="checkbox"/> Good understanding of chosen topic. Connection between mathematics and art. Related to abstract/project proposal. No or few factual errors. | 13-16 pts |
| <input type="checkbox"/> Some understanding of chosen topic. Vague connection between mathematics and art. Some factual errors. | 9-12 pts |
| <input type="checkbox"/> Poor understanding of chosen topic. Several factual errors. | 1-8 pts |

Organization: 10 points

- | | |
|---|----------|
| <input type="checkbox"/> Material is presented in a logical, interesting sequence | 8-10 pts |
| <input type="checkbox"/> Material is difficult to understand or poorly organized | 4-7 pts |
| <input type="checkbox"/> Material is presented with no organization or cannot be understood | 0-3 pts |

Grammar and Mechanics: 10 points

- | | |
|---|----------|
| <input type="checkbox"/> Well written with very few grammatical or spelling errors. | 8-10 pts |
| <input type="checkbox"/> Fairly well written with several grammatical or spelling errors. | 4-7 pts |
| <input type="checkbox"/> Poorly written with many errors. | 0-3 pts |

References: 10 points

- | | |
|---|---------|
| <input type="checkbox"/> Paper includes at least 3 references with citations throughout | 10 pts |
| <input type="checkbox"/> Paper includes 2 references and/or does not have proper citations throughout | 4-7 pts |
| <input type="checkbox"/> Paper includes 0-1 references and/or does not have citations | 0-3 pt |

Creative Project Rubric (Creative Project Only)

Paper Formatting: 10 points

- Meets formatting requirements (typed, 1-2 pages, size 12 font, 1.5" margins) 10 pts
- Some length or formatting requirements not met 3-9 pts
- Does not meet formatting or length requirement 0-2 pts

Paper Content: 10 points

- Clear understanding of chosen topic. Paper explains how creative work was created. No factual errors. 8-10 pts
- Good understanding of chosen topic. Paper explains how creative work was created. No or few factual errors. 6-7 pts
- Some understanding of chosen topic. Poor explanation of how creative work was created. Some factual errors. 4-5 pts
- Poor understanding of chosen topic. Several factual errors. 1-3 pts

Paper Grammar and Mechanics: 10 points

- Well written with very few grammatical or spelling errors. 8-10 pts
- Fairly well written with several grammatical or spelling errors. 4-7 pts
- Poorly written with many errors. 0-3 pts

Creative Work: 30 points

- Work is original and of high quality, with strong connection between mathematics and art. Work closely follows project proposal. 25-30 pts
- Work is original and of good quality, with some connection between mathematics and art. Work closely follows project proposal. 20-24 pts
- Work is original, with vague connection between mathematics and art. Work differs from project proposal. 15-19 pts
- Work is unoriginal or of low quality, with little connection between mathematics and art. Work differs significantly from project proposal. 8-14 pts
- Work is unoriginal and of poor quality, with little or no connection between mathematics and art. 1-7 pts