

## Essays Guidance Math 3010. Fall 2023

### Topics of essays

**Concept** Introductory free-style essay "Mathematics in our world." Share your opinion. Pay attention to the structure: the essay includes an abstract, introduction, main text, conclusion, and list of references (if applicable). The length is approximately 5000 characters (3 standard pages); pictures, graphs, and the list of references are not counted.

Midterm Essay describes the development of a mathematical concept before the 18th century, the origins, the authors and their world, and the transfer of the idea. The length is approx 9000 characters (5 standard pages).

The Final Essay describes a mathematical concept's development, complication, and generalization and specifies the contributions of involved mathematicians. The length is approx 11000 characters (6 standard pages).

### Examples of topics

Below are examples of topics for the essay. You may choose a topic from a list or suggest your own.

#### Introductory essay

- Is math discovered or invented?
- In your opinion, what branches of mathematics will be trendy in 20 years?
- Outreach: how to inform the general public about discoveries in abstract fields? Is it worth it?
- What is a correct mathematical model? (*Some models developed by groups of mathematicians are so large and complex that no one knows how they work.*)  
*More than 120 000 research papers in math are published annually.*
- How can mathematicians communicate their funding?
- Is it possible and worthwhile to preserve the results?
- What research should be saved for the future?

#### Midterm essay

- History of numerals: From Babylonian to binary.
- History of mathematical notations.
- History of Golden Ratio

- History of  $\pi$
- History of Zero
- History of numbers: natural, irrational, complex, negative, then vectors and matrices
- Building pyramids (what math is involved in designing and building the Great Pyramid)
- The five platonic solids and duality.
- Highlights of Indian Mathematics
- Highlights of Chinese Mathematics
- Highlights of Arab-Iranian Mathematics

### **Final essay**

- History of Euclid's Fifth Postulate
- History of tilings: From Greek and Muslim mosaics to Esher to Penrose tiling
- History of gravitation equation: Kepler, Newton, Laplace, Einstein
- History of computers: From Leibniz to Turing, von Neumann, and AI
- Geometry of infinitesimals: from Archimedes to Fractals
- History of foundations: From Aristoteles and Euclid to Cantor and Gödel
- History of mathematical modeling: Models of Universe
- Emmy Noether: The Life and the Work
- Newton and Leibniz
- History of proofs: From Euclid to Computer-assisted proofs
- History of calculation techniques: From Babylonians to Numerical analysis
- History of polynomial equations: early algorithms, complex roots, Lagrange-Galois theory

## Factors for essay grading

### LOGISTICS AND STRUCTURE

Essay proposal and comments about other proposals submitted on time

Essay draft is submitted on time

Formatting conforms to standards

Mathematical terminology

Is the paper written in an engaging, thought-provoking manner

### HISTORY OF MATHEMATICS

Was the proper historical background given?

Was the material selected for the essay appropriate to the topic?

Was the essay mathematically correct?

Connection of mathematics to the broader cultural perspective

### SOURCES

Was the information referenced throughout the presentation?

Was the material connected to the specific topic in the course?

### CRITICAL THINKING

Did the main conclusions of the essay follow from the material presented?

Were the main ideas presented in an orderly and precise manner?

## Comments and suggestion

**Logistics** Every student will write a paper on their topic. Topics are organized into groups, and students from each group will help each other by reviewing and commenting on drafts.

The essay proposal (one paragraph) should include the goals of your theme, a future layout, and a suggested bibliography. I comment on and approve the proposal.

The draft (no less than 50%)

The essay will be graded using the above rubric.

**Hints** The paper should have an abstract, introduction, and conclusion sections. The page limit excludes the bibliography. You are welcome to add figures if you like.

Be careful and generous with quotations. Instead of rephrasing a text, give a citation followed by your analysis; summarize, paraphrase, or quote. Choose a few facts and ideas and give an in-depth analysis. You may include theorems. When you are writing about a mathematician, select several most important contributions. In a research paper, details are essential.

**Bibliography** The textbook will be a natural starting point for most of the essays. Web-based resources should be used cautiously and cross-examed when appropriate, except for electronic libraries and depositories, such as google books. MacTutor's History of Mathematics archive and MAA publications are helpful for biographies of mathematicians.