TEXAS A&M UNIVERSITY
DEPARTMENT OF MATHEMATICS

Fall 2018

Undergraduate Handbook

OVERVIEW OF UNDERGRADUATE PROGRAM

The Undergraduate Programs in the Department of Mathematics seek to provide a high quality education to our students, focusing both on depth and breadth in all fields of Mathematics. This may include but is not limited to algebra, analysis, topology, number theory, differential equations, geometry and numerical analysis.

The Undergraduate mathematics Program offers three degrees which allow our majors to choose a plan that is best suited to their academic and career objectives—

The **Bachelor of Arts (BA)** degree has an emphasis on the teaching aspects of the field. Teacher preparation is one of the most important tasks for an academic program, for it has a direct and fundamental impact in our society. We strive to produce knowledgeable teachers who will be effective professionals and capable of working in diverse environments while maintaining the highest quality of instruction. Students seeking the B.A. degree in Mathematics are prepared to fill teaching positions at the secondary school level, upon receiving the appropriate secondary teaching certification.

Students seeking the **Bachelor of Science (BS)** degree in Mathematics are prepared to pursue admission to graduate degree programs or employment in industry. This program fosters an innovation culture, with an emphasis on undergraduate research to provide high-impact learning experiences and to develop the necessary skills to work in teams or on large-scale projects.

While the study of mathematics in and of itself is its central focus, the **Applied Mathematical Sciences (APMS)** degree provides students an opportunity to explore applications of mathematics to various other fields (tracks), such as *Actuarial Sciences*, *Statistics*, *Economics*, *Computational Sciences*, and *Biological Sciences*. Students in the program are prepared to pursue admission to graduate degree programs or employment in the professional industrial job marketplace.

The comprehensive professional preparation provided by our programs benefits not only our students but provides future employers and society in general with uniquely prepared professionals capable of effectively facing our rapidly developing world.

Questions relating to this handbook can be directed to:

Ms. Heather Ramsey, Undergraduate Advisor
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IMPORTANT CAMPUS TELEPHONE NUMBERS/EMAILS

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Dr. N. Sivakumar, Undergraduate Advisor	sivan@math.tamu.edu
Dr. Gregory Berkolaiko, Honors Student Advisor	berko@math.tamu.edu
Dr. Riad Masri, Honors Student Advisor	masri@math.tamu.edu
Admissions	845-1031
Bus Operations	845-1971
Campus Bookstore	845-8681
Campus Information	845-3211
College of Science Dean's Office	845-7361
Student Affairs Office	845-7362
Cooperative Education Office	845-7725
Degree Audit	845-1089
Dial-A-Ride	847-7433
Evans Library	845-5741
Financial Aid	845-3236
University Honors Program Office	845-1957
Math Department (Main Office)	845-3261
Data & Research Services (DARS)	845-0532
Placement Center	845-5139
Registrar's Office	845-7117
Statistics Department	845-3141
Student Counseling	845-1651
Student Fees Office	845-8127
Student Locator	845-4741
Transfer Admissions	845-1098

WHY SHOULD YOU MAJOR IN MATH?

There are a number of important benefits associated with being a mathematics major at TAMU:

Flexible Degree Plans - Our degree plans offer more elective hours and flexibility than any other degree plan on campus. The requirements and options for each plan are listed in this handbook, and each plan requires 120 credit hours.

Honors Opportunities in Math – Honors majors are encouraged to take special courses, may be honors mentors, may earn an MS and BS in 5 years, and have extra opportunities to advance their career goals. Earning the Honors in Mathematics distinction makes the student more attractive to future employers and graduate schools.

Job Opportunities - Almost all of our majors have jobs prior to graduation. Currently, 50% of our majors plan to work in industry, 20% plan to attend graduate school, and 30% plan to teach.

Graduate School Opportunities - The variety of graduate school choices available to mathematics majors is perhaps the largest amongst all majors on campus.

Small Class Size - Typical mathematics courses have an enrollment of 40 or less during the freshman year, and 30 or less in subsequent years. The overall student to professor ratio in the Math Department is extremely small, offering small classroom settings to its undergraduate majors. This also results in ample opportunities for students interested in undergraduate research projects.

Study Lounge - The Undergraduate Program Office is very fortunate to have one of the few undergraduate study lounges on campus. Math majors have access to this lounge 24 hours a day. Use the code:

31425

to access the lounge after regular working hours. On any given day, it is typical to find students working on assignments, using one of the computer terminals, eating lunch or simply hanging out in between classes. This lounge provides a relaxed environment for our majors to study or escape from the stress of their day.

Friendly and Helpful Advisors - The advisors make it a point to know each student. They are always willing to help with any questions you might have relating to your degree and classes.

PROGRAM CURRICULA

The layout of our curricula utilizes the following courses.

Courses offered (for Math and Science Majors)

Crs. No.	Crs. Name	Crs. No.	Crs. Name
150	Functions, Trigonometry and Linear Systems	308	Differential Equations
170	Freshman Mathematics Laboratory	323	Linear Algebra
171	Analytic Geometry and Calculus	325	The Mathematics of Interest
172	Calculus	396	Communications in Mathematics
200	Horizons of Mathematics		
220	Foundations of Mathematics		
221	Several Variable Calculus		
225	Advanced Spreadsheet Techniques		
285	Directed Studies		
289	Special Topics in...		
407	Complex Variables	436	Introduction to Topology
409	Advanced Calculus I	437	Principles of Numerical Analysis
410	Advanced Calculus II	439	Differential Geometry of Curves and Surfaces
411	Mathematical Probability	442	Mathematical Modeling
412	Theory of Partial Differential Equations	446	Principles of Analysis I
414	Fourier Series and Wavelets	447	Principles of Analysis II
415	Modern Algebra I	460	Tensors and General Relativity
416	Modern Algebra II	467	Modern Geometry
417	Numerical Methods	469	Introduction to Mathematical Biology
419	Applications of Actuarial Science	470	Communications and Cryptography
420	Application of Actuarial Science II	471	Communications and Cryptography II
423	Linear Algebra II	482	Research Seminar
425	The Mathematics of Contingent Claims	485	Directed Studies
427	Introduction to Number Theory	489	Special Topics in...
431	Structures and Methods of Combinatorics	490	The Putnam Challenge
433	Applied Algebra	491	Research

Bachelor of Arts – Teacher Certification (BA)

Degree Plan

Category	Courses	Hours
Math Core	171, 172, 220, 221, 308, 323, 409	24
Math Elec. (see Note)	415 or 433; 467, 403, MATH 4xx, MSCI 4xx	15
STAT/CSCE	STAT 211; CSCE 110, 111, 206, or 121	7
EDUC Core	SCEN 201, TEFB 322, TEFB 324, TEFB 407 (methods), RDNG 372 or 465	13
EDUC Elec.	SOCI 317 or INST 222	3
Student Teaching	TEFB 429	12
Science Elec. (see Note)	elec., elec., PHYS 218	12
Gen. Core Elec.	ENGL 103 or 104; COMM 203, 205, or 243; INST 210, Lang. Phil. and Cult., Creative Arts	15
HIST/POLS Elec.	HIST 105, HIST 106, POLS 206, POLS 207	12
Free Elec.		7
Total Hrs.		**120**

NOTE

- **Math Electives:** (15 hours) Take 415 or 433; 467, 403. Of the remaining 6 hours of 4xx, at least 3 hours must be selected from MATH 325, 407 – 499. The other 3 hours should be selected from MATH 407 - 499; STAT 404 - 482; CSCE 210-470 (except CSCE 222, 285, 289, 291); ISEN 320-430.
- **Science Electives:** (8 hours) Select 4 hours from ASTR 111, BIOL 111, BIOL 112, CHEM 101/111, CHEM 102/112, CHEM 107/117; select 4 hours from any 100 level course(s) listed above that you have not taken or ATMO 201/202, GEOL 101/102, or OCNG 251/252.
- Note: Maximum of 3 hours of MATH 411 or STAT 414 may be used in this degree program.
- Note: Maximum of 4 hours of MATH 417 or MATH 437 may be used in this degree program.
- See the **Common requirements to all degrees** below for details on General Core, HIST/POLS, and Free Electives.

Bachelor of Arts - Non-Certification (BA)

Degree Plan

Category	Courses	Hours
Math Core	171, 172, 220, 221, 308, 323, 409	24
Math Elec. (see Note)	415, 423, or 433; MATH 4xx, MATH 4xx, MATH 4xx, MSCI 4xx	15
STAT/CSCE	STAT 211; CSCE 110, 111, 206, or 121	7
Science Elec. (see Note)	elec., elec., PHYS 218	12
Gen. Core Elec.	ENGL 103 or 104; COMM 203, 205, or 243; Lang. Phil. and Cult. w/ICD, Social and Behavioral Sci., Creative Arts w/ICD	15
HIST/POLS Elec.	HIST 105, HIST 106, POLS 206, POLS 207	12
Free Elec.		17
Minor Elec.		18
Total Hrs.		**120**

NOTE

- **Math Electives:** (15 hours) Take 415, 423, or 433. Of the remaining 12 hours of 4xx, at least 9 hours must be selected from MATH 325, 403 – 499. The other 3 hours should be selected from MATH 403 - 499; STAT 404 - 482; CSCE 210-470 (except CSCE 222, 285, 289, 291); ISEN 320-430.
- **Science Electives:** (8 hours) Select 4 hours from ASTR 111, BIOL 111, BIOL 112, CHEM 101/111, CHEM 102/112, CHEM 107/117; select 4 hours from any 100 level course(s) listed above that you have not taken or ATMO 201/202, GEOL 101/102, or OCNG 251/252.
- Note: Maximum of 3 hours of MATH 411 or STAT 414 may be used in this degree program.
- Note: Maximum of 4 hours of MATH 417 or MATH 437 may be used in this degree program.
- See the **Common requirements to all degrees** below for details on General Core, HIST/POLS, and Free Electives.

Bachelor of Sciences - Mathematics (BS)

Degree Plan

Category	Courses	Hours
Math Core	171, 172, 220, 221, 308, 323, 409, 410 or 446	27
Math Elec. (see Note)	415, 416, MATH 411 or STAT 414; MATH 4xx, MATH 4xx, MATH 4xx, MATH 4xx	21
CSCE	CSCE 110, 111, 206, or 121	4
PHYS	PHYS 218, PHYS 208 or OCNG 451	8
Science Elec.	(see Note)	18
Gen. Core Elec.	ENGL 103 or 104; COMM 203, 205, or 243; Lang., Phil. and Cult. w/ICD, Social and Behavioral Sci., Creative Arts w/ICD	15
HIST/POLS Elec.	HIST 105, HIST 106, POLS 206, POLS 207	12
Free Elec.		15
Total Hrs.		**120**

NOTE

- **Math Electives:** (12 hours required) 3 to 12 hours to be selected from MATH 427, 431, 436, 439. Up to 9 hrs. may be selected from MATH 325, 407-489. Departmental permission is required to include MATH 485, or to enroll in a MATH 6xx course. Students who plan to attend graduate school are encouraged to take MATH 446 and 447 and at least one 6xx course as electives.
- **Science Electives:** (18 hours required) Select 4 hours from ASTR 111, BIOL 111, BIOL 112, CHEM 101/111, CHEM 102/112, CHEM 107/117; select 4 hours from any 100 level course(s) listed above that you have not taken or ATMO 201/202, GEOL 101/102, or OCNG 251/252. Select 6 hours from BICH 401-489, BIOL 200-470, CHEM 222-474, GENE 301-452, OCNG 251, 252, 401-420, PHYS 221, 302-305, 307-314, 324-428. The remaining 4 hours may be selected from any course listed above.
- Note: Maximum of 3 hours of MATH 411 or STAT 414 may be used in this degree program.
- Note: Maximum of 4 hours of MATH 417 or MATH 437 may be used in this degree program.
- See the **Common requirements to all degrees** below for details on General Core. HIST/POLS, Free and Science Elec.

Bachelor of Sciences - Applied Mathematical Sciences (APMS)

Degree Plans: APMS MATH/STAT/ACTUARY

	BS APMS MATH		BS APMS STAT		BS APMS ACTUARY	
	Crs	Hrs	Crs	Hrs	Crs	Hrs
Math Core	171, 172, 220, 221, 308, 323, 409, 410 or 446, 417 or 437	31	171, 172, 220, 221, 308, 323, 409, 417 or 437	28	171, 172, 220, 221, 308, 323, 409, 417 or 437, 419	30
Math Elec.	MATH 415 or 433; MATH 412, 414, 442, or 470	6	MSCI 4xx, MSCI 4xx, MS 4xx, MS 4xx,	12	MATH 325, MATH 425, MATH 411 or STAT 414, MSCI 4xx, MSCI 4xx	15
Emphasis Electives	MATH 4xx, MATH 4xx, MATH 4xx, MSCI 4xx, MSCI 4xx	15	STAT 404, STAT 408, STAT 414 or MATH 411, ISEN 320 or 340	12	3 x ECON/ECMT/FINC 3xx or 4xx	9
STAT/CSCE	STAT 211, STAT 212, CSCE elec, CSCE elec	14	STAT 211, STAT 212, CSCE elec, CSCE elec	14	STAT 211, STAT 212, CSCE elec, CSCE elec	14
PHYS	PHYS 218; PHYS 208 or OCNG 451	8	PHYS 218; PHYS 208 or OCNG 451	8	PHYS 218; PHYS 208 or OCNG 451	8
Science Elec.	See note 4 on page 10	8	See note 4 on page 10	8	See note 4 on page 10	8
(General) Core Elec.	ENGL 103 or 104; COMM 203, 205, or 243; ECON 202 or 203; Lang., Phil. and Cult. w/ ICD; Creative Arts w/ICD	15	ENGL 103 or 104; COMM 203, 205, or 243; ECON 202 or 203; Lang., Phil. and Cult w/ ICD; Creative Arts w/ICD	15	ENGL 103 or 104; COMM 203, 205, or 243; ECON 202 or 203; Lang., Phil. and Cult. w/ ICD; Creative Arts w/ICD	15
HIST/POLS Elec.	HIST 105, HIST 106, POLS 206, POLS 207	12	HIST 105, HIST 106, POLS 206, POLS 207	12	HIST 105, HIST 106, POLS 206, POLS 207	12
Free Elec.		11		11		9
TOTAL HOURS		**120**		**120**		**120**

1. **Math and Emphasis Electives:**
   - **APMS MATH** (21 hours): Take
     - → MATH 415 or 433,
     - → 3 hours from MATH 412, 414, 442, or 470.
     - → 9-15 hours from MATH 325, 407-499.
     - → Up to 6hrs may be from STAT 404-482; CSCE 210 - 470 (except CSCE 222, 285, 289, 291); ISEN 320, 340.
       - Students pursuing a minor in CSCE may use up to 9hrs of 300/400 level CSCE courses towards their 15hr Math elective requirement (course adjustment is required in Howdy).
   - **APMS STAT** (24 hours): Take
     - → ISEN 320 or 340.
     - → Select 6-12 hours from MATH 325, 407-499; STAT 415, 485, 489.
     - → Select up to 6 hours from CSCE 210-470 (except CSCE 222, 285, 289, 291); ISEN 320-499; STAT 404-482.
   - **APMS ACTUARY** (24 hours): Take
     - → MATH 325, 425 and STAT 414 or MATH 411.
     - → Of the remaining 6 hours of 4xx, select 2 courses from MATH 407-499; STAT 404-482; CSCE 210-470 (except CSCE 222, 285, 289, 291); ISEN 320 or 340.
     - → Select 3 courses from ECON 311-489; ECMT 463; FINC 309-489.
   - **Note:** Maximum of 3 hours of MATH 411 or STAT 414 may be used in these degree programs.
   - **Note:** Maximum of 4 hours of MATH 417 or MATH 437 may be used in these degree programs.
2. **CSCE electives**:
   - **APMS MATH/STAT/ACTUARY:** (8 hours) Select 2 courses from CSCE 110, 111, 121, and 206.

Degree Plans: APMS ECON/CPCS/BIOL

	BS APMS ECON		BS APMS CPCS		BS APMS BIOL	
	Crs	Hrs	Crs	Hrs	Crs	Hrs
Math Core	171, 172, 220, 221, 308, 323, 409, 411 or STAT 414	27	171, 172, 220, 221, 308, 323, 409, 417 or 437	28	171, 172, 220, 221, 308, 323, 409, 417 or 437	28
Math Elec.	325, 425, MATH 4xx, MATH 4xx	12	MATH 415 or 433, 3 x MATH 4xx, MSCI 4xx	15	MATH 415 or 433, MATH 410 or 446, 4 x MATH 4xx	18
Emphasis Electives	ISEN 320 or 340, ECON 323, ECON 459, ECMT 463	12	CSCE 221, CSCE 314, CSCE 411, CSCE 433	13	MATH 442, MATH 469, 6 x MATH/BIOL 285 (1 hr.), BIOL 213, BIOL 214	18
STAT/CSCE	STAT 211, STAT 212, CSCE elec., CSCE elec.	14	STAT 211, STAT 212, CSCE elec., CSCE 121	14	STAT 211, STAT 212, CSCE elec.	10
PHYS/CHEM	PHYS 218, PHYS 208 or OCNG 451	8	PHYS 218, PHYS 208 or OCNG 451	8	CHEM 101/111 or 107/117, CHEM 222/242	8
Science Elec.	See note 4 on page 10	8	See note 4 on page 10	8	BIOL 111, BIOL 112	8
(General) Core Elec.	ENGL 103 or 104; COMM 203, 205, or 243; ECON 202; Lang., Phil. and Cult. w/ ICD; Creative Arts w/ ICD	15	ENGL 103 or104; COMM 203, 205, or 243; ECON 202 or 203; Lang., Phil. and Cult. w/ ICD; Creative Arts w/ ICD	15	ENGL 103 or 104; COMM 203, 205, or 243; ECON 202 or 203; Lang., Phil. and Cult. w/ ICD; Creative Arts w/ ICD	15
HIST/POLS Elec.	HIST 105, HIST 106, POLS 206, POLS 207	12	HIST 105, HIST 106, POLS 206, POLS 207	12	HIST 105, HIST 106, POLS 206, POLS 207	12
Free Elec.		12		7		3
TOTAL HOURS		**120**		**120**		**120**

1. **Math and Emphasis Electives:**
   - **APMS ECON** (24 hours): Take
     → MATH 325 and 425
     → 6 hours from MATH 407-499
     → ISEN 320 or 340
     → ECON 323, ECON 459, and ECMT 463
   - **APMS CPSC** (28 hours): Take
     → MATH 415 or 433
     → 9 hours from MATH 325, MATH 407-499
     → Select 3 hours from MATH 325, 407-499; STAT 404-482; CSCE 210-470 (except CSCE 222, 285, 289, 291); ISEN 320 or 340
     → CSCE 221, 314, 411, and 433
   - **APMS BIOL** (36 hours): Take
     → MATH 415 or 433
     → MATH 410 or 446
     → 12 hours from MATH 325, MATH 407-499
     → MATH 442 and 469
     → MATH/BIOL 285 6 times (1 hr. each)
     → BIOL 213 and 214
   - **Note:** Maximum of 3 hours of MATH 411 or STAT 414 may be used in these degree programs.
   - **Note:** Maximum of 4 hours of MATH 417 or MATH 437 may be used in these degree programs.
2. **CSCE electives:**
   - **APMS ECON:** (8 hours) Select 2 courses from CSCE 110, 111, 121, and 206.
   - **APMS CPCS:** (8 hours) Select 1 course from CSCE 110, 111, or 206; then take CSCE 121.
   - **APMS BIOL:** (4 hours) Select 1 course from CSCE 110, 111, 121, and 206.

COMMON REQUIREMENTS TO ALL DEGREES

The following requirements and remarks apply to all degree plans:

1. **General Core Electives:** (15 hours) Take
   - ENGL 103 or 104 (3 hours)
   - COMM 203, 205, or 243 (3 hours)
   - 3 hours of a Social and Behavioral Sciences CORE course
     - → For BA MATH (Non-Certification) and BS MATH take any Social and Behavioral Sciences CORE course. (For a list of the acceptable Social and Behavioral Sciences courses, please visit core.tamu.edu.)
     - → For BA MATH (Certification) take INST 210
     - → For all APMS degrees, take ECON 202 or 203. Note: APMS ECON majors must take ECON 202.
   - 3 hours of a 200-400 level Language, Philosophy and Culture CORE course
     - → For a list of the acceptable Language, Philosophy and Culture courses, please visit core.tamu.edu.
   - 3 hours of a Creative Arts CORE course
     - → For a list of the acceptable Creative Arts courses, please visit core.tamu.edu.
   - 6 hours of International and Cultural Diversity are required.
     - → Some of these courses may be used to satisfy other degree requirements. In all degree plans shown on pages 5-9, we have assumed that at least two CORE courses with the ICD attribute have been selected. If you choose CORE courses that do not have the ICD attribute, your available free electives will decrease by 6 credit hours. Please visit core.tamu.edu and check the very last column of the spreadsheet to determine which CORE courses carry the ICD attribute.
2. **HIST/POLS:** (12 hours)
   - POLS 206 and 207 are required.
   - For the HIST requirement, 6 hours of American History are required.
     - → Most students satisfy this requirement by taking HIST 105 and 106.
     - → For other options, please visit core.tamu.edu.
3. **Free electives:** Almost every course offered at TAMU will count as a free elective, with some exceptions.
   - → Please see an advisor or the Mathematics Department's List of Ineligible Free Electives for a list of unacceptable courses.
   - → Math 170 counts as free elective hours.
4. **General Science Electives (all degrees except APMS BIOL)**: (8 hours)
   - Select 4 hours from ASTR 111, BIOL 111, BIOL 112, CHEM 101/111, CHEM 102/112, CHEM 107/117
   - Select 4 hours from any 100 level course(s) listed above that you have not taken or ATMO 201/202, GEOL 101/102, or OCNG 251/252.
   - APMS BIOL majors must take BIOL 111 and BIOL 112.
5. **Writing Requirement:**
   - All TAMU students are required to take two writing intensive (W) courses within their major. Students may opt to take one W and one C (Communications) course or two W courses. One of these W course requirements is met with completion of MATH 220. The second requirement may be met with completion of MATH 396, MATH 442, or MATH 467. Some degrees have additional options as follows:
     - → BA MATH (Certification): RDNG 372
     - → APMS ACT and APMS ECON: ECMT 463
     - → All degrees: MATH 482 or 491 with instructor approval
   - All W and C courses will appear in Howdy as 9xx sections.

CAREER OPPORTUNITIES

BA in Mathematics

The BA in Mathematics is designed primarily for students who are interested in teaching, pursuing a professional degree in medicine or law, and those students who are interested in both mathematics and some other area. The BA in Mathematics requires the fewest number of hours of mathematics and has 27 hours of free electives, but it does require that at least 15 hours be taken in some focused area of study other than mathematics. Students planning to attend a professional school (medical, dental, law, etc.) may use the 27 hours of free electives for courses required for the school. Please see the Office of Professional School Advising (OPSA) website for more details: http://opsa.tamu.edu/index.shtml.

Students interested in the liberal arts and who can write will find that this degree plan with a minor in English or Communications is greatly desired by employers. In particular, technical firms frequently need people who can produce a logical argument and then explain it to others. Newspapers and publishing houses are other places such graduates are valued.

BS in Mathematics

The BS in Mathematics is the "pure mathematics" degree. The mathematics courses required by this degree prepare students for graduate school in mathematics, physics, and engineering. Because this option requires a total of 26 hours of science courses, 10 hours more than the APMS degree, it is also a good degree for students who are interested in science as well as mathematics and pre-med students. If you are planning to attend a medical school, the BS and BA in Mathematics are the best degree plans. Please see the Office of Professional School Advising (OPSA) website for more details: http://opsa.tamu.edu/index.shtml.

For students not planning to pursue an advanced degree, the jobs open to graduates with a BS in Mathematics are similar to the job opportunities of APMS/MATH graduates. Technical companies that have hired recent graduates include Microsoft, Apple, Google, and CGG Veritas. These firms hire people to be software engineers and to design web pages. Software development firms can pay very well, but they expect prospective employees to be able to program. This degree plan only requires 4 hours of computer science, so it would be wise to take one or two more CSCE courses if you want a job with a high tech firm.

In summary, there are many job opportunities available with this degree, but this degree will not train you for a specific profession. It would be best to start attending job fairs in your freshman year to get an idea of what sort of jobs interest you and what courses besides math courses will strengthen your resume.

BS in APMS

The BS degree in Applied Mathematics has six emphases: Math, Actuarial Science, Economics, Statistics, Computational Science, and Biological Science. The APMS degree is the most flexible degree and prepares students for the widest possible number of careers.

Over half of the APMS graduates seeking employment directly after graduation look to business, in particular consulting firms and technical companies. All of these companies are looking for people with good problem solving skills. Employers need to be able to train new employees to solve their particular technical problems. In the broadest possible terms, math graduates are hired to work as part of a problem solving team. See the next page for career information on specific areas of emphasis within the APMS degree.

Math Emphasis: Students getting a BS in Applied Mathematics with the Math Emphasis have prepared themselves for graduate school in Mathematics and employment with high-tech firms, engineering firms, and consulting companies. The career opportunities with high-tech firms will depend in part on a student's programming ability and willingness to take a job which requires some programming. Recently Hewlett Packard hired a graduate to work in their mathematical programming group. Texas Systems and Tivoli Systems hire graduates to be software engineers. All these jobs require employees to be able to both program and do mathematics. There is a high demand for mathematicians with programming skills. However, the type of high-tech jobs that are available changes greatly from year to year. The best way to determine what is currently hot is to go to the Engineering Job Fair, the Sciences Career Fair, and the Career Center.

Actuarial Science Emphasis: Students pursuing an Applied Mathematics degree with the Actuarial Science Emphasis have chosen a degree that is suited to a career in business, particularly actuarial and financial consulting. An actuary is a mathematician who analyzes risk. Pension actuaries work with client firms to help them determine their retirement liability and funding status, while casualty actuaries work in insurance firms and run statistical models to determine proper insurance premiums. Actuarial and financial consulting firms that have hired recent graduates include AIG, Aon Hewitt, EY, Fidelity, Forethought Financial, Houston Casualty Company, Mercer, Willis Towers Watson, and USAA. A minor in business or economics is well suited to this degree plan. Some graduates with this degree go on to graduate school in finance, economics, or business, but if you are interested in a graduate-level mathematics or mathematical finance degree, you will need to take additional mathematics courses. Those who want to pursue this degree but are also interested in teacher certification should consider Post Bacc Certification or emergency certification.

Statistics Emphasis: The government always needs mathematicians. The CIA, NSA, FBI, NIST and Census Bureau need mathematically trained personnel. Some former students have been hired by the state transportation division. Most of the students who graduate with an APMS/STAT degree go on to graduate school in statistics. At present, there is a shortage of statisticians. A Masters in Statistics will greatly improve the chance for a high paying job. Career options also greatly increase with a Masters degree. People with a Masters degree have recently found positions with banks, INTEL, pharmaceutical firms, and biotech firms.

Economics Emphasis: Like the Actuarial Science Emphasis, graduates of this degree plan can be hired to be business analysts, financial analysts, and actuaries. A minor in business is well suited to this degree plan. Some graduates with this degree go on to graduate school in economics, finance, and business. A Masters degree will greatly improve the chance for a high paying job. Career options also greatly increase with a Masters degree.

Computational Science Emphasis: Some graduates with this degree will go on to graduate school in Computer Science or seek employment with such companies as Apple, Google, and Microsoft, and government agencies such as NSA, and NASA. A Masters in Computer Science will greatly improve both pay and career options both at places listed for the BS and other types of firms needing advanced IT help.

Biological Sciences Emphasis: Students graduating with an APMS degree with an Emphasis in the Biological Sciences have chosen a degree that is suited to a career in applications of mathematics to the life sciences. The 21st century has been dubbed the Century of the Life Sciences. The life sciences are poised for revolutionary advances in this century. Among the many areas of the life sciences in which mathematics makes enabling contributions are: genomics, computational neuroscience, modeling human and animal physiology, epidemiology, ecology, and pharmacology. Breakthroughs in these fields will be made by interdisciplinary teams of scientists, statisticians and mathematicians working in commercial (industrial) laboratories, governmental laboratories, privately or publicly funded research centers, and universities. Information on career opportunities in mathematics applied to the life sciences can be found at the websites of the Society for Mathematical Biology (http://www.smb.org/) and the Society of Industrial and Applied Mathematics (http://www.siam.org/). A minor in biology or some other area of the biological sciences is well suited to this degree plan. This degree plan will prepare you for graduate work in mathematics or statistics with an emphasis in applications to the biological sciences. People interested in teaching as one of several possible options should consider Post Bacc Certification or Emergency Certification. If you are interested in this option, there are specific math courses that should be chosen for your math elective courses.

MAJOR in MATHEMATICS with HONORS

What is an Honors Mathematics Program?

The Department of Mathematics offers a variety of honors courses. Mathematics majors who fulfill specific requirements, basically to take seven honors mathematics courses, can graduate with Honors in Mathematics. (An Honors Minor in Mathematics is also available.) Other honors programs, with overlapping but different requirements, are Honors in Science and University Honors Fellows.

What is an honors course?

"Honors courses are intended to be more complex, not necessarily more difficult," and "are expected to provide increased intellectual challenge through more sophisticated material, a higher level of intellectual engagement, and more responsibility for the learning process than would typically be expected in an undergraduate course," **says the university**. The philosophy of the Department of Mathematics is that honors students should be more intellectually curious, more motivated, and more independent than the average undergraduate.

Perks of being an Honors Mathematics Major

- Smaller, more interesting classes and the best professors (and, when possible, a reduction in routine busywork).
- Honors priority registration, which is the first two days of the pre-registration period.
- An increased probability of being taken to mathematics conferences with all expenses except for food paid for by the department.
- An increased probability to be hired for the higher paying jobs such as undergraduate TA.
- A few honors mathematics students are invited to be Honors Mentors, students who run help sessions for honors classes they have earned an A in.
- A greatly increased probability of being accepted into FastTrack, our five year combined bachelors/master's program in mathematics.
- Looks great on a résumé.

Becoming an Honors Mathematics Major

- Qualified entering freshmen are invited into the math honors program at their new student conferences.
- Any mathematics major with at least a 3.5 GPA may ask the Director of Honors Programs in Mathematics to be added to the honors program in mathematics as long as the student can still take the required seven honors mathematics classes before graduation.

NOTE: Any student with at least a 3.5 GPA may take an honors class if there are seats available, but doing so does not, by itself, earn the student the Honors distinctions nor gain any of the perks listed above. Any honors classes taken before entering an Honors Program (e.g., Honors in Mathematics, College of Science Honors) can be used to fulfill the program requirements.

Remaining in the Honors Mathematics Program

1. Maintain at least a 3.5 GPA.
2. Take at least one honors math class each academic year.

Students with under a 3.5 but high enough GPA to be over a 3.5 at the end of the next semester will be put on probation for one semester and removed from the program if they are under a 3.5 a second consecutive semester.
Exceptions to Rule 2 must be approved by the Director of the Honors Programs in Mathematics. A year-long study abroad program in which there is no opportunity to take an honors mathematics class is an example of an acceptable reason.

Reinstatement into the Honors Mathematics Program

To be reinstated into the Honors Mathematics Program, the student must meet all the requirements to become a mathematics honors student and be registered for an honors mathematics class in the semester in which reinstatement is requested from the Director of Honors Programs in Mathematics.

Requirements to earn the transcript distinction of Honors in Mathematics

In order to receive Honors in Mathematics, a mathematics major must complete all of the requirements for a BA or BS in Math or a BS in APMS of which 21 hours must be completed as follows:

1. at least 3 hours in an honors mathematics course 100 level or above (honors Calculus I does not count towards the Honors in Mathematics distinction but does count towards the at least one honors math class each academic year),
2. additionally at least 3 hours in an honors mathematics course 200 level or above,
3. additionally at least 3 hours in an honors mathematics course 300 level or above,
4. additionally at least 9 hours in honors mathematics courses 400 level or above,
5. additionally at least 3 hours from one of the following:
    a. a graduate mathematics class other than 601, 695, 696
    b. Math 482H — Research Seminar in Mathematics
    c. Math 485H — Only when used for credit for an internship
    d. Math 491H — supervised research, supervised projects for business/industry or education, or honors credit for an REU.

NOTES:

- With very few exceptions, all math honors courses must be taken at Texas A&M. (An example of an exception would be earning an A at Budapest Semesters in Mathematics. For more information, speak to the Director of Honors Programs in Mathematics.)
- APMS students with emphases in Computational Science or in Statistics may use honors level 4xx courses from CSCE or STAT that are on their degree plans or some 6xx courses in their emphasis area to count toward math honors. Approval from the Director of Honors Programs in Mathematics is required.
- To earn credit for an internship (485H) or for an REU (491H), the student must see the Director of Undergraduate Research in Mathematics (or, for an actuarial internship, the Actuarial Advisor) after spring break but before finals of the spring term to set up the course and to fill out paperwork.

Grade requirements at the time of graduation:

1. a cumulative grade point average of at least 3.5;
2. a grade point average of at least 3.25 and no grade lower than a B in the 21 required honors hours;
3. no grade of F* on the transcript.

Eligible Mathematics Courses when offered; no guarantee that they will be:

- 172H (171H does not count towards the honors major distinction!)
- 220H, 221H
- 308H, 323H, 325H
- all 400-level honors math courses except 401, 403, 433, 490; as above 485H and 491H credit for an REU. No more than a combined total of 6 hours of 485H and 491H courses may be counted towards mathematics honors. Only under very unusual circumstances will the Director of Honors Programs in Mathematics allow 9.
- all 600-level courses except 601, 695, 696.

NOTES:

- When no honors section of an eligible course is available, individual students have the option to negotiate an honors contract with the instructor. The steps for an honors contract are:
  - Ask the professor if an honors contract would be possible.
  - Ask the professor what such a contract would entail.
  - If both of you agree, you need to fill out the Honors Course Contract & Honors Independent Study Applications. You will need to log in under your TAMU User ID to bring up the form. It is recommended that you and your professor fill out the form online together.
  - Submit the form online. **This must be done before the 12th class day of the semester in which the contract is in effect.**
  - Fulfill the agreed upon contract.
- Honors Fellow requires 30 honors hours taken at A&M. College of Science Honors requires 28 hour. All of the hours for Math honors will count towards College of Science Honors and those taken at A&M towards Honors Fellow.
- Three sample programs to fulfill the honors requirements are:
  - 172H, 220H, 323H, 409H, 425H, 484H, 470H
  - 220H, 308H, 323H, 409H, 424H, 467H, 629
  - 409H, 415H, 416H, 446H, 447H, 482H, 491H

INTERNATIONAL and CULTURAL DIVERSITY - Core Curriculum Requirement

Students are required to take 6 hours of International and Cultural Diversity; however, these courses (and only these courses) can be applied to a second University Core Curriculum requirement if possible. To avoid taking extra required courses (and therefore having more free electives in your degree plan), the following is a summary of International and Cultural Diversity courses which also satisfy other requirements for one of the Mathematics degrees. Updates to these lists can be found at http://core.tamu.edu .

(*-indicates that the course has a prerequisite which is not built into any of the Mathematics degree plans)

Language, Philosophy and Culture Courses

AFTS 204, 345; ANTH 205, 210; ARAB 201-202; ARCH 213; CARC 331; CHIN 201- 202; COMM 327; ENGL 204, 206, 221-222, 232, 333, 338, 362, 374, 376; FREN 201-202; FSTC 300; GEOG 301, 305; GERM 201-202; HISP 362; HIST 210, 214, 345; INTS 251; ITAL 201-202; JAPN 201-202; LAND 240; MODL 221-222; MUSC 227, 325-326; NUTR 300; PERF 325-326; RELS 312; RUSS 201-202; SPAN 201-202; SPMT 220; WGST 200, 333, 374

Creative Arts Courses

ANTH 324, ARCH 249, ARCH 250, ARCH 350, ARTS 150, DCED 202, ENDS 101, FILM 251, FILM 425, FREN 425, HISP 205, MUSC 201, MUSC 221, MUSC 222, MUSC 226, MUSC 301, MUSC 324, MUSC 328, MUSC 386, PERF 301, THAR 101, THAR 201, THAR 281, THAR 301, THAR 328, THAR 386

Social and Behavioral Science Courses

(NOTE: Applies to BA Math and BS Math only. All APMS degree plans require ECON 202 or ECON 203 to satisfy the Social and Behavioral Science requirement)

ALEC 450, ANTH 201, ARCH 212, ARCH 458, COMM 335, COMM 365, EPSY 320, GEOG 201, HLTH 236, INST 210, INST 222, JOUR 365, MARS 210, SOCI 205, SOCI 206, SOCI 207, SOCI 212, SOCI 217, SOCI 312, SOCI 313, SOCI 314, SOCI 315, SOCI 327, SPMT 336, SPMT 337, WGST 207

Upper-Level Economics Courses

NOTE: Applies to APMS Actuarial Science Emphasis majors and Economics minors

ECON 312*, 318*, 320*, 324*, 330*, and 452*

TEACHER CERTIFICATION

The demand for secondary mathematics teachers is always strong. There are three paths a student may choose from to obtain secondary (8-12) math certification:

AGGIE TEACH program certification

This is the program outlined in the BA MATH (Certification) plan. Students must complete 22 hours of education courses: SCEN 201, TEFB 322, TEFB 324, INST 210, TEFB, and student teaching (TEFB 429). In addition, students must complete RDNG 372 or 465, and either SOCI 317 or INST 222. Students interested in becoming certified through the AGGIE TEACH program should contact Dr. Jennifer Whitfield or Ms. Laura Wilding in Blocker 514, then obtain a Teaching Field Plan from Dr. Vince Schielack (979-845-2831) before completing a Certification Plan from the College of Education in Harrington Tower, Room 107. Students completing this plan will be certified upon graduating and passing the TExES exams for certification.

Post-baccalaureate certification

Students who choose this option need to complete 9 hours of education courses: INST 210, TEFB 322, and TEFB 324. After graduating with at least a 2.75 GPA, students enter graduate school at Texas A&M in the college of education and take 9 hours of courses in the summer, then 12 hours of courses during a one-year internship. Students completing this plan will be certified upon completing the 21 hours of graduate courses, the internship, and passing the TExES exams for certification. If a student wishes to complete a Masters Degree in Education, they only need 15 additional hours after certification.

Alternative (Accelerated) Certification

Many institutions offer one-year alternative certification programs after graduation. The requirements for these programs vary by institution. Students interested in alternative certification should contact the institution they wish to attend to pursue this for specific requirements. Typically, students who choose this option will be certified upon completing their degree, one year of teaching, and passing the TExES exams for certification.

Contact Dr. Vince Schielack at
vinces@math.tamu.edu
or Dr. Jennifer Whitfield at
jwhitfld@math.tamu.edu
for more information

ADVISING PROCEDURES

All undergraduate mathematics majors should consult with an advisor at least once per semester, prior to registering for courses.

Honors students: Please see your assigned advisor, one of Drs. Anshelevich, Berkolaiko, Papanikolas and Masri. If unsure, email one of them and ask them to look your advisor up for you. You will have the same advisor for all the time you are in the math honors program.

Non-honors students: See Ms. Heather Ramsey if in the actuarial science emphasis of APMS.

All other students are welcome to schedule an appointment with Mr. Ben Aurispa, Ms. Heather Ramsey or Dr. N. Sivakumar. However, upperclassmen must visit with Dr. N. Sivakumar at least twice, once at the end of your junior for a preliminary degree audit and then again before the 5th class day of your final semester for a final degree audit. Additionally, *graduating seniors MUST apply for graduation online in the HOWDY portal at the beginning of the semester in which they expect to graduate.* Failure to do so will result in delayed graduation.

Please schedule an appointment ahead of time by going to the advising page--

http://www.math.tamu.edu/undergraduate/advising

For questions during the semester you can also visit the advising page on the undergraduate web site

http://www.math.tamu.edu/undergraduate/faq.html

Students can use this page to obtain on-line advising, to contact an undergraduate advisor, or to contact the Undergraduate Program Office.

MISCELLANEOUS INFORMATION

Grade Point Requirements

All students must maintain both an overall grade point average and a mathematics grade point average of at least 2.0. **If a grade of D or F is earned in any of the following courses, Math 171/151, 172/152, 221/251/253, 220, 323, or 308, this course must be *immediately* retaken and a grade of C or better earned. The department will allow at most two (2) D's in upper level (300-400) math courses. If a third D is earned, one of the three courses in which a D was earned must be retaken and a grade of C or better earned.** The mathematics grade point average is the average of all grades in mathematics and statistics courses. Grades of S are not included in the GPA calculation. However, a grade of U is treated the same as a grade of F in the GPA calculation.

Writing Requirement

All TAMU students are required to take two writing intensive (W) courses within their major. Students may opt to take one W and one C (Communications) course or two W courses. One of these W course requirements is met with completion of MATH 220. The second requirement may be met with completion of MATH 396, MATH 442, or MATH 467. Some degrees have additional options as follows:

- → BA MATH (Certification): RDNG 372
- → APMS ACT and APMS ECON: ECMT 463
- → All degrees: MATH 482 or 491 with instructor approval

All W and C courses will appear in Howdy as 9xx sections.

Residency Requirement

Students must satisfy the University residency requirement by completing 36 hours of upper level courses (300 - 400 level) at Texas A&M University.

Undergraduate Degree Planner

All students entering Texas A&M University are required to complete an online undergraduate degree plan. The Undergraduate Degree Planner is in Howdy on the My Record tab in the Undergraduate Degree Planner channel. Guides for using the Undergraduate Degree Planner are also available in Howdy. Completing the degree plan is important as it will help you plan your courses and graduate in the least amount of time.

Foreign Language Requirement for the Core Curriculum

The foreign language requirement for the core curriculum states that a student must either complete two years of high school foreign language (in the same language) or complete two semesters of college foreign language (in the same language).

Free Electives

Aside from minor restrictions, a free elective is a course which is not used for a specific degree requirement. A list of ineligible free electives is posted on the Undergraduate Program website. Any course which is more elementary than a required course in the student's major may not be used as a free elective. For example, no mathematics course numbered below MATH 403 may be used as a free elective, except Math 150, 170, 302, 325, 365 and 366. Students must use free electives to satisfy core curriculum and residency requirements which are not satisfied by their specific degree plan.

English 104 Restrictions

The English Department will not allow juniors and seniors to enroll in English 104. This is a strict rule, and they will make NO exceptions. As a result, if you plan to take ENGL 104 at here at TAMU, it MUST BE TAKEN BEFORE YOU ACHIEVE 60 CREDIT HOURS. Otherwise, you will be required to take ENGL 1301 at another institution.

Credit by Examination

Credit by examination is available for courses in biology, chemistry, computer science, economics, English, foreign languages, mathematics, physics, psychology, political science, and history. Students may obtain credit by exam through a variety of College Board advanced placement exams or through departmental exams administered by Data and Research Services (DARS) located in the General Services Building on Agronomy Road.

Accepting Advanced Placement (AP) Credit

Advanced Placement (AP) credits from courses taken in high school do not automatically appear on a student's transcript. In order to formally accept AP credit from high school courses, students must do so in the Howdy system. This is necessary because some students elect to retake high school courses rather than accept their AP credit. Note: AP credit for Statistics or Physics B cannot be used for credit for a math major even as a free elective, so it is recommended that these credits not be accepted. It is possible to accept them later should a student change to a major that will accept the credit(s). Please consult with an advisor before accepting ANY AP credit.

Preparation for Actuarial Examinations

Students interested in actuarial sciences should follow the APMS Actuarial Science degree plan. Interested students should talk to Ms. Heather Ramsey. Actuaries take a series of examinations prior to and during employment. Students should take as many exams as possible prior to graduation. The Math Department offers courses to help students prepare for the first three exams, Exam P, Exam FM and Exam IFM. Notices of exam dates as well as registration information and study materials are available at soa.org.

Scholarships and Financial Aid

The Mathematics Department offers some undergraduate scholarships for mathematics majors. Continuing students may apply for Math scholarships by selecting "College of Science" on this website: https://sfaid.tamu.edu/UWideApp/. Other forms of financial aid and work study programs are available from the Office of Student Financial Aid, located in the Pavilion.

Please note that only courses that satisfy degree requirements are eligible to be paid for with Financial Aid.

Mathematical Association of America, Association for Women in Mathematics, and Pi Mu Epsilon

The Texas A&M Math Department has student chapters of these two national mathematics organizations. These organizations attempt to educate students about math outside their typical coursework and to give them an understanding of possible careers in math and math-related fields.

Texas A&M's MAA student chapter is open to all students who have an interest in mathematics. There are no scholastic requirements such as class standing or grade point average. Students from any major are welcome to join. The cost of membership ranges from $20 to $30.

The Association for Women in Mathematics (AWM) student chapter is open to all students, men and women, who wish to promote full participation in mathematics by women. There are no scholastic requirements such as classification or grade point average to join. Students from any major are welcome to join. AWM is free for our AWM chapter members, which are any members of our math club.

Pi Mu Epsilon is an honorary mathematics organization. Students are required to meet certain requirements to join. There is a $30 lifetime membership fee. For more information about requirements, please contact Donna Hoffman at (979)862-4306. The three organizations share student officers and hold joint monthly meetings and events. At the meetings, speakers are invited to talk to the group. Often, prospective employers are invited to give presentations.

Employment Search

The Texas A&M University Career Center helps juniors and seniors find prospective employers. In recent years, approximately 35 companies have recruited mathematics majors through the Career Center. Some of these companies include Aon Hewitt, Mercer, Fidelity, Willis Towers Watson, EY, Milliman, Schlumberger, CGG Veritas, IBM, Texas Instruments, General Motors, and Shell Oil Company. U.S. government agencies such as the CIA, the FBI, the Army, the Air Force, and NSA also interview through the Career Center. For more information, visit hireaggies.com or contact the Career Center Office, Suite 209 of the Koldus Building at (979)845-5139.

Graduate School

An undergraduate degree in mathematics is an excellent background for graduate studies in mathematics, computer science, statistics, industrial engineering, and business as well as many other fields. Graduate students usually receive financial support in the form of scholarships, fellowships, industrial internships or teaching assistantships.

Students interested in graduate school should begin applying for admission and take the GRE (Graduate Records Examination) two semesters prior to graduation. Students planning to take the GRE at Texas A&M should register online at: GRE.org and select the General Services Complex at TAMU as the Testing Center.

The American Mathematical Society publishes a list of graduate programs and information associated with graduate assistantships and fellowships in the mathematical sciences each fall. Information on Graduate School in Mathematics at Texas A&M University is available through the Graduate Program Office located in Blocker 227B. Information on Graduate School in Statistics at Texas A&M University is available in the Statistics Office located in Blocker 447.