

Course Syllabus

EXPERIMENTAL MATHEMATICS (Math 371)

Description:	<i>A study of the role of computation and experimentation in mathematical proof. Students will learn to write code in a mathematical programming language (e.g. Maple), and then apply programming skills to a variety of mathematical problems. Topics include enumeration, continued fractions, high precision computing, and numerical integration, among others. Students will also study famous proofs that integrate computation in nontrivial ways, and the current state of automated theorem proving/automated proof-checking software.</i>
Credit Hours:	3
Audience	May be chosen as an upper level mathematics elective.
Prerequisites:	Math 266 or consent of instructor.
Format:	3 lectures (50 min) per week
Textbook:	<i>The Computer as Crucible</i> , Borwein & Devlin, First Edition, (Required) ISBN 978-1568813431, and handouts.
Technology:	We will use the mathematical software package Maple throughout this course. Maple is available in our lab classroom in Gellersen, and may be available in other labs on campus. You may also purchase your own copy of Maple , but you are not required to do so.
Internet:	Course material and grades are maintained in Blackboard.
Disability Support:	Students with a documented disability who need classroom accommodations, such as extra time for test-taking, note-taking assistance, readers, etc., are recommended to contact the Disability Support Coordinator at 219-464-6496.
Notice of Cancellation:	In the event class is cancelled, you will be notified through your Valparaiso University e-mail account

Student Learning Objectives:

- A. Students understand the current competing philosophies of experimental math.
- B. Students develop and/or improve programming ability in Maple.
- C. Students apply programming skills to explore a variety of mathematical problems.
- D. Students use computer data to formulate precise conjectures about mathematical processes.
- E. Students understand the historical use of computers in mathematical proofs.

Topics & Performance Requirements Include (but are not limited to):

1. reading a number of articles on the nature of experimental mathematics and discussing those articles with the class
2. using Maple during class periods to accompany lecture and/or class discussion
3. writing simple Maple programs as part of regular homework
4. completing an individualized mathematical experiment by programming in Maple
5. converting continued fractions to decimals and vice versa
6. implementing historical methods of computing digits of π
7. recognizing famous combinatorial enumeration sequences arising from recurrences

8. using algorithms to determine relationships between lists of numbers
9. using existing computer databases (Online Encyclopedia of Integer Sequences, Inverse Symbolic Calculator, etc.) to discover connections between mathematical objects
10. stating the Riemann hypothesis
11. stating the 4-color theorem and summarizing historical attempts to prove it
12. stating the Kepler conjecture