Mathematics has been described as the Queen of the Sciences. Mathematics is the language of quantitative information and structure. Quantitative information is acquired, classified and processed according to mathematical models of physical phenomena with mathematical tools. There is a wide range of applications even of the most pure of mathematical disciplines. Cryptography is based on algebra, signal processing is based on Fourier analysis, and important applications have arisen from topology to physics. Our department offers unique research opportunities for undergraduates in mathematical biology, scientific computing, and finance mathematics as well as algebra, geometry, and analysis.

The Department of Mathematics offers an ample selection of courses leading to a Bachelor of Science degree in mathematics, applied mathematics, and actuarial mathematics as well as various courses for non-majors. We also offer the possibility of joint majors in mathematics-economics (see separate sheets for joint majors). Each of the department’s majors has its own philosophy and its own formal requirements. For additional information, visit the Department of Mathematics Web site.

### Required courses for the Applied Mathematics major

The Applied Mathematics major requires the completion of 38 credits in mathematics or as few as 31 with UHC (University Honors Course) options, plus 8 in Physics, at least 3 in Statistics, and 3 in Computer Science. They are distributed as follows.

**Calculus courses**
- MATH 0220 Analytic Geometry and Calculus 1
- MATH 0230 Analytic Geometry and Calculus 2
  - Note: Qualified students may substitute MATH 0235 Honors 1-Variable Calculus (UHC) for MATH 0220 and MATH 0230
- MATH 0240 Analytic Geometry and Calculus 3

**Professional Development**
- MATH 0500 Professional Development

**Introductory theoretical courses**
- MATH 0413 Introduction to Theoretical Mathematics
- MATH 0420 Introduction to Theory 1-Variable Calculus
  - Note: Qualified students may substitute MATH 0450 Introduction to Analysis (UHC) for MATH 0413 and MATH 0420

**Upper-level required courses**
- MATH 1180 Linear Algebra 1 or 1185 Honors
- MATH 1270 Ordinary Differential Equations 1 or 1275 Honors

**One of the following numerical math courses**
- MATH 1070 Numerical Mathematical Analysis
- MATH 1080 Numerical Linear Algebra
- MATH 1101 Introduction to Optimization
- MATH 1127 Predictive Analytics

**One of the following applied analysis courses**
- MATH 1550 Vector Analysis and Applications
- MATH 1560 Complex Variables and Applications
- MATH 1570 Transform Methods in Applied Math

**One of the following differential equations courses or an additional Numerical Math or Applied Analysis course**
- MATH 1280 Ordinary Differential Equations 2
- MATH 1470 Partial Differential Equations 1

**One of the following courses**
- MATH 1103 Mathematical Problems in Business, Industry and Government
- MATH 1360 Modeling in Applied Math 1
- MATH 1370 Computational Neuroscience
- MATH 1380 Mathematical Biology

**Physics courses**
- PHYS 0174 Basic Physics for Science and Engineering 1
- PHYS 0175 Basic Physics for Science and Engineering 2

**One Computer Science course**
- CS 0007 Introduction to Computer Programming in Java
- CS 0008 Introduction to Computer Programming in Python
- CS 0010 Introduction to Computing for Systems Engineers
- CS 0011 Introduction to Computing for Scientists
- CS 0012 Introduction to Computing for the Humanities
- CMPINF 0401 Intermediate Programming using Java

**One Statistics course**
- MATH 1119 Applied Probability for Actuarial Mathematics
- MATH 1510 Mathematical Theory of Probability
- STAT 1000 Introduction to Applied Statistics
- STAT 1100 Statistics and Probability for Business Mgmt.
- STAT 1151 Introduction to Probability

**Recommended courses**
Students interested in graduate study are strongly advised to take MATH 1530 and MATH 1540. These courses may be substituted for the Applied Analysis course and the Differential Equations course respectively. Students interested in pursuing secondary education certification in mathematics should take MATH 1290 in addition to the courses required for the major. These courses are required for secondary education certification in Pennsylvania and by the School of Education for admission to the MAT program in Mathematics Secondary Education.
Grade requirements
A grade of C or better is required in each course that is to count toward the major. A minimum GPA of 2.0 in departmental courses is required for graduation.

Satisfactory/No Credit option
Only MATH 0500 may be taken on an S/NC basis. All other courses must be taken on a letter grade basis.

Writing (W) requirement
Students must complete at least one W-course in the major.

Related area
A minimum of 12 credits of related coursework is required within the major. Eligible courses are listed on the right side of this sheet and should be chosen in consultation with the major advisor.

Honors major requirements
Departmental Honors in Applied Mathematics is granted if the student:
- completes all other requirements for the major and:
  - completes the following courses with a grade of B or better.
    - MATH 1470
    - MATH 1530
    - MATH 1540
    - a 2000 level course in lieu of a 1000 level elective
- completes an honors thesis under the direction of a member of the mathematics faculty or completes a 2000-level course in lieu of the honors thesis.

Note: The statistics requirement is waived for students seeking honors in Applied Mathematics.

Advising
Jason DeBlois
THACK 407
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Checklist for the Applied Mathematics major

Calculus courses
_______ MATH 0220
_______ MATH 0230 / MATH 0235
_______ MATH 0240

Professional Development
_______ MATH 0500

Introductory theoretical courses
_______ MATH 0413 / MATH 0450 *
_______ MATH 0420

* Students who successfully complete MATH 0450 are exempted from taking MATH 0413 and MATH 0420.

Upper level required courses
_______ MATH 1180 / MATH 1185
_______ MATH 1270 / MATH 1275

One numerical math course
_______ MATH 1070 ________ MATH 1127
_______ MATH 1080
_______ MATH 1101

One applied analysis course
_______ MATH 1550 ________ MATH 1570
_______ MATH 1560

One differential equations course
_______ MATH 1280 ________ MATH 1470

One of the following
_______ MATH 1360 ________ MATH 1380
_______ MATH 1370 ________ MATH 1103

Physics courses
_______ PHYS 0174 / PHYS 0475
_______ PHYS 0175 / PHYS 0476

One Computer Science course
_______ CS 0007 ________ CS 0011
_______ CS 0008 ________ CS 0012
_______ CS 0010 ________ CMPINF 0401

One Statistics course
_______ MATH 1119
_______ MATH 1510 ________ STAT 1100
_______ STAT 1000 ________ STAT 1151

Approved Related Area departments and courses
Requests to use course sequences not included in these lists can be made by petition to the Undergraduate Director.

Chemistry*
_______ CHEM 0110 / CHEM 0710
_______ CHEM 0120 / CHEM 0720
_______ CHEM 0310 / CHEM 0730
_______ CHEM 0320 / CHEM 0740
_______ CHEM 0330
_______ CHEM 0345
_______ CHEM 0130
_______ CHEM 1410
_______ CHEM 1420
_______ CHEM 1430
_______ CHEM 1440
_______ CHEM 1450

Physics*
_______ PHYS 0174 / PHYS 0475
_______ PHYS 0175 / PHYS 0476
_______ PHYS 0477
_______ PHYS 0481
_______ PHYS 1321
_______ PHYS 1351
_______ PHYS 1372
_______ PHYS 1331
_______ PHYS 1341
_______ PHYS 1361
_______ PHYS 1370
_______ PHYS 1371
_______ PHYS 1373

Computer Science*
_______ CS 0007
_______ CS 0008
_______ CS 0010
_______ CS 0011
_______ CS 0012
_______ CS 0132
_______ CS 0401
_______ CS 0411
_______ CS 0441
_______ CS 0445
_______ CS 0447
_______ CS 1501
_______ CS 1510
_______ CS 1515

Economics*
_______ ECON 0100
_______ ECON 0110
_______ ECON 0280
_______ ECON 1100
_______ ECON 1110
_______ ECON 1150
_______ ECON 1180
_______ ECON 1200

* These departments offer official minors.

+ This course cannot be used for both the statistics course for the major and for the related area requirement.