## What courses do I take?

Among the courses required for a mathematics major the following are especially important for students concentrating on computational mathematics:

- MTH 111 - Analytic Geometry and Calculus I
- MTH 112 - Analytic Geometry and Calculus II
- MTH 211 - Analytic Geometry and Calculus III
- MTH 204 - Computational Experiments in Mathematics
- MTH 212 - Differential Equations I
- MTH 221 - Linear Algebra
- MTH 280 - Introduction to Scientific Programming
- MTH 353 - Applied Linear Algebra
- MTH 361 - Numerical Analysis I
- MTH 362 - Numerical Analysis II
- MTH 463 - Math Modeling
- MTH 471 - Partial Differential Equations
- MTH 472 - Numerical Methods for Partial Differential Equations
- MTH 473 - Numerical Linear Algebra
- MTH 474 - Numerical Optimization
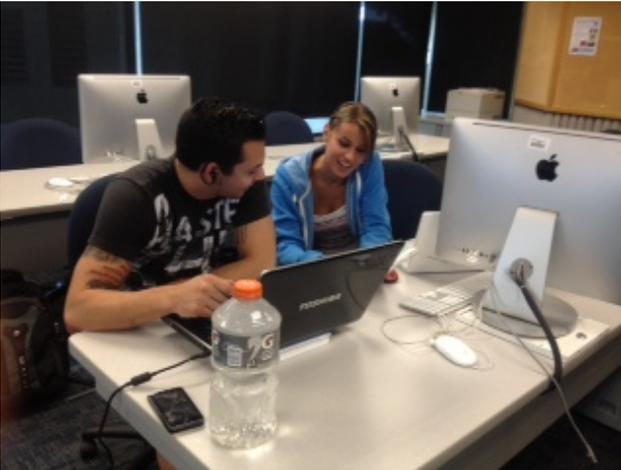
Students are encouraged from their Freshman year to become involved in research. Experienced faculty act as research mentors to students on original research objects. Commonly students work on research projects in groups and learn to use computational software, the mathematical typesetting software LaTeX, and learn to present their work to others.

Undergraduate research

Students have many opportunities during semester and Summer to engage in undergraduate research projects with expert faculty, who guide and mentor them. Students have presented their research at local, national, and international conferences. Undergraduate students have formed a local chapter of the Society for Industrial and Applied Mathematics (SIAM) which meets weekly. A student led group MPOWR (Mathematics and Physics Opportunities for Women in Research) also actively promotes mathematics and physics opportunities for women students.

Ph.D. program

The Department participates in the Computational Science and Engineering (CSE) option of the Ph. D. program in Engineering and Applied Science. Graduate students interested in research in computational science and mathematics receive mentoring from mathematics experts, in a supportive collegial atmosphere.

Center for Scientific Computing & Visualization Research

The Department of Mathematics is a major partner in the new Center for Scientific Computing & Visualization Research, which includes mathematicians, physicists, engineers and oceanographic scientists. The Center has research and education activities that engage graduate and undergraduate students in mathematics.

Students learn from their contemporaries who are carrying out original research projects, and from outstanding faculty who are experts in their fields.

This research includes numerical methods for partial differential equations, black holes and quantum cosmology, giant molecular clouds, star formation and Type Ia supernovae, computational and theoretical studies of the upper ocean submesoscale and mesoscale processes, computational modeling of solids and structures including biomaterials, and efficient numerical methods to study multiphase flows.

UMass | Dartmouth

Department of Mathematics

http://www.umassd.edu/cas/math/

Computational Mathematics

$$\frac{d}{dx}\left(\sqrt{1-x^2}\frac{dT_n(x)}{dx}\right) + \frac{n^2}{\sqrt{1-x^2}}T_n(x) = 0,$$
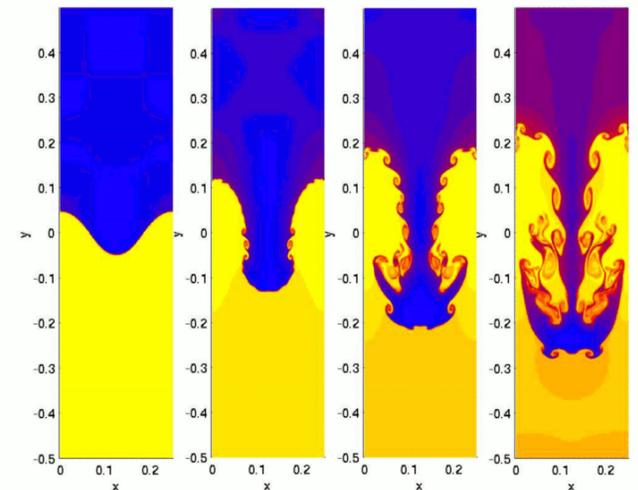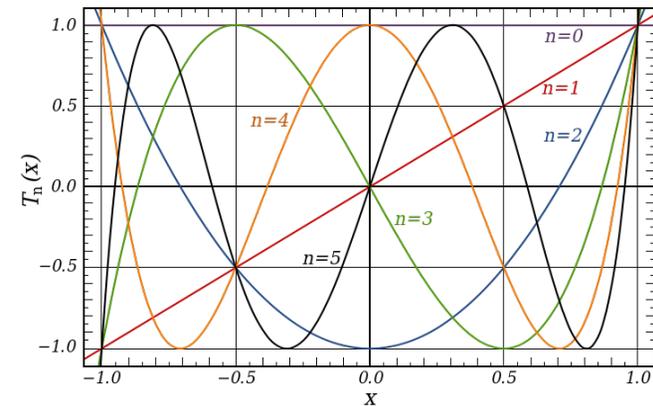
What is computational mathematics?

Computational mathematicians devise and analyze new methods to find accurate numerical solutions to applied problems. They are in great demand in areas of applied mathematics, science and engineering where complicated equations need to be approximated numerically. Computational mathematics includes such things as:

- numerical methods used in scientific computation, for example numerical linear algebra and numerical solution of partial differential equations
- numerical analysis including the theory of numerical methods
- symbolic computation and computer algebra systems
- solving mathematical problems by computer simulation including stochastic procedures such as Monte Carlo methods
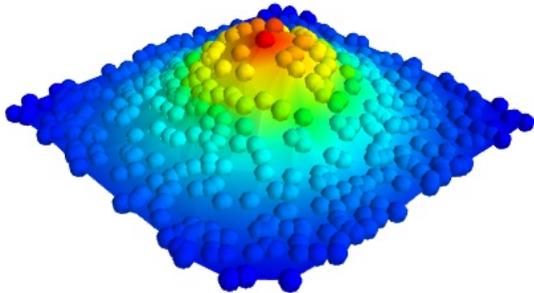
The Department of Mathematics has a very strong concentration in computational mathematics and scientific computing, training applied mathematicians who are in demand.

Careers in computational mathematics & scientific computing

Some examples of computational mathematics careers are:
Computational Mathematician, Argonne National Laboratory: developing general-purpose numerical algorithms and software for scientific and engineering simulations.

Mathematician, Naval Surface Warfare Center: developing algorithms & technologies to solve problems related to machinery systems typically used by the Navy; modeling and simulation, using computers to solve problems.

Software Engineer, Google Inc: What data structure is the most efficient? Pros and cons of different algorithms? If an application becomes potentially slower due to a change, how do you know if it's a statistically significant difference? How do you process and analyze massive quantities of data quickly?

Manager of Statistical & Mathematical Support, Michelin America: creating proposals, leading projects, guiding technical personnel, contributing technically to projects, and evaluating results.

Research Engineer, NASA: developing mathematical models, & algorithms, discussing models or solutions with customers or team members, planning future research, researching relevant literature, documenting research results.

How much will I make ?

Annual salaries depend very much on the industry. A typical range is $55,000 + entry level to $150,000 + senior level. More information at:

http://bit.ly/Y1oDP6

Who will hire me ?

Examples of companies & research institutions that hire computational mathematicians:

Air Force Office of Scientific Research
Lawrence Berkeley National Laboratory
Los Alamos National Laboratory
Oak Ridge National Laboratory
Pacific Northwest National Laboratory
Sandia National Laboratories
Institute for Defense Analyses Center
National Center for Computing Sciences
National Institute of Standards and Technology
National Security Agency
Naval Surface Warfare Center
Department of Energy
Mitre Corporation RAND Corporation
Aerospace Corporation
AT&T Laboratories – Research
Exxon Research and Engineering
NEC Laboratories America, Inc.
Schlumberger-Doll Research
IBM Research
Adobe; Google; Kuberre Systems; MathWorks, Inc;
Mentor Graphics; Microsoft
Mosek; MSC.Software Corporation; Palo Alto Research
Center; Thomson West; Yahoo Research
Lockheed-Martin Energy Research Corporation
Schatz Energy Research Center (SERC)
Alcatel-Lucent; Hewlett-Packard; Honeywell; Motorola;
Philips Research; SGI
Daniel H. Wagner Associates
McKinsey and Company
Boeing; Ford; General Motors; Lockheed Martin;
United Technologies
Citibank; Moody's Corporation; Morgan Stanley;
Prudential
FedEx Corporation United Parcel Service
Clear Channel Communications; CenturyLink; Verizon
DuPont; GlaxoSmithKline; Merck & Co., Inc.; Pfizer
Baxter Healthcare; Boston Scientific; and Medtronic;
Constellation Energy Group; Petróleo Brasiliero S/A/
Petrobras; Shell; Chevron