OAKLAND UNIVERSITY
DEPARTMENT OF MATHEMATICS AND STATISTICS
COLLEGE OF ARTS AND SCIENCES

STUDENT INFORMATION SHEET

COURSE: MTH 4114 (MTS 5014), History of Mathematics, 4 Credits

SEMESTER: Winter 2018

CLASS TIME: 3:30-5:17 MW ROOM: 187 MSC Section: 11897(11898)

FACULTY: D. Schmidt OFFICE: 552 MSC PHONE: (248) 370-3433

EMAIL: schmidt@oakland.edu

OFFICE HOURS: 2:40-3:20 on Mondays and Wednesdays in my office (552 SEB) and 2:00-3:00 in the Tutoring Center (103 NFH) on Tuesdays. Others are by appointment or just by walking in (if I happen to be in the office). You are highly encouraged to use my office hours. In fact, you will be required to see me in my office regarding your projects.

PREREQUISITES: 2.0 or better in Introduction to Advanced Mathematical Thinking (MTH 3002) for MTH 414; 2.0 or better in Advanced Calculus (MTH 4552) (or equivalent) for MTS 5014

TEXTS: A History of Mathematics, 3rd Ed. by Victor J. Katz, published by Addison Wesley. (The second edition can also be used.), Journey through Genius by William Dunham, published by Penguin Books

CATALOG DESCRIPTION: Mathematics from ancient to modern times, its growth, development and place in human culture. Offered every winter. *Satisfies the university general education requirement for capstone experience. Satisfies the university general education requirement for a writing intensive course in the major. Prerequisite for writing intensive: completion of the university writing foundation requirement.*

LaTeX: As this course satisfies the general education requirement for writing intensive in the major, you are required to use and learn up to some extent the state of the state of the art writing software in mathematics, LaTeX. For a PC, you can download it for free at miktex.org. You need to download Basic MiKTeX. In the installation process, you will be asked to choose between the "notifying you when updates are available" or "allowing updates to be made on the fly." Choose the option "allow updates to be made on the fly." After installation, you will have two package manager programs that allow you to add or remove packages. You will likely need to use these. You will also have a program "TeXworks" which serves as an editor and typersetter and a manual. For MACs, you need to download mactex by going to tug.org/mactex/ and downloading a version of mactex. A convenient editor for mactex is TeXShop which you can get at macupdate.com/app/mac/12104/texshop. There is a text "LaTeX: a Document Preparation System (2nd Edition)" by L. Lamport, one of the developers of LaTeX, that can be useful. Generously using google.com will help you learn a lot about using LaTeX.

COURSE OBJECTIVES: Most likely all of the students taking MTH 414 are mathematics majors, and most are in a secondary mathematics teaching program. As secondary mathematics teachers, you will need to know more than what you will be teaching in order to differentiate between what is important and what is not. All of you will need to know how particular subjects

have evolved over time and know something about the social context that influenced the development of a mathematical subject.

READING: There will be regular reading assignments from the textbook and other sources given in class.

ASSESSMENT:

QUIZZES: There will be four to six quizzes on the reading material and the material discussed in class. These will be announced in advance in class. They will be worth 30% of your final grade. There will be no make-up quizzes, but the lowest quiz score will be dropped. If you miss a second quiz for a good reason, a portion of your final exam will be applied to the quiz.

HOMEWORK: Some of the assigned homework will be collected and graded. This will amount to 10% of your final grade.

PROJECTS: There will be two writing projects based on outside reading. For each project, you will have at least one opportunity to rewrite and resubmit your project based on my comments. The projects will be worth 30% of your final grade.

WEEKLY EXPLORATIONS: Each week you will be asked to read a short item. In some cases, the topic will be assigned (and may be a technical item). When a specific item is not assigned, your paper will be on an internet search dealing with History of Mathematics. Weekly papers should be approximately one page. The writing is to be yours, and you are to cite the site(s) you have read. This will be worth 10% of your final grade. These should be reasonably coordinated with what we are covering in class at the time. A good source for this is the MacTutor web site which contains a wide collection of items on the history of mathematics categorized by mathematician, topic, and culture. It also includes material history of mathematics education. Your reports should be short. Please do not plagiarize.

FINAL EXAM: There will be a comprehensive final exam worth 20% of your final grade give on Monday, April 27386, at 3:30-6:30 pm.

ACADEMIC HONESTY: Oakland University policy requires that all suspected instances of cheating be reported to the Dean of Students for possible adjudication by the Academic Conduct Committee. Anyone found guilty of cheating in this course will receive a course grade of 0.0, in addition to any penalty assigned by the Academic Conduct Committee. Working with others on homework does not constitute cheating; handing in an assignment that has essentially been copied from someone else does. You are encouraged to work with other students. It is suggested that if you do so, the write up of such problems be done individually. Receiving help form someone else or from unauthorized written material during a test or final exam is cheating, as is using a calculator as an electronic "crib sheet." In writing your projects, plagiarizing someone else's writing constitutes cheating.

INTENDED SYLLABUS: The intent is to cover all of the following topics. Depending on how the class keeps on track, we may deviate from this plan to some extent. The first sections numbers given are for the third edition of the text, and the section numbers given in parentheses are for the second edition of the text if the sections numbers are different for the two editions. These reading sections reflect what will be discussed in class. You are expected to read more than these sections as assigned in class.

1. Preamble Topics
Syllabus, Assessment, etc.

> Reading: Mathematics and History, W. S. Anglin, Mathematical Intelligencer, Vol. 14, No. 4, 1992.

2. The number concept
Topics: Innate Capacity, Ordinal and Cardinal Number, Numbers and Numerals

> Additional Reading (optional): "Where Mathematics Comes From," by Lakoff and Nunez

3. Whole numbers and rational numbers
Topics: Numerals; Natural Numbers; Negative Numbers; Zero; Ratios and Rational Numbers; Fractions and Decimal Expansion

> Reading:
> 1.1 (1.2) Counting Ancient Egypt
> 1.1 (1.3) Computations
> 2.1.1 Earliest Greeks (Thales and Pythagoras)
> 2.3.2 Aristotle (numbers and magnitudes)
> 3.5 (2.4.5) Ratios and Proportions
> 6.1 (5.1) Nicomachus
> 9.2 (6.9) Decimal Positional System
> 9.2 (7.1) Decimal Arithmetic
> 10.5.1 (8.4.1) Ratio and Irrationals
> 12.5 (9.4.3) Decimal Fractions

4. Equation Solving
Topics: Quadratics, Cubics, Quartics, Fundamental Theorem of Algebra, Irrational and Complex Numbers

> Reading:
> 1.1.2 (1.4) Linear Equations
> 1.2.3 (1.7) Square Roots
> 1.2.3(1.9 ) Quadratic Equations
> 6.2 (5.2) Diophantine Equations
> 7.4-7.5 (6.3-6.4) Remainder Theorem and Polynomial Equations
> 6.8* Algebra (India)
> 9.3 (7.2) Algebra (Islam)
> 10.4 (8.3) Medieval Algebra
> 22.2 (16.2.1) Arithmetization of Analysis (Dedekind Cuts)
> 21.3 (15.4) Symbolic Algebra
> 22.3.1 (16.3.1) Geometric Representation of Complex Numbers

5. Trigonometry and Logarithms
Topics: Chords in Ancient Greece, Emergence of Trigonometric Functions, Spherical Trigonometry, Hyperbolic Trigonometry

> Reading:
> 5.1.3 (4.1.3) Origins (chords)
> 5.2 (4.2) Ptolemy's Almagest
> 8.7 (6.6) Indian Trigonometry

9.6 (7.5) Trigonometry in Islam
13.3.1 (10.3.1) Renaissnace, Regiomontanus
13.4 (10.4) Logarithms
17.1.3 (13.1.3) Euler-Trigonometric functions
17.3.4 (13.2.4 ) Euler-Exponential, logarithmic, and trigonometric functions

6. Geometry
Topics: Euclid's Work, Attacks on the Parallel Postulate, Non-Euclidean Geometry

Reading:
Chapter 3 (2.4.2-2.4.2) Euclid's basic geometry
20.2.1 (14.3.2) Saccheri and the parallel postulate
20.2.2 (14.3.3) Lambert and the parallel postulate
24.2 (17.2) Non-Euclidean geometry
24.6 (17.5) Foundations of geometry

7. Proofs and Computations
Topics: What is a proof? How did it change over time? Formalism and its limits, Computabliity

Reading:
Lakatos: Proofs and Refutations, Chapter 1
Barbin: What is obvious in geometry?
18.1*Goedel
18.4* Turing

8. Differential Calculus
Topics: Definitions of derivatives
Reading:
17.2.1 (13.2.1) Euler
22.1.4 (16.1.4) Cauchy
13.5.1* Lagrange

IMPORTANT DATES FOR THIS CLASS

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| Jan. 15 | Martin Luther King. Jr. Day (No Classes) |
| Jan. 17 | Last day for no record drop (with refund) and to add |
| Feb. 17-25 | Winter Recess (No Classes) |
| Mar. 14 | Last day for official withdrawal (W grade) |
| Apr.16 | Last class (for MTH 4114/MTS 5014) |
| Apr. 25 | Final Exam, 3:30-6:30 pm |