

MATH299W: Mathematics and Art

Course Description

This course explores how math connects to different areas of visual and performing arts. We will spend one to two weeks on each area of art, surveying topics like origami, fractals, and knitting. This course is not meant to be a rigorous introduction to art theory or mathematics; rather, it is focused on introducing students to the math in art through projects, activities, and lectures.

Course Details

- **Course Code:** MATH299W
- **Prerequisites:** None, but precalculus recommended
- **Credits:** 1
- **Seats:** 40
- **Lecture Time:** Thursday 1:00pm - 1:50pm
- **Location:** ESJ2309
- **Semester:** Spring 2023
- **Textbook:** None, but check out *Math and Art* by Sasho Kalajdievksi for further optional reading
- **Course Facilitator(s):** Karthik Sellakumaran Latha, Rae Wu
- **Faculty Advisor:** Niranjan Ramachandran

Topics Covered

Syllabus may be subject to minor changes.

- **Geometry**
 - Review of basic geometry: translations, transformations
 - History: evolution of geometry and evolution of art
 - Renaissance art and projective geometry
- **Tilings and Tessellations**
 - Islamic art and periodic tilings
 - Penrose and aperiodic tilings
 - Escher and tilings on other surfaces
 - Higher-dimensional tessellations

- **Fractals**
 - What is a fractal
 - How to describe fractals
- **Origami**
 - Crease patterns and foldability
 - Kirigami
 - Flexagons
- **Knots and Knitting**
 - Knot theory
 - Knots in art
 - Knitting and crochet
- **Miscellaneous Topics**
 - Students vote from an array of topics like dance, juggling, fractals, and balloon twisting!

Schedule*

Subject to Change

Week	Topic	Homework
1 (1/26)	Introduction to the class, syllabus, and fun exercise ● Why do we want math in art and vice versa? ● Class structure, grading, topics ● Activity: Origami	Due: Nothing Assigned: Nothing
2 (2/2)	Geometry ● Golden ratio ● Transformations: ○ One-to-one, onto ○ Reflection, rotation, glide, shear ○ Symmetries ● Activity: Construct golden spiral	Due: Nothing Assigned: Homework #1
3 (2/9)	Geometry ● Math of transformations, matrices ● Projective geometry ○ 1/2/3/N point perspective ○ Focal length	Due: Homework #1 Assigned: Homework #2

	• Polyhedra (tentative) • Activity: Perspective drawings	
4 (2/16)	Tilings and Tessellations • Frieze patterns • Wallpaper patterns • Activity: Wallpaper game	Due: Homework #2 Assigned: Homework #3 Assigned: Presentation Proposal
5 (2/23)	Tilings and Tessellations • Escher tessellations • Spherical, hyperbolic tilings, 3D tilings • Activity: Make Escher tessellations	Due: Homework #3 Assigned: Presentation Rough Draft Assigned: Homework #4
6 (3/2)	Fractals • What is a fractal • Describe fractals mathematically • Trees, golden ratio • Activity: Make fractals	Due: Homework #4 Assigned: Presentation Assigned: Homework #5 due 3/16
7 (3/9)	Presentations	Due: Presentation
8 (3/16)	Origami • History of origami • Gaussian curvature • Graph theory in crease patterns • Activity: Fold origami	Due: Homework #5 Assigned: Homework #6
9 (3/23)	Spring Break	
10 (3/30)	Origami • Flexagons • Kirigami • Make flexagons • Activity: Fold origami	Due: Homework #6 Assigned: Homework #7
11 (4/6)	Knots and Knitting • Basic knot theory • Knots in art • Activity: Make knots	Due: Homework #7 Assigned: Homework #8 Assigned: Project proposal

12 (4/13)	Knots and Knitting • Weaving, knitting, and crochet • Hyperbolic crochet • Activity: Learn to crochet	Due: Homework #8 Assigned: Homework #9 Assigned: Project draft
13 (4/20)	Buffer week Vote on miscellaneous topics	Due: Homework #9 Assigned: Homework #10
14 (4/27)	Miscellaneous	Due: Homework #10 Assigned: Project
15 (5/4)	Miscellaneous	
16 (5/11)	Final Project Art Gallery	Due: Project

Grading

Grades will be maintained on ELMS. You will be responsible for all material discussed in lecture as well as other standard means of communication (Email announcements, etc.), including but not limited to deadlines, policies, assignment changes, etc.

Any request for reconsideration of any grading on coursework must be submitted within one month of when it is returned. No requests will be considered afterwards.

Your final course grade will be determined according to the following percentages:

Percentage	Title	Description
25%	Presentation	Students will choose a work or area of art and research the related math (individual or group)
25%	Project	Students will create or perform a work of art and detail the related math (individual or group)

30%	Participation	Attendance and level of participation during in-class activities. (Late policy is to respond in an ELMS discussion and post about what we did today by the following lecture.)
20%	Homework	Weekly assignments with a mix of worksheets and short art projects. (-1 point out of 10 per day late.)
10%	Extra Credit	Optional worksheet with harder, more math-oriented problems or another project.

Communicating with course staff

We prefer communication about the course, homeworks, or any other concerns via email.

Instructor Name and Email:

- Niranjan Ramachandran: atma@umd.edu

Facilitator Names and Emails:

- Karthik Sellakumaran Latha: karthiks@umd.edu
- Rae Wu: rwuu@umd.edu

Excused Absence and Academic Accommodations

See the section titled "Attendance, Absences, or Missed Assignments" available at [Course Related Policies](#).

Disability Support Accommodations

See the section titled "Accessibility" available at [Course Related Policies](#).

Academic Integrity

Note that academic dishonesty includes not only cheating, fabrication, and plagiarism, but also includes helping other students commit acts of academic dishonesty by allowing them to obtain copies of your work. In short, all submitted work must be your own. Cases of academic dishonesty will be pursued to the fullest extent possible as stipulated by the [Office of Student Conduct](#). It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more

information on the Code of Academic Integrity or the Student Honor Council, please visit <http://www.shc.umd.edu>.

Course Evaluations

If you have a suggestion for improving this class, don't hesitate to tell the facilitators or instructor during the semester. At the end of the semester, please don't forget to provide your feedback using the campus-wide CourseEvalUM system. Your comments will help make this class better.