Mathematics – Honors Program Revision

Part I - Summary

The Department of Mathematics has two majors: Mathematics and Actuarial Science. Additionally, in the mathematics major, there are six (6) distinct tracks (Applied, Math Biology, Financial, Education, Honors and Theoretical). Currently, only actuarial science majors and math majors in the honors track in math are eligible for an honors degree in mathematics (along with other ASC and university requirements). The proposed revision to the honors program in mathematics extends the eligibility of honors degrees to math majors in the non-honors tracks (excepting the education track – these students are better served by the theoretical track), with suitable requirements for doing so. In addition to honors designation, the Department of Mathematics proposes to add a designation of Distinction or Honors Distinction to students completing all honors courses in the honors track (as appropriate).

A component of all honors requirements is a required number of honors eligible courses. These courses are any honors math courses at the 2000-level or above and certain specified math courses at the 5000-level or above. The Honors eligibility of a course is track dependent. The Departmental Honors Committee will review the curriculum of the honors eligible courses.

Below are the proposed revisions:

1. Math majors satisfy the following requirements for the with honors in Arts and Sciences designation:

   a) Complete the requirements for a math major track.

   b) Complete at least five (5) honors eligible courses with at most two (2) courses at the 2000 or 3000-level.

   c) Among the five (5) honors eligible courses, complete a one-year sequence in from table 1.

   d) Complete a College Honors Contract. This requirement is overseen by the College Honors Program.

Table 1 – Math Major Yearlong Sequences

All tracks:
Math 4181H-4182H Honors Analysis I & II
Math 5590H-5591H Honors Abstract Algebra I & II
Applied, Math Bio and Financial Track:
Math 5401-5402 Applied Differential Equations I & II
Math 5401-5651 Applied Differential Equations I and Math Modeling of Bio Processes
Math 5601-5602 Essentials of Numerical Methods and Computational PDEs
Math 5633-5634 Loss Models I & II
Math 5635-5636 Stochastic Calculus for Finance I & II
Math 5756-5757 Mathematical Methods in Relativity Theory I & II

2. Actuarial Science majors satisfy the following requirements for the with honors in Arts and Sciences designation:

    a) Complete the requirements for an actuarial science major.

    b) Complete at least five (5) honors eligible courses with at most two (2) courses at the 2000 or 3000-level.

    c) Among the five (5) honors eligible courses, complete a one-year sequence in from table 2.

    d) Complete a College Honors Contract. This requirement is overseen by the College Honors Program.

Table 2 – Actuarial Science Yearlong Sequences

Math 4181H-4182H Honors Analysis I & II
Math 5630-5631 Life Contingencies I & II
Math 5633-5634 Loss Models I & II
Math 5635-5636 Stochastic Calculus for Finance I & II

3. Math majors satisfy the following requirements for the with Distinction in Mathematics designation:

    a) Complete the requirements for the Honors track.

    b) Complete all of the honors mathematics courses listed in table 3.

Table 3 – Honors course for Distinction

Math 4181H-4182H Honors Analysis I & II
Math 5520H Honors Linear Algebra & Differential Equations
Math 5522H Honors Complex Analysis
Math 5529H Honors Combinatorics
Math 5530H Honors Probability Theory
Math 5540H Honors Differential Geometry
Math 5576H Honors Number Theory
Math 5590H-5591H Honors Abstract Algebra I & II

    e) Students who additionally complete a College Honors Contract (as overseen by the College Honors Program) will receive the with Honors Distinction in Mathematics designation.

As the Department of Mathematics transitions from its current honors program to this proposed program, current students in the honors program should be unaffected. Principally, the proposed honors program contains the current honors track, which meets all of the proposed requirements for an honors designation. In fact, many of these students would likely satisfy the requirements for Honors Distinction in mathematics.

Part II – Current Track Advising Sheets

Actuarial Science Requirements

Part A: Required Prerequisites

Math 1151	Calculus I	5
Math 1152	Calculus II	5
AcctMIS 2000	Foundations of Accounting	3
Econ 2001	Principles of Microeconomics	3
Econ 2002	Principles of Macroeconomics	3

Choose one of the following three:

CSE 1222	Introduction to Computer Programming in C++ for Engineers and Scientists	3
CSE 1223	Introduction to Computer Programming in Java	3
CSE 2111	Modeling and Problem Solving with Spreadsheets and Databases	3

Part B: Major Program (Minimum grade of C- and GPA of 2.0)

Math 2153	Calculus III	4
Math 2568	Linear Algebra	3

Choose one of the following two:

Math 4530	Probability1	3
Stat 4201	Introduction to Mathematical Statistics I	4

Complete the following four:

Stat 4202	Introduction to Mathematical Statistics II	4
Math 3588	Practicum in Actuarial Science	3
Math 3618	Theory of Interest	3
Math 5632	Financial Economics for Actuaries	3
BusFin 3120	Foundations of Finance	3

Choose one of the following sequences:

Math 5630	Life Contingencies I	3
Math 5631	Life Contingencies II	3
Math 5633	Loss Models I	3
Math 5634	Loss Models II	3
	Total Hours	32-33

Math Applied Track (Chemistry) Requirements

Part A: Required Prerequisites

Math 1151 and 1152	Calculus I and II	10
Math 1295	Introductory Seminar	1
Physics 1250 and 1251	Mechanics, Thermal Physics, Waves and E & M, Optics, Modern Physics	10
Chem 1210 and 1220	General Chemistry I and II	10
CSE 1222 or 1223	Intro to Computer Programming in C++ or Intro Computer Programming in Java	3
Choose one of the following two:		
Biology 1113	Biological Sciences: Energy Transfer and Development	4
Biology 1114	Biological Sciences: Form, Function, Diversity and Ecology	4

Part B: Major Program (Minimum grade of C- and GPA of 2.0)

Core Requirements		
Math 2153	Calculus III	4-5
Math 2568	Linear Algebra	3
Math 3345	Foundations of Higher Mathematics	3
Math 4530 or Stat 4201	Probability or Introduction to Mathematical Statistics I	3-4
Stat 4202	Introduction to Mathematical Statistics II	4
Required Courses		
Math 2255	Differential Equations and Their Applications	3
Math 4557	Partial Differential Equations	3
Applied Math Courses (choose two of the following three):		
Math 3607	Beginning Scientific Computing	3
Math 4552	Complex Analysis	3
Math 4556	Dynamical Systems	3
Applied Math Electives (choose at least 6 hours of science):		
Chem 2210	Analytical Chemistry I: Quantitative Analysis	5
Chem 4300	Physical Chemistry I	3
Chem 4310	Physical Chemistry II	3
Applied Math ELectives (choose at least 6 hours of math):		
Math 3607	Beginning Scientific Computing (IF NOT BEFORE)	3
Math 4350	Quantitative Neuroscience	3
Math 4547	Introductory Analysis I	3
Math 4548	Introductory Analysis II	3
Math 4551	Vector Analysis	3
Math 4552	Complex Analysis (IF NOT BEFORE)	3
Math 4556	Dynamical Systems (IF NOT BEFORE)	3
Math 4578	Discrete Mathematical Models	3
Math 5101	Linear Mathematics in Finite Dimensions	3
Math 5102	Linear Mathematics in Infinite Dimensions	3
Math 5451	Calculus of Variations and Tensor Calculus	3
Math 5756	Mathematical Methods in Relativity Theory I	3
Math 5757	Mathematical Methods in Relativity Theory II	3
	Total Hours	41-45

Math Applied Track (Physics) Requirements

Part A: Required Prerequisites

Math 1151 and 1152	Calculus I and II	10
Math 1295	Introductory Seminar	1
Physics 1250 and 1251	Mechanics, Thermal Physics, Waves and E & M, Optics, Modern Physics	10
Chem 1210	General Chemistry I	10
CSE 1222 or 1223	Intro to Computer Programming in C++ or Intro Computer Programming in Java	3
Choose one of the following two:		
Biology 1113	Biological Sciences: Energy Transfer and Development	4
Biology 1114	Biological Sciences: Form, Function, Diversity and Ecology	4

Part B: Major Program (Minimum grade of C- and GPA of 2.0)

Core Requirements

Math 2153	Calculus III	4-5
Math 2568	Linear Algebra	3
Math 3345	Foundations of Higher Mathematics	3
Math 4530 or Stat 4201	Probability or Introduction to Mathematical Statistics I	3-4
Stat 4202	Introduction to Mathematical Statistics II	4
Required Courses		
Math 2255	Differential Equations and Their Applications	3
Math 4557	Partial Differential Equations	3
Applied Math Courses:		
Physics 2300	Intermediate Mechanics I	4
Physics 2301	Intermediate Mechanics II	4
Choose two of the following three:		
Math 3607	Beginning Scientific Computing	3
Math 4552	Complex Analysis	3
Math 4556	Dynamical Systems	3
Applied Math Electives (choose at least 6 hours of math):		
Math 3607 or 3607H	Beginning Scientific Computing (IF NOT BEFORE)	3
Math 4350	Quantitative Neuroscience	3
Math 4547	Introductory Analysis I	3
Math 4548	Introductory Analysis II	3
Math 4551	Vector Analysis	3
Math 4552	Complex Analysis (IF NOT BEFORE)	3
Math 4556	Dynamical Systems (IF NOT BEFORE)	3
Math 4578	Discrete Mathematical Models	3
Math 5101	Linear Mathematics in Finite Dimensions	3
Math 5102	Linear Mathematics in Infinite Dimensions	3
Math 5451	Calculus of Variations and Tensor Calculus	3
Math 5756	Mathematical Methods in Relativity Theory I	3
Math 5757	Mathematical Methods in Relativity Theory II	3
	Total Hours	43-45

Math Biology Track Requirements

Part A: Required Prerequisites

Math 1151 and 1152	Calculus I and Calculus II	10
Math 1295	Introductory Seminar	1
Chem 1210	General Chemistry I	5
Biology 1113	Biological Sciences: Energy Transfer and Development	4
Biology 1114	Biological Sciences: Form, Function, Diversity and Ecology	4

Part B: Major Program (Minimum grade of C- and GPA of 2.0)

Core Requirements

Math 2153	Calculus III	4-5
Math 2568	Linear Algebra	3
Math 3345	Foundations of Higher Mathematics	3
Math 4530 or Stat 4201	Probability or Introduction to Mathematical Statistics I	3-4
Stat 4202	Introduction to Mathematical Statistics II	4

Required Courses

Math 2255	Differential Equations and Their Applications	3
Math 3350	Introduction to Mathematical Biology	3

Choose one of the following two:

Biology 3401	Integrated Biology	4
Math/MolGen 5660	Integrated Molecular and Cellular Biology for Non-Biologists	5

Applied Math Courses (choose two of the following three):

Math 3607	Beginning Scientific Computing	3
Math 4556	Dynamical Systems	3
Math 4557	Partial Differential Equations	3

Applied Math Electives (choose at least 6 hours):

Math 3607	Beginning Scientific Computing (IF NOT BEFORE)	3
Math 4350	Quantitative Neuroscience	3
Math 4547	Introductory Analysis I	3
Math 4551	Vector Analysis	3
Math 4552	Complex Analysis	3
Math 4556	Dynamical Systems (IF NOT BEFORE)	3
Math 4557	Partial Differential Equations (IF NOT BEFORE)	3
Math 4580	Abstract Algebra I	3
Math 5101	Linear Mathematics in Finite Dimensions	3
Math 5102	Linear Mathematics in Infinite Dimensions	3
Math 5540H	Honors Differential Geometry	5
Biochem 4511	Introduction to Biological Chemistry	4
Chem 2510	Organic Chemistry	4
EEOB 3310	Evolution	4
EEOB 3420	Behavioral Ecology	3-4
EEOB 4520	Comparative Physiology	3
MolGen 4500	General Genetics	3
MolGen 5601	Eukaryotic Molecular Genetics Lab	3-4
	Total Hours	39-45

Math Financial Track Requirements

Part A: Required Prerequisites

Math 1151	Calculus I	5
Math 1152	Calculus II	5
Math 1295	Introductory Seminar	1
Econ 2001.01	Principles of Microeconomics	3
Econ 2002.01	Principles of Macroeconomics	3
CSE 2111	Modeling and Problem Solving with Spreadsheets and Databases	3
Choose ONE of the following accounting options:		
ACCTMIS 2000	Foundations of Accounting	3
ACCTMIS 2200 & 2300	Introduction to Accounting I & II	6
Choose ONE of the following:		
CSE 1222	Intro to Computer Programming in C++ for Engineers and Scientists	3
CSE 1223	Intro to Computer Programming in Java	3

Part B: Major Program (Minimum grade of C- and GPA of 2.0)

Core Requirements

Math 2153	Calculus III	4-5
Math 2568	Linear Algebra	3
Math 3345	Foundations of Higher Mathematics	3
Math 4530 or Stat 4201	Probability or Intro to Math Stat I	3-4
Stat 4202	Intro to Mathematical Statistics II	4
Required Courses for Math Track		
Math 2255	Differential Equations	3
Math 3589	Intro to Financial Mathematics	3
Math 3607	Beginning Scientific Computing	3
Math 3618	Theory of Interest	3
Math 5632	Financial Economics for Actuaries	3
Choose ONE of the following:		
Math 4557	Partial Differential Equations	3
Math 4512	Partial Differential Equations for Sci & Eng	3
Math 4547	Introductory Analysis I	3
Choose ONE of the following:		
BusFin 3120	Foundations of Finance	3
BusFin 3220	Business Finance	3
	Total Hours	38-40

Math Honors Track 1 Requirements

Part A: Required Prerequisites

Math 1181H	Honors Calculus I	5

Part B: Major Program (Minimum grade of C- and GPA of 2.0)

Core Requirements

Math 2182H	Honors Calculus II	5
Math 3345	Foundations of Higher Mathematics	3
Math 5520H	Honors Linear Algebra and Differential Equations	5
Stat 4202	Introduction to Mathematical Statistics II	4

Required Courses

Math 4181H	Honors Analysis I	5
Math 4182H	Honors Analysis II	5
Math 5529H	Honors Combinatorics	5
Math 5530H	Honors Probability	5
Math 5590H	Honors Abstract Algebra I	5
Math 5591H	Honors Abstract Algebra II	5

Math Major Electives (choose 5 hrs)

Math 5522H	Honors Complex Analysis	5
Math 5540H	Honors Differential Geometry	5
Math 5576H	Honors Number Theory	5
	Total Hours	52

Math Honors Track 2 Requirements

Part A: Required Prerequisites

Part B: Major Program (Minimum grade of C- and GPA of 2.0)

Core Requirements

Math 5520H	Honors Linear Algebra and Differential Equations	5
Stat 4202	Introduction to Mathematical Statistics II	4

Required Courses

Math 4181H	Honors Analysis I	5
Math 4182H	Honors Analysis II	5
Math 5529H	Honors Combinatorics	5
Math 5530H	Honors Probability	5
Math 5590H	Honors Abstract Algebra I	5
Math 5591H	Honors Abstract Algebra II	5

Math Major Electives (choose 5 hrs)

Math 5522H	Honors Complex Analysis	5
Math 5540H	Honors Differential Geometry	5
Math 5576H	Honors Number Theory	5
	Total Hours	44

Math Theoretical Track Requirements

Part A: Required Prerequisites

Math 1151	Calculus I	5
Math 1152	Calculus II	5
Math 1295	Introductory Seminar	1

Part B: Major Program (Minimum grade of C- and GPA of 2.0)

Core Requirements

Math 2153	Calculus III	4-5
Math 2568	Linear Algebra	3
Math 3345	Foundations of Higher Mathematics	3
Math 4530 or Stat 4201	Probability or Introduction to Mathematical Statistics I	3-4
Stat 4202	Introduction to Mathematical Statistics II	4

Required Courses

Math 2255	Differential Equations and Their Applications	3
Math 4547	Introductory Analysis I	3
Math 4548	Introductory Analysis II	3
Math 4580	Abstract Algebra I	3
Math 4581	Abstract Algebra II	3

Math Major Electives (choose at least 6 hours):

Math 3589	Introduction to Financial Mathematics	3
Math 3607	Beginning Scientific Computing	3
Math 3618	Theory of Interest	3
Math 4350	Quantitative Neuroscience	3
Math 4504	History of Mathematics	3
Math 4507	Geometry	3
Math 4556	Dynamical Systems	3
Math 4557	Partial Differential Equations	3
Math 4551	Vector Analysis	3
Math 4552	Complex Analysis	3
Math 4573	Elementary Number Theory	3
Math 4575	Combinatorial Mathematics	3
Math 4578	Discrete Mathematical Models	4
Math 5632	Financial Economics for Actuaries	3
	Total Hours	38-40

Part III – Honors Advising Sheets

Actuarial Science – Honors Requirements

(Courses in bold denote honors eligible courses)

Part A: Required Prerequisites

	ACCTMIS 2000 Foundations of Accounting (3 hrs)
	Econ 2001.01 Principles of Microeconomics (3 hrs)
	Econ 2002.01 Principles of Macroeconomics (3 hrs)
	Math 1151 Calculus I (5 hrs)
	Math 1152 Calculus II (5 hrs)

[   ] Choose **One** of the following

	CSE 1222 Intro to Computer Programming in C++ for Engineers and Scientists (3 hrs)
	CSE 1223 Intro to Computer Programming in Java (3 hrs)
	CSE 2111 Modeling and Problem Solving with Spreadsheets and Databases (3 hrs)

Part B: Major Program

	BusFin 3120 Foundations of Finance (3 hrs)
	Math 2153 or **2182H** Calculus III or Honors Calculus II (4-5 hrs)
	Math 2568 or **2568H** Linear algebra (3 hrs)
	Math 3588 Introduction to Financial Mathematics (3 hrs)
	Math 3618 Theory of Interest (3 hrs)
	Math 4530 or Stat 4201 Probability or Introduction to Mathematical Statistics I (3-4 hrs)
	Math 5632 Financial Economics (3 hrs)
	Stat 4202 Introduction to Mathematical Statistics II (4 hrs)

[   ] Choose **One** of the following year-long sequences (may choose both to satisfy minimum number of honors eligible course)

	Math 5630 & 5631 Life Contingencies I & II
	Math 5633 & 5634 Loss Models I & II

Honors Eligible Courses Chosen Above:

A minimum of 5 honors eligible courses must be chosen, with at least 3 at the 4000-level and higher and with at least one year-long sequence.

[   ]   [   ]   [   ]   [   ]   [   ]

Math Applied (Chem) Track – Honors Requirements

(Courses in bold denote honors eligible courses)

Part A: Required Prerequisites

	Chem 1210 General Chemistry I (5 hrs)
	Chem 1220 General Chemistry II (5 hrs)
	Physics 1250 Mechanics, Thermal Physics, Waves (5 hrs)
	Physics 1251 E & M, Optics, Modern Physics (5 hrs)
	Math 1151 Calculus I (5 hrs)
	Math 1152 Calculus II (5 hrs)
	Math 1295 Introductory Seminar (1 hr)

Choose **One** of the following Biology options

	Biology 1113 Biological Sciences: Energy Transfer and Development (4 hrs)
	Biology 1114 Biological Sciences: Form, Function, Diversity and Ecology (4 hrs)

Choose **One** of the CSE following

	CSE 1222 Intro to Computer Programming in C++ for Engineers and Scientists (3 hrs)
	CSE 1223 Intro to Computer Programming in Java (3 hrs)

Part B: Major Program

	Math 2153 or **2182H** Calculus III or Honors Calculus II (4-5 hrs)
	Math 2255 Differential Equations (3 hrs)
	Math 2568 or **2568H** Linear algebra (3 hrs)
	Math 3345 or **3345H** Foundations of Higher Mathematics (3 hrs)
	Math 4530 or Stat 4201 Probability or Introduction to Mathematical Statistics I (3-4 hrs)
	Math 4557 Partial Differential Equations (3 hrs)
	Stat 4202 Introduction to Mathematical Statistics II (4 hrs)

Choose **Two** of the following

	Math 3607 Beginning Scientific Computing (3 hrs)
	Math 4552 Complex Analysis (3 hrs)
	Math 4556 Dynamical Systems (3 hrs)

	Choose **Two** of the following

	Chem 2210 Analytical Chemistry I: Quantitative Analysis (5 hrs)
	Chem 4300 Physical Chemistry I (3 hrs)
	Chem 4310 Physical Chemistry II (3 hrs)

	Choose **at least six hours** of the following

	Math 3607 Beginning Scientific Computing (IF NOT BEFORE) (3 hrs)
	Math 4181H Honors Analysis I (5 hrs)
	Math 4182H Honors Analysis II (5 hrs)
	Math 4530 Quantitative Neuroscience (3 hrs)
	Math 4547 Introductory Analysis I (3 hrs)
	Math 4548 Introductory Analysis II (3 hrs)
	Math 4551 Vector Analysis (3 hrs)
	Math 4552 Complex Analysis (IF NOT BEFORE) (3 hrs)
	Math 4556 Dynamical Systems (IF NOT BEFORE) (3 hrs)
	Math 4578 Discrete Mathematics Models (4 hrs)
	Math 5101 Linear Mathematics in Finite Dimensions (3 hrs)
	Math 5102 Linear Mathematics in Infinite Dimensions (3 hrs)
	Math 5401 Applied Differential Equations I (3 hrs)
	Math 5402 Applied Differential Equations 2 (3 hrs)
	Math 5451 Calculus of Variations and Tensor Calculus (3 hrs)
	Math 5601 Essentials of Numerical Methods (3 hrs)
	Math 5602 Computational PDEs (3 hrs)
	Math 5756 Mathematical Models in Relativity Theory I (3 hrs)
	Math 5757 Mathematical Models in Relativity Theory II (3 hrs)

	Choose **One** of the following year-long sequences (note, some courses may have been chosen above – overlap is allowed)

	Math 4181H & 4182H Honors Analysis I & II
	Math 5590H-5591H Honors Abstract Algebra I & II
	Math 5401 & 5402 Applied Differential Equations I & II
	Math 5601 & 5602 Essentials of Numerical Methods and Computational PDEs
	Math 5756 & 5757 Mathematical Methods in Relativity Theory I & II

Honors Eligible Courses Chosen Above:

A minimum of 5 honors eligible courses must be chosen, with at least 3 at the 4000-level and higher and with at least one year-long sequence.

Math Applied (Physics) Track – Honors Requirements

(Courses in bold denote honors eligible courses)

Part A: Required Prerequisites

	Chem 1210 General Chemistry I (5 hrs)
	Physics 1250 Mechanics, Thermal Physics, Waves (5 hrs)
	Physics 1251 E & M, Optics, Modern Physics (5 hrs)
	Math 1151 Calculus I (5 hrs)
	Math 1152 Calculus II (5 hrs)
	Math 1295 Introductory Seminar (1 hr)

	Choose **One** of the following Biology options

	Biology 1113 Biological Sciences: Energy Transfer and Development (4 hrs)
	Biology 1114 Biological Sciences: Form, Function, Diversity and Ecology (4 hrs)

	Choose **One** of the CSE following

	CSE 1222 Intro to Computer Programming in C++ for Engineers and Scientists (3 hrs)
	CSE 1223 Intro to Computer Programming in Java (3 hrs)

Part B: Major Program

	Math 2153 or **2182H** Calculus III or Honors Calculus II (4-5 hrs)
	Math 2255 Differential Equations (3 hrs)
	Math 2568 or **2568H** Linear algebra (3 hrs)
	Math 3345 or **3345H** Foundations of Higher Mathematics (3 hrs)
	Math 4530 or Stat 4201 Probability or Introduction to Mathematical Statistics I (3-4 hrs)
	Math 4557 Partial Differential Equations (3 hrs)
	Physics 2300 Intermediate Mechanics I (4 hrs)
	Physics 2301 Intermediate Physics II (4 hrs)
	Stat 4202 Introduction to Mathematical Statistics II (4 hrs)

	Choose **Two** of the following

	Math 3607 Beginning Scientific Computing (3 hrs)
	Math 4552 Complex Analysis (3 hrs)
	Math 4556 Dynamical Systems (3 hrs)

| | Choose **at least six hours** of the following |

	Math 3607 Beginning Scientific Computing (IF NOT BEFORE) (3 hrs)
	Math 4181H Honors Analysis I (5 hrs)
	Math 4182H Honors Analysis II (5 hrs)
	Math 4530 Quantitative Neuroscience (3 hrs)
	Math 4547 Introductory Analysis I (3 hrs)
	Math 4548 Introductory Analysis II (3 hrs)
	Math 4551 Vector Analysis (3 hrs)
	Math 4552 Complex Analysis (IF NOT BEFORE) (3 hrs)
	Math 4556 Dynamical Systems (IF NOT BEFORE) (3 hrs)
	Math 4578 Discrete Mathematics Models (4 hrs)
	Math 5101 Linear Mathematics in Finite Dimensions (3 hrs)
	Math 5102 Linear Mathematics in Infinite Dimensions (3 hrs)
	Math 5401 Applied Differential Equations I (3 hrs)
	Math 5402 Applied Differential Equations 2 (3 hrs)
	Math 5451 Calculus of Variations and Tensor Calculus (3 hrs)
	Math 5601 Essentials of Numerical Methods (3 hrs)
	Math 5602 Computational PDEs (3 hrs)
	Math 5756 Mathematical Models in Relativity Theory I (3 hrs)
	Math 5757 Mathematical Models in Relativity Theory II (3 hrs)

| | Choose **One** of the following year-long sequences (note, some courses may have been chosen above – overlap is allowed) |

	Math 4181H & 4182H Honors Analysis I & II
	Math 5590H-5591H Honors Abstract Algebra I & II
	Math 5401 & 5402 Applied Differential Equations I & II
	Math 5601 & 5602 Essentials of Numerical Methods and Computational PDEs
	Math 5756 & 5757 Mathematical Models in Relativity Theory I & II

Honors Eligible Courses Chosen Above:

A minimum of 5 honors eligible courses must be chosen, with at least 3 at the 4000-level and higher and with at least one year-long sequence.

Math Mathematical Biology Track – Honors Requirements

(Courses in bold denote honors eligible courses)

Part A: Required Prerequisites

	Chem 1210 General Chemistry I (5 hrs)
	Biology 1113 Biological Sciences: Energy Transfer and Development (4 hrs)
	Biology 1114 Biological Sciences: Form, Function, Diversity and Ecology (4 hrs)
	Math 1151 Calculus I (5 hrs)
	Math 1152 Calculus II (5 hrs)
	Math 1295 Introductory Seminar (1 hr)

Part B: Major Program

	Math 2153 or **2182H** Calculus III or Honors Calculus II (4-5 hrs)
	Math 2255 Differential Equations (3 hrs)
	Math 2568 or **2568H** Linear algebra (3 hrs)
	Math 3345 or **3345H** Foundations of Higher Mathematics (3 hrs)
	Math 3350 Introduction to Mathematical Biology (3 hrs)
	Math 4530 or Stat 4201 Probability or Introduction to Mathematical Statistics I (3-4 hrs)
	Stat 4202 Introduction to Mathematical Statistics II (4 hrs)

Choose **One** of the following courses

	Biology 3410 Integrated Biology (4 hrs)
	Math 5660 Integrated Molecular and Cellular Biology for Non-Biologists (5 hrs)

Choose **Two** of the following

	Math 3607 Beginning Scientific Computing (3 hrs)
	Math 4556 Dynamical Systems (3 hrs)
	Math 4557 Partial Differential Equations (3 hrs)

Choose **at least six hours** of the following

	Math 3607 Beginning Scientific Computing (IF NOT BEFORE) (3 hrs)
	Math 4181H Honors Analysis I (5 hrs)
	Math 4530 Quantitative Neuroscience (3 hrs)
	Math 4547 Introductory Analysis I (3 hrs)
	Math 4551 Vector Analysis (3 hrs)
	Math 4552 Complex Analysis (IF NOT BEFORE) (3 hrs)
	Math 4556 Dynamical Systems (IF NOT BEFORE) (3 hrs)
	Math 4557 Partial Differential Equations (IF NOT BEFORE) (3 hrs)
	Math 4578 Discrete Mathematics Models (4 hrs)
	Math 4580 Abstract Algebra I (3 hrs)
	Math 5101 Linear Mathematics in Finite Dimensions (3 hrs)

	Math 5102 Linear Mathematics in Infinite Dimensions (3 hrs)
	Math 5401 Applied Differential Equations I (3 hrs)
	Math 5540H Differential Geometry (5 hrs)
	Math 5590H Honors Abstract Algebra I (5 hrs)
	Math 5601 Essentials of Numerical Methods (3 hrs)
	Math 5651 Math Modeling of Bio Processes (3 hrs)
	Biochem 4511 Introduction to Biological Chemistry
	Chem 2510 Organic Chemistry (4 hrs)
	EEOB 3310 Evolution (4 hrs)
	EEOB 3420 Behavioral Ecology (3-4 hrs)
	EEOB 4520 Comparative Physiology (3 hrs)
	MolGen 4500 General Genetics (3 hrs)
	MolGen 5601 Eukaryotic Molecular Genetics Lab (3-4 hrs)

Choose **One** of the following year-long sequences (note, some courses may have been chosen above – overlap is allowed)

	Math 4181H & 4182H Honors Analysis I & II
	Math 5590H-5591H Honors Abstract Algebra I & II
	Math 5401 & 5402 Applied Differential Equations I & II
	Math 5401 & 5651 Applied Differential Equations I and Math Modeling of Bio Processes
	Math 5601 & 5602 Essentials of Numerical Methods and Computational PDEs

Honors Eligible Courses Chosen Above:

A minimum of 5 honors eligible courses must be chosen, with at least 3 at the 4000-level and higher and with at least one year-long sequence.

Math Financial Track – Honors Requirements

(Courses in bold denote honors eligible courses)

Part A: Required Prerequisites

	CSE 2111 Modeling and Problem Solving with Spreadsheets and Databases (3 hrs)
	Econ 2001.01 Principles of Microeconomics (3 hrs)
	Econ 2002.01 Principles of Macroeconomics (3 hrs)
	Math 1151 Calculus I (5 hrs)
	Math 1152 Calculus II (5 hrs)
	Math 1295 Introductory Seminar (1 hr)

Choose **One** of the following accounting options

	ACCTMIS 2000 Foundations of Accounting (3 hrs)
	ACCTMIS 2200 & 2300 Introduction to accounting I & II (6 hrs)

Choose **One** of the following

	CSE 1222 Intro to Computer Programming in C++ for Engineers and Scientists (3 hrs)
	CSE 1223 Intro to Computer Programming in Java (3 hrs)

Part B: Major Program

	Math 2153 or **2182H** Calculus III or Honors Calculus II (4-5 hrs)
	Math 2255 Differential Equations (3 hrs)
	Math 2568 or **2568H** Linear algebra (3 hrs)
	Math 3345 or **3345H** Foundations of Higher Mathematics (3 hrs)
	Math 3589 Introduction to Financial Mathematics (3 hrs)
	Math 3607 Beginning Scientific Computing (3 hrs)
	Math 3618 Theory of Interest (3 hrs)
	Math 4530 or Stat 4201 Probability or Introduction to Mathematical Statistics I (3-4 hrs)
	Math 5632 Financial Economics (3 hrs)
	Stat 4202 Introduction to Mathematical Statistics II (4 hrs)

Choose **One** of the following

	Math 4181H Honors Analysis I (5 hrs) (can also be counted as part of a year-long sequence)
	Math 4512 Partial Differential Equations for Scientists and Engineers (3 hrs)
	Math 4557 Partial Differential Equations (3 hrs)
	Math 4547 Introductory Analysis I (3 hrs)
	Math 5401 Applied Differential Equations I (3 hrs) (can also be counted used as part of a year-long sequence)

| | Choose **One** of the following |

	BusFin 3120 Foundations of Finance (3 hrs)
	BusFin 3220 Business Finance (3 hrs)

| | Choose **One** of the following year-long sequences (note, some first courses may have been chosen above – overlap is allowed) |

	Math 4181H & 4182H Honors Analysis I & II
	Math 5401 & 5402 Applied Differential Equations I & II
	Math 5633 & 5634 Loss Models I & II
	Math 5635 & Math 5636 Stochastic Calculus I & II

Honors Eligible Courses Chosen Above:

A minimum of 5 honors eligible courses must be chosen, with at least 3 at the 4000-level and higher and with at least one year-long sequence.

Math Honors Track I – Honors Requirements

(Courses in bold denote honors eligible courses)

Part A: Required Prerequisites

	Math 1181H Honors Calculus I (5 hrs)

Part B: Major Program

	Math 2182H Calculus III or Honors Calculus II (4-5 hrs)
	Math 3345 or **3345H** Foundations of Higher Mathematics (3 hrs)
	Math 5520H Honors Linear Algebra & Differential Equations (5 hrs)
	Math 4181H Honors Analysis I (5 hrs)
	Math 4182H Honors Analysis II (5 hrs)
	Math 5529H Honors Combinatorics (5 hrs)
	Math 5530H Honors Probability (5 hrs)
	Math 5590H Honors Abstract Algebra I (5 hrs)
	Math 5591H Honors Abstract Algebra II (5 hrs)
	Stat 4202 Introduction to Mathematical Statistics II (4 hrs)

	Choose **One** of the following

	Math 5522H Honors Complex Analysis (5 hrs)
	Math 5540H Honors Differential (5 hrs)
	Math 5576H Honors Number Theory (5 hrs)

Math Honors Track II – Honors Requirements

(Courses in bold denote honors eligible courses)

Part A: Required Prerequisites

Part B: Major Program

	Math 4181H Honors Analysis I (5 hrs)
	Math 4182H Honors Analysis II (5 hrs)
	Math 5520H Honors Linear Algebra & Differential Equations (5 hrs)
	Math 5529H Honors Combinatorics (5 hrs)
	Math 5530H Honors Probability (5 hrs)
	Math 5590H Honors Abstract Algebra I (5 hrs)
	Math 5591H Honors Abstract Algebra II (5 hrs)
	Stat 4202 Introduction to Mathematical Statistics II (4 hrs)

	Choose **One** of the following

	Math 5522H Honors Complex Analysis (5 hrs)
	Math 5540H Honors Differential (5 hrs)
	Math 5576H Honors Number Theory (5 hrs)

Math Theoretical Track – Honors Requirements

(Courses in bold denote honors eligible courses)

Part A: Required Prerequisites

	Math 1151 Calculus I (5 hrs)
	Math 1152 Calculus II (5 hrs)
	Math 1295 Introductory Seminar (1 hr)

Part B: Major Program

	Math 2153 or **2182H** Calculus III or Honors Calculus II (4-5 hrs)
	Math 2255 Differential Equations (3 hrs)
	Math 2568 or **2568H** Linear algebra (3 hrs)
	Math 3345 or **3345H** Foundations of Higher Mathematics (3 hrs)
	Math 4530 or Stat 4201 Probability or Introduction to Mathematical Statistics I (3-4 hrs)
	Stat 4202 Introduction to Mathematical Statistics II (4 hrs)

Choose **One** of the following Analysis Sequences

	Math 4547 & 4548 Introductory Analysis I & II (6 hrs)
	Math 4181H & 4182H Honors Analysis I & II (10 hrs)

Choose **One** of the following Abstract Algebra Sequences

	Math 4580 & 4581 Abstract Algebra I & II (6 hrs)
	Math 5590H-5591H Honors Abstract Algebra I & II (10 hrs)

Choose **at least six hours** of the following

	Math 3589 Introduction to Financial Mathematics (3 hrs)
	Math 3607 Beginning Scientific Computing (3 hrs)
	Math 3618 Theory of Interest (3 hrs)
	Math 4530 Quantitative Neuroscience (3 hrs)
	Math 4504 History of Mathematics (3 hrs)
	Math 4507 Geometry (3 hrs)
	Math 4551 Vector Analysis (3 hrs)
	Math 4552 Complex Analysis (3 hrs)
	Math 4556 Dynamical Systems (3 hrs)
	Math 4557 Partial Differential Equations (3 hrs)
	Math 4573 Number Theory (3 hrs)
	Math 4575 Combinatorial Mathematics (3 hrs)
	Math 4578 Discrete Mathematics Models (4 hrs)
	Math 5201 Introduction to Real Analysis I (5 hrs)
	Math 5576H Honors Number Theory (5 hrs)

	Math 5632 Financial Economics for Actuaries
	Math 5702 Curves and Surfaces in Euclidian Three Space
	Math 5801 General Topology and Knot Theory

Choose **One** of the following year-long sequences (note, some first courses may have been chosen above – overlap is allowed)

	Math 4181H & 4182H Honors Analysis I & II
	Math 5590H-5591H Honors Abstract Algebra I & II (10 hrs)

Honors Eligible Courses Chosen Above:

A minimum of 5 honors eligible courses must be chosen, with at least 3 at the 4000-level and higher and with at least one year-long sequence.

Part IV – Honors 4-year Plans

Actuarial Science Honors Sample Schedule

	Autumn		Spring	
Year 1	Math 1151	5	Math 1152	5
	CSE 1222, 1223 or 2111	3	AcctMIS 2000	3
	Econ 2001 or 2002	3	Econ 2001 or 2002	3
	ARTSSCI 1100.01	1	English 1110	3
	GE	3	GE	3
		15		17
Year 2	Math 2153	4	**Math 2568H**	3
	Math 3618	3	Stat 4201 or Math 4530	3-4
	GE	3	GE	3
	GE	3	GE	3
	GE	3	GE	3
		16		16
Year 3	Stat 4202	4	Math 3588	3
	BusFin 3120	3	**Math 5632**	3
	GE	3	GE	3
	GE	3		
		13		9
Year 4	**Math 5630**	3	**Math 5631**	3
	Math 5633	3	**Math 5634**	3
	GE	3	GE	3
		9		9

Math Applied Track (Chemistry) Honors Sample Schedule

	Autumn		Spring	
Year 1	Math 1151	5	Math 1152	5
	Chem 1210	5	Math 1295	1
	CSE 1222 or 1223	3	Chem 1220	5
	ARTSSCI 1100.01	1	English 1110	3
	GE	3	GE	3
		17		17
Year 2	Math 2153	4	**Math 3345H**	3
	Physics 1250	5	Math 2255	3
	Biology 1113 or 1114	4	**Math 2568H**	3
	GE	3	Physics 1251	5
			GE	3
		16		17
Year 3	Math 4530 or Stat 4201	3-4	Stat 4202	4
	Chemistry 2210	5	Chemistry 4300	3
	Math 4557	3	GE	3
	GE	3	GE	3
		14-15		13
Year 4	**Math 5401**	3	**Math 5402**	3
	Math 5601	3	Applied Math Course or	3-5
	GE	3	GE	3
	GE	3		
		12		9-11

Additional hours may be necessary depending on course selection.

Math Applied Track (Physics) Honors Sample Schedule

	Autumn		Spring	
Year 1	Math 1151	5	Math 1152	5
	Chem 1210	5	Math 1295	1
	CSE 1222 or 1223	3	Physics 1250	5
	ARTSSCI 1100.01	1	English 1110	3
	GE	3	GE	3
		17		17
Year 2	Math 2153	4	**Math 3345H**	3
	Physics 1251	5	Math 2255	3
	GE	3	**Math 2568H**	3
	GE	3	Biology 1113 or 1114	4
			GE	3
		15		16
Year 3	Math 4530 or Stat 4201	3-4	Stat 4202	4
	Physics 2300	4	Physics 2301	4
	Math 4557	3	GE	3
	GE	3	GE	3
		13-14		14
Year 4	**Math 5401**	3	**Math 5402**	3
	Math 5601	3	Applied Math Course or	3-5
	GE	3	GE	3
	GE	3		
		12		9-11

Additional hours may be necessary depending on course selection.

Math Biology Honors Track Sample Schedule

	Autumn		Spring	
Year 1	Math 1151	5	Math 1152	5
	Chem 1210	5	Math 1295	1
	ARTSSCI 1100.01	1	Biology 1113	4
	GE	3	English 1110	3
	GE	3	GE	3
		17		16
Year 2	Math 2153	4	**Math 3345H**	3
	Biology 1114	4	Math 2255	3
	GE	3	**Math 2568H**	3
	GE	3	GE	3
		14		12
Year 3	Math 4530 or Stat 4201	3-4	Stat 4202	4
	Biol 3401 or Math/MolGen 56	4-5	**Math 5601**	3
	GE	3	Math 3350	3
		10-12		10
Year 4	**Math 5401**	3	**Math 5651**	3
	Applied Math Course or Electiv	3-5	GE	3
	GE	3	GE	3
		9-11		9

Additional hours may be necessary depending on course selection.

Math Financial Track Honors Sample Schedule

	Autumn		Spring	
Year 1	Math 1151	5	Math 1152	5
	CSE 2111	3	English 1110	3
	Econ 2001 **or** 2002	3	Econ 2001 **or** 2002	3
	ARTSSCI 1100.01	1	CSE 1222 or 1223	3
	GE	3		
		15		14
Year 2	Math 2153	4	Math 2255	3
	Math 3618	3	**Math 3345H**	3
	AcctMIS 2000	3	GE	3
	GE	3	GE	3
	GE	3		
		16		12
Year 3	**Math 2568H**	3	Math 3589	3
	Math 4530 **or** Stat 4201	3 or 4	Stat 4202	4
	Math 4557	3	GE	3
	GE	3	GE	3
	GE	3		
		15 or 16		13
Year 4	Math 3607	3	**Math 5632**	3
	Math 5633	1	BusFin 3120	3
	GE	3	**Math 5634**	
	GE	3	GE	3
	GE	3		
		13		12

Additional hours may be necessary depending on course selection.

Math - Honors Track 1 Sample Schedule

	Autumn		Spring	
	Math 1181H	5	**Math 2182H**	5
	ArtsSci 1100.01	3	**Math 3345H**	3
Year 1	GE	3	English 1110	3
odd Au/even Sp	GE	3	GE	3
	GE	3		
		14		14
Year 2	**Math 4181H**	5	**Math 4182H**	5
	Math 5529H[1]	5	**Math 5530H**[2]	5
	GE	3	GE	3
	GE	3	GE	3
		13		11
Year 3	**Math 5520H**	5	**Math 5522H**	5
	Stat 4202	4	GE	3
	GE	3	GE	3
		12		11
Year 4	**Math 5590H**	5	**Math 5591H**	5
	Math Major Elective[3]	5	GE	3
	GE	3	GE	3
		13		11

[1]Math 5529H is only offered during autumn semester of even numbered years

[2]Math 5530H is only offered during spring semester of odd numbered years

[3]Math Major

Additional hours may be necessary depending on course selection.

Math - Honors Track 2 Sample Schedule

	Autumn		Spring	
Year 1	**Math 4181H**	5	**Math 4182H**	5
	ArtsSci 1100.01	3	English 1110	3
	GE	3	GE	3
	GE	3	GE	3
	GE	3		
		17		11
Year 2	**Math 5520H**	5	**Math 5530H**[2]	5
	Math 5529H[1]	5	GE	3
	GE	3	GE	3
		10		8
Year 3	**Math 5590H**	5	**Math 5591H**	5
	Math Major Elective[3]	0-5	**Math Major Elective**[3]	0-5
	GE	3	GE	3
	GE	3	GE	3
		11-16		11-16
Year 4	Stat 4202	4	**Math Major Elective**[3]	0-5
	Math Major Elective[3]	0-5	GE	3
	GE	3		
		7-12		3-8

[1]Math 5529H is only offered during autumn semester of even numbered years

[2]Math 5530H is only offered during spring semester of odd numbered years

[3]Math Major

Additional hours may be necessary depending on course selection.

Math Theoretical Honors Track Sample Schedule

	Autumn		Spring	
Year 1	Math 1151	5	Math 1152	5
	ARTSSCI 1100.01	1	Math 1295	1
	GE	3	English 1110	3
	GE	3	GE	3
	GE	3	GE	3
		15		15
Year 2	Math 2153	4	**Math 3345H**	3
	GE	3	**Math 2568H**	3
	GE	3	GE	3
	GE	3	GE	3
	GE	3		
		16		12
Year 3	Math 4530 or Stat 4201	3-4	Stat 4202	4
	Math 4181H	5	**Math 4181H**	5
	Math 2255	3	GE	3
	GE	3	GE	3
		14-15		15
Year 4	Math 4580	3	Math 4581	3
	Math 5201	3	Math Major Elective	3
	GE	3		
		9		6

Additional hours may be necessary depending on course selection.

Part V – Current Assessment Plans

Assessment: Plan

Program - Actuarial Science (BS)

Program Code (alpha abbreviation): ACTSCI-BS
Degree: Bachelor of Science (BS)
Unit (dept/div/sch): Department of Mathematics
Department Number (D#): D0671
Curricular Dean - Name: Deborah Haddad
Curricular Dean - Title: Assistant Dean
Curricular Dean - Email: Haddad.2@osu.edu

Program Assessment Contact - Name: Chunsheng Ban
Program Assessment Contact - Title: Associate Professor
Program Assessment Contact - Email: ban.1@osu.edu

Assessment Plan - Summary*: The Actuarial Science Program assesses its success in achieving departmental educational goals on a regular basis via course coordination and evaluation of final examination grades in key courses, analysis of data from our annual actuarial surveys, analysis of student success on professional actuarial examinations administered by Society of Actuary and Casualty Actuarial Society, and analysis of student placement in summer internships and employments.

2013 Assessment Report - Summary (2012-13 reporting period): In the current reporting cycle, we paid special attention in the following two areas: - In response to employers' feedback, we provided more focused advise to students in career preparation. - Summarizing students' feedback in taking professional exams, we adjusted several courses to prepare students better. The results have been very encouraging. - The satisfaction reported by students in the annual survey is very high. - More students passed more actuarial exams with higher scores. - This year, the number of students who got summer internships or actuarial employments is the highest in the history of the program.

2014 Assessment Report - Summary (2013-14 reporting period): The Actuarial Science Program assesses its success in achieving departmental educational goals on a regular basis via course coordination and evaluation of final examination grades in key courses, analysis of data from our annual actuarial surveys, analysis of student success on actuarial examinations administered by the professional societies, and analysis of student placement in summer internships and employments. In summary, almost all students meet the C- or better requirement in the major courses, the satisfaction with the major reported by students is very high, more students passed the actuarial exams, and more students got summer internships or actuarial employments than before.

2015 Assessment Report - Summary (2014-15 reporting period): The Actuarial Science Program assesses its success in achieving departmental educational goals on a regular basis via course coordination and evaluation of final examination grades in key courses, analysis of data from our annual actuarial surveys, analysis of student success on actuarial examinations administered by the professional societies, and analysis of student placement in summer internships and employments. In summary, almost all students meet the C- or better requirement in the major courses, the satisfaction with the major reported by students is very high, more students passed the actuarial exams, and more students got summer internships or actuarial employments than before.

Outcome: Background Knowledge

Students will be supplied with a strong general background in mathematics, statistics, and relevant concepts from the insurance industry.

Outcome Status: Active
Start Date: 09/03/2012
Outcome Category (Primary): Knowledge-General

Assessment Methods

Program - Actuarial Science (BS)

Direct - Embedded testing - Embedded test questions in junior and senior math and statistics courses. Results evaluated every semester by course coordinators. (Active)
Criteria: Students get grades of C- or better in major courses.

Outcome: Actuarial Exam Preparedness

Students will be prepared to take some of the national actuarial examinations administered by the Society of Actuaries and the Casualty Actuarial Society.

Outcome Status: Active
Start Date: 09/03/2012
Outcome Category (Primary): Knowledge-Specialized

Assessment Methods

Direct - Certification or licensure examination - Students take the professional exams administered by the professional societies. (Active)
Criteria: Students pass the professional exams administered by the professional societies.

Assessment: Plan

Program - Mathematics (BS)

Program Code (alpha abbreviation): MATH-BS
Degree: Bachelor of Science (BS)
Unit (dept/div/sch): Department of Mathematics
Department Number (D#): D0671
Curricular Dean - Name: Deborah Haddad
Curricular Dean - Title: Assistant Dean
Curricular Dean - Email: Haddad.2@osu.edu

Unit Administrator (chair/director) - Name: Luis Casian
Unit Administrator (chair/director) - Title: Professor and Chair
Unit Administrator (chair/director) - Email: Casian@math.ohio-state.edu
Program Assessment Contact - Name: David Terman
Program Assessment Contact - Title: Professor
Program Assessment Contact - Email: terman.1@osu.edu

Implementation Schedule for Assessment Plan: The undergraduate program has been reviewed and overhauled as part of semester conversion.

Planned Use of Assessment Information: Information is regularly discussed with the Math Counselors, shared at the Undergraduate Committee and Advisory Committee meetings of the Department. Any deficiencies will influence decisions on hiring, salary, and curriculum.

Assessment Plan - Summary*: The Department of Mathematics will assess the effectiveness the undergraduate math major program using the criteria of final exams in courses (common finals for basic calculus courses), exit surveys, alumni surveys, input from colleagues within and outside the department gleaned informally or through the Math/Engineering Liaison Committee, graduate and professional school placement information, and licensure examination data for secondary math educators.

2013 Assessment Report - Summary (2012-13 reporting period): The assessment report has identified several key areas for quality improvement of the undergraduate math major. These include the need for more active involvement of faculty in advising. We have addressed this by encouraging faculty to use AdvisingConnect. The assessment report identified a need to make it easier for students to interact with faculty at an earlier stage of their college education. Here, we developed a new freshman seminar course for all math majors. The course is designed to address this concern.

2014 Assessment Report - Summary (2013-14 reporting period): We feel that we have made significant progress in addressing concerns of students. In particular, we have made it easier for faculty to advise students and mentor them in research. We have initiated social events and other activities in order to encourage faculty and students to more easily interact. Several of our courses, including those in applied mathematics, have been revised to meet the needs of our math majors.

2015 Assessment Report - Summary (2014-15 reporting period): The Department of Mathematics assesses the effectiveness of the undergraduate math major program using several criteria, including final exams in courses (common finals for basic calculus courses), exit surveys, alumni surveys, input from colleagues within and outside the department, graduate and professional school placement information and licensure examination data for secondary math educators. Assessment information in collected in the past has led to the development of several new undergraduate courses, particularly in more applied, interdisciplinary areas, and has increased faculy involvement in advising of undergraduate majors.

2016 Assessment Report - Summary (2015-16 reporting period)*: The Department of Mathematics continues to assess its Mathematics BS program using several criteria. This year, additional indirect assessments related to student success in key mathematical courses have been collected and analyzed. This new assessment data indicated that most Mathematics BS students are successfully completing the key mathematical courses with are directly related to the outcomes of this program. This new data along with data that has traditionally been collected is helping to shape the future direction of the Mathematics BS program.

Outcome: Conceptual Frameworks

Program - Mathematics (BS)

Math majors will learn conceptual frameworks needed to study higher mathematics, including an introduction to mathematical reasoning, and an understanding of how to read and write proofs.

Outcome Status: Active
Planned Assessment Year: 2013 - 2014
Start Date: 09/03/2012
Outcome Category (Primary): Knowledge-General

Assessment Methods

Direct - Embedded testing - Embedded test questions in final exams. Basic calculus courses have common final exams. (Active)
Criteria: A minimum of 80% of the Mathematics BS students who take Math 1151 will achieve 70% or more on an embedded question on the Math 1151 final exam. **Assessment Method Schedule:** Once per year.

Indirect - Survey (Student) - Departmental student exit survey. ASC student exit survey. (Active)
Assessment Method Schedule: Survey data is reviewed annually by the department's Undergraduate Committee and used to propose programmatic modifications.

Indirect - Grade review - Final course grades for Math 3345 for Mathematics BS students will be collected. (Active)
Criteria: A minimum of 80% of Mathematics BS students that take Math 3345 will successfully complete Math 3345 (C- or better). This will be reexamined to see if B- or better is a more appropriate standard. **Assessment Method Schedule:** Once per year.

Outcome: Mastery

Math majors will acquire basic mastery of core areas of mathematics, including calculus, analysis and algebra.

Outcome Status: Active
Planned Assessment Year: 2013 - 2014
Start Date: 09/03/2012
Outcome Category (Primary): Knowledge-Specialized

Assessment Methods

Indirect - Grade review - Final course grades in Math 4547 and Math 4580 for Math BS students will be collected. (Active)
Criteria: A minimum of 80% of Mathematics BS students that take Math 4547 or Math 4580 will successfully complete Math 4547 or Math 4580 (C- or better). This will be reexamined to see if B- or better is a more appropriate standard. **Assessment Method Schedule:** Once per year.

Indirect - Survey (Student) - Departmental student exit survey. ASC student exit survey. (Active)
Assessment Method Schedule: Survey data is reviewed annually by the department's Undergraduate Committee and used to propose programmatic modifications.

Outcome: Problem-Solving

Math majors will develop powerful mathematical problem solving skills.

Outcome Status: Active
Planned Assessment Year: 2013 - 2014
Start Date: 09/03/2012
Outcome Category (Primary): Problem Solving

Program - Mathematics (BS)

Assessment Methods

Indirect - Survey (Student) - Departmental exit survey, ASC student exit survey. (Active)
Assessment Method Schedule: Exit survey results will be reviewed annually.

Indirect - Grade review - Final course grades for Math 2568 for Mathematics BS students will be collected. (Active)
Criteria: A minimum of 80% of the Mathematics BS students who take Math 2568 will successfully complete Math 2568 (C- or better). **Assessment Method Schedule:** Once per year.

Outcome: Communication

Math majors will learn to communicate mathematical understanding effectively.

Outcome Status: Active
Planned Assessment Year: 2013 - 2014
Start Date: 09/03/2012
Outcome Category (Primary): Communication-Written (default)

Assessment Methods

Indirect - Survey (Student) - Departmental exit survey, ASC student exit survey. (Active)
Assessment Method Schedule: Exit survey results will be reviewed annually.

Outcome: Proficiency

Math majors will become proficient in chosen tracks within the major.

Outcome Status: Active
Planned Assessment Year: 2013 - 2014
Start Date: 09/03/2012
Outcome Category (Primary): Knowledge-Specialized

Assessment Methods

Indirect - Survey (Student) - Departmental exit survey, ASC student exit survey. (Active)
Assessment Method Schedule: Exit survey results will be reviewed annually.

Indirect - Grade review - Final course grades for Math 4556 and Math 3607 for Mathematics BS students will be collected. (Active)
Criteria: A minimum of 80% of the Mathematics BS students that take Math 4556 or Math 3607 will successfully complete Math 4556 or Math 3607 (C- or better). This will be reexamined to see if B- or better is a more appropriate standard. **Assessment Method Schedule:** Once per year.

Indirect - Participation levels - Number of students in various tracks (Active)

Appendix

Ad Hoc Honors Committee Report

Committee Members: Chunsheng Ban, Ovidiu Costin, Adriana Dawes, Marty Golubitsky (chair), Bill Husen (ex officio), Eric Katz, Warren Sinnott (consultant), Liz Vivas

Part I: Proposed *Honors Programs*

1 Introduction

In this report we discuss two[1] designations that undergraduates can receive on their diplomas: *honors* and *distinction*. The *honors* designation is controlled by the College of Arts and Sciences and is earned by satisfying College and Department course requirements. The *distinction* designation is controlled by the Mathematics Department and is earned by satisfying a different (and more demanding) set of course requirements. A student can earn one or both designations on their diplomas. The possible designations are:

- *with honors in Arts and Sciences*

- *with distinction in Mathematics*

- *with honors distinction in Mathematics*

The Ad Hoc Committee is suggesting six changes in the Department Honors Program, most having to do with how *honors* and *distinction* are obtained.

(a) The establishment of requirements for undergraduate math majors to participate in the College *Honors Program* at a level of difficulty that is similar to other departments in the College of Arts and Sciences. The designation *with honors in Arts and Sciences* will appear on student diplomas. These requirements will be math major track dependent. See Section 3.

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[1]*Research* is a third possible designation that is equated with writing an undergraduate thesis. This designation will not be discussed in this document.

(b) The recommendation that students who complete the Math Department *Honors Track* receive the designation *with distinction in Mathematics* on their diplomas. Those students who also satisfy the requirements for the College *Honors Program* will receive the designation *with honors distinction in Mathematics* on their diplomas. See Section 4.

(c) Students who complete both the math *Honors Track* and the extra requirements **currently** required for the designation *with distinction in Mathematics* will have the option of graduating after four years simultaneously with BS and MS degrees. See Section 5.

(d) The requirements for obtaining the designation *with honors in Arts and Sciences* for actuarial science majors will be similar to those demanded of math majors. See Section 7.

(e) The Ad Hoc Committee suggestions for improving diversity, recruitment, and retention in the Math *Honors Program* are discussed in Section 8.

(f) The establishment of a revised Math Department Honors Committee. See Section 9.

This document is divided in two parts. Part I consists of nine sections and describes in detail the proposed changes in the *Honors Programs*. The reasons that changes in the Math Department *Honors Program* are needed are discussed in Section 2. Starting and transition points for the various Math *Honors Programs* are discussed in Section 6.

The sections beginning with Section 10 are reference sections, and constitute Part II. The term 'honors' is used in at least five different ways and this often causes confusion when surveying honors in the Math Department. The uses are: *Honors Courses*, the Math Department *Honors Track*, the College *Honors Program*, the diploma designation *with honors*, and the student required *Honors Contract*. The first four uses, along with background, are described in detail in Section 10. Some aspects of student *Honors Contracts* are discussed in Section 11. Descriptions of the *Honors Programs* in three other Arts and Sciences departments are given in Section 12. The charges of the Arts and Sciences Honors Committee are reviewed in Section 13. The current College rules for obtaining the designation *with honors in the Arts and Sciences* or the designation *with honors distinction in Mathematics* are

reviewed in Section 14. The 1998 requirements for the designation *with distinction in Mathematics* are given in Section 15. These documents were taken from an archived department website. Finally, since completing a math major track is needed to graduate with an honors designation, the requirements for each of the seven math major tracks are summarized in Section 16.

2   The Ad Hoc Honors Committee Charge

The Ad Hoc Committee was asked to review aspects of the Math Department *Honors Program* with certain goals in mind. In this section we outline the goals of our review and some of the reasons that changes are being considered.

(a) Preserve the current *Honors Courses* and *Honors Track* at their high levels.

(b) Make it realistic, although still difficult, for excellent students who start with Math 1181H to succeed in obtaining a *with distinction in Mathematics* designation.

(c) Provide a soft landing in the *Honors Program* for very good students who try the difficult *Honors Track* option and cannot make it. See Section 6.

(d) Increase student diversity in the math *Honors Program*. For example, the percentage of math majors who are female has recently been three times the percentage of females in the *Honors Track*. See Table 1.

Table 1: Participation by Gender in Traditional Honors Track

	Honors Track			Math Majors		
Year	Males	Females	% Females	Male	Female	% Female
AU12	16	3	15.79%	626	375	37.46%
AU13	18	3	14.29%	689	421	37.93%
AU14	24	2	7.69%	728	412	36.14%
AU15	39	6	13.33%	765	427	35.82%
AU16	48	6	11.11%	731	413	36.10%

(e) Provide a way to obtain the *with honors in the Arts and Sciences* designation that is open to all math majors.

Make the effort needed to obtain this designation in line with the effort required of students in other majors.

(f) Increase the level of faculty participation in *Honors Program*.

Between AU13 and SP18, three faculty have taught 23 honors courses (at the 4000 level and above) and 10 additional faculty have taught the remaining 20 honors courses at that level.

(g) Improve advising for honors students at all levels of the *Honors Programs*.

3 Honors in Mathematics: College Program

A mathematics major who wants to graduate with the designation *with honors in Arts and Sciences* must satisfy requirements set by the Math Department (in addition to requirements set by the College *Honors Program*). We propose that the department adopt requirements for the *with honors in Arts and Sciences* designation that are comparable with the requirements in other departments[2]. Our aim is to accommodate students who start in Math 1181H (Honors Calculus I), or in a higher level honors calculus course, but who need not be in the Honors Track.

Specifically, we propose that math majors satisfy the following requirements for the *with honors in Arts and Sciences* designation:

(a) Complete the requirements for a math major track[3].

(b) Complete at least five (5) *honors eligible courses*[4] with at most two (2) courses from Table 2.

(c) Among the five (5) *honors eligible courses*, complete a one-year sequence such as in Table 3.

(d) Complete a *College Honors Contract*. This requirement is overseen by the *College Honors Program*.

The Departmental Honors Committee will review the curriculum of the *honors eligible courses* in Table 3.

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[2]Requirements from several other College Departments are described in Section 12

[3]Note: The interdisciplinary tracks are the *Applied Track*, the *Mathematical Biology Track*, and the *Mathematical Finance Track*.

[4]*Honors Eligible Courses* are *Honors Courses* at the 2000 level or above and certain specified non-honors 5000 level courses. See Table 3.

Table 2: 2000 and 3000 level Honors Courses

Math 2182H	Honors Multivariable Calculus
Math 2568H	Honors Linear Algebra
Math 3345H	Honors Foundations of Higher Mathematics
Math 3607H	Honors Beginning Scientific Computing

Table 3: Yearlong Sequences

Yearlong Sequences for All Tracks	
Honors Analysis I, II	Math 4181H - Math 4182H
Honors Abstract Algebra I, II	Math 5590H - Math 5591H
Yearlong Sequences for Interdisciplinary Tracks	
Applied Differential Equations I, II	Math 5401 - Math 5402
Applied Differential Equations I and Math Modeling of Bio Processes	Math 5401 - Math 5651
Essentials of Numerical Methods and Computational PDE	Math 5601 - Math 5602
Loss Models I, II	Math 5633 - Math 5634
Stochastic Calculus for Finance I, II	Math 5635 - Math 5636
Mathematical Methods in Relativity Theory I, II	Math 5756 - Math 5757

4 *Honors Track* and *Distinction*

We propose that students who complete the *Honors Track* (the ten math *honors courses* in Table 4) receive the *with distinction in Mathematics* designation. Those who also complete the requirements for the designation *with honors in the Arts and Sciences* will receive the designation *with honors distinction in Mathematics*.

Table 4: Ten Required Courses for the New *Honors Track*

Math 4181H	Analysis I	Math 4182H	Analysis II
Math 5520H	Linear Algebra & Differential Equations	Math 5522H	Complex Analysis
Math 5529H	Combinatorics	Math 5530H	Probability
Math 5540H	Differential Geometry	Math 5576H	Number Theory
Math 5590H	Abstract Algebra I	Math 5591H	Abstract Algebra II

Historical Comparison

The new requirements for *with distinction in Mathematics* are more in line with the requirements demanded of students when this designation was first introduced. An expansion in the requirements seems to have occurred during quarter to semester conversion.

Twenty years ago the *distinction in Mathematics* designation required that a student take a yearlong course in analysis (5201-5202), topology (5801-6801), or combinatorics (no current equivalent, but at the 5000 level), or a yearlong course at the 6000 level in addition to completing the 40 credit hour major. The following seven courses were required in the *Honors Track*: Math 4181H, 4182H, 5520H, 5522H, 5590H, 5591H, 5540H. See Section 15.

The current requirements for the *distinction in Mathematics* designation (see Section 16.1) are eight 5000 level honors courses rather than five and two 6000 level yearlong sequence rather than one. So, current students are being asked to take an additional five high level courses to earn the designation *with distinction in Mathematics* on their diploma. To receive this designation, the committee proposes that the current four 6000 level course requirement be removed and the current eight 5000 level course requirement be retained. See Section 15 for a description of the old rules for obtaining the designation *with distinction in Mathematics*. The comparison of these requirements (old program, current program, and proposed new program) are summarized in Table 5. The number of credit hours required in 1998 was calculated in quarter credit hours and then converted to semester credit hours for comparison.

Table 5: Upper Level Honors and Total Credit Hours Courses Required for *distinction in Mathematics*

	Current	Old (1998)	New
honors contract	yes	yes	yes
4181H - 4182H	yes	yes	yes
5000 level honors	8	5	8
6000 level	4	2	0
total credit hours	62–70	40–44	50

6

Sample Schedules

As a proof of concept we indicate in Tables 6 and 7[5] sample programs that students might take to satisfy the *Honors Track* starting either from Math 4181H (the likely) or from Math 1181H (the possible). Note that in Table 7 Math 5520H could be taken in the student's sophomore year.

Table 6: Sample *Honors Track* starting with Math 4181H

	If year 1 is odd		If year 1 is even	
	Autumn	Spring	Autumn	Spring
Year 1	4181H	4182H	4181H	4182H
Year 2	5520H 5529H	5530H	5520H 5576H	5540H
Year 3	5576H	5540H 5522H	5529H	5530H 5522H
Year 4	5590H	5591H	5590H	5591H

Table 7: Sample *Honors Track* starting with Math 1181H

	If year 1 is odd		If year 1 is even	
	Autumn	Spring	Autumn	Spring
Year 1	1181H	2182H 3345H	1181H	2182H 3345H
Year 2	4181H	4182H	4181H	4182H
Year 3	5520H 5576H	5522H 5540H	5520H 5529H	5522H 5530H
Year 4	5590H 5529H	5591H 5530H	5590H 5576H	5591H 5540H

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[5]There is an issue in Table 7 involving Stat 4202 that will need to be resolved in the odd year program. Currently Stat 4202 is required of *Honors Track* students and has Math 5530H as a prerequisite. There are several ways around this issue, but that need not be discussed here.

5 *Honors Track* with *Masters Option*

For students who have done substantial math preparation in high school and have obtained OSU credit for this work, a four-year program can be fashioned that leads simultaneously to bachelors and masters degrees. The decision on whether or not to pursue this *Masters Option* should be made in consultation with the student's honors advisor. Note that the *Masters Option* will require the completion of 14 upper division and graduate honors classes. This dual degree option was previously available to honors students in 1998. See p. 33.

General process for a four-year combined bachelors and masters program The University and the College of Arts and Sciences allow for combined bachelors and masters degree programs. The general process is that a student begins in a specific undergraduate degree program and maintains a minimum 3.5 GPA. The student then applies to the corresponding masters program, beginning in the semester in which at least 90 credit hours have been earned. This is typically halfway through the junior year. Once a student is admitted to the relevant masters program, the student may use up to 12 credit hours of graduate level course work for both their bachelors and masters degree requirements. The student continues to take courses to satisfy their bachelors degree requirements at the same time they take courses to fulfill the masters degree requirements. After satisfying all academic requirements for both degrees, the student is awarded both degrees simultaneously.

Specifics for *Masters Option* Program Students choosing the *Masters Option* will complete the requirements for the *with distinction in Mathematics* designation and with proper planning also complete the requirements for an MS degree. One goal of the *Masters Option* is to keep the number of semesters required for graduation to eight. To reach this goal, students in this option will need to have earned some previous college credit and/or take an increased course load (averaging 18 credit hours per semester). This is needed so the student may begin the masters degree portion of his/her coursework in the spring of their junior year.

Tables 8 and 9 present possible four-year course plans for a *Masters Option* combined degree, one beginning in an even numbered year, the other in an odd numbered year. Two plans are needed because certain courses are only offered every other year.

Table 8: A possible four-year *Masters Option* Program (starting in odd numbered years)

	Autumn	Hrs	Spring	Hrs
Yr 1	4181H (5 hrs)	18	4182H (5 hrs)	18
	Gen'l Ugrad Courses (13 hrs)		Gen'l Ugrad Courses (13 hrs)	
Yr 2	5520H (5 hrs)	18	5522H (5 hrs)	18
	Gen'l Ugrad Courses (13 hrs)		Gen'l Ugrad Courses (13 hrs)	
Yr 3	5529H (5 hrs)	18	***5530H (5 hrs)**	**18**
	5590H (5 hrs)		***5591H (5 hrs)**	
	Gen'l Ugrad Courses (8 hrs)		**Gen'l Ugrad Courses (8 hrs)**	
Yr 4	****5576H (5 hrs)**	**17**	****5540H (5 hrs)**	**16**
	**6111 (5 hrs)		****6112 (5 hrs)**	
	**6211 (5 hrs)		****6212 (5 hrs)**	
	Gen'l Ugrad Courses (2 hrs)		**Gen'l Ugrad Courses (1 hrs)**	

Table 9: A possible four-year *Masters Option* Program (starting in even numbered years)

	Autumn	Hrs	Spring	Hrs
Yr 1	4181H (5 hrs)	18	4182H (5 hrs)	18
	Gen'l Ugrad Courses (13 hrs)		Gen'l Ugrad Courses (13 hrs)	
Yr 2	5520H (5 hrs)	18	5522H (5 hrs)	18
	Gen'l Ugrad Courses (13 hrs)		Gen'l Ugrad Courses (13 hrs)	
Yr 3	5576H (5 hrs)	18	***5540H (5 hrs)**	**18**
	5590H (5 hrs)		***5591H (5 hrs)**	
	Gen'l Ugrad Courses (8 hrs)		**Gen'l Ugrad Courses (8 hrs)**	
Yr 4	****5529H (5 hrs)**	**17**	****5530H (5 hrs)**	**16**
	**6111 (5 hrs)		****6112 (5 hrs)**	
	**6211 (5 hrs)		****6212 (5 hrs)**	
	Gen'l Ugrad Courses (2 hrs)		**Gen'l Ugrad Courses (1 hrs)**	

Courses in **bold** in Tables 8 and 9 are taken during the combined bachelors and masters semesters. Courses with an * are courses taken for combined undergraduate and graduate credit. Courses with ** are taken for graduate credit only. The exact choice of courses will be specified in the student's *Honors Contract*. Students who complete the *Masters Option* will have completed:

(a) 121 undergraduate credit hours.

(b) 40 undergraduate credit hours in Mathematics.

(c) 32 graduate credit hours in Mathematics.

(d) Each of the above includes 10 hours of combined undergraduate and graduate credit hours.

Additional Requirements for *Masters Option*: Students attempting the *Masters Option* will also need to satisfy requirements of the degree other than course requirements. For example, if the *thesis option* is attempted, then a masters thesis will need to be written. If the *course option* is chosen, then the four-hour written exam will need to be taken. In the latter case, the Honors Committee will oversee the administration of this exam.

With distinction in Mathematics in the Masters Option: A *Masters Option* student will typically complete the *Honors Track* and hence will receive the designation *with distinction in Mathematics* on his or her undergraduate degree. If that student also fulfills the requirements of the *with honors in Arts and Sciences* degree, then he or she will receive the designation *with honors distinction in Mathematics* on their undergraduate diploma.

6 Transitions

We propose three ways that freshmen interested in *with honors* or *with distinction* designated degrees could begin their collegiate math careers: Math 1181H (Honors Calculus I), Math 2182H[6] (Honors Multivariable Calculus), and Math 4181H (Honors Analysis I). Those freshmen aiming for a *with honors in Arts and Sciences* designation will likely begin with Math 1181H, though any of these departure points can lead to a *with honors in Arts and Sciences* designation.

Those freshmen aiming for the *with distinction in Mathematics* designation would be best served by choosing Math 2182H or Math 4181H. Those beginning with Math 2182H (a course that quickly reviews first year calculus, including some proofs, and proceeds with multivariable calculus) would likely take Math 2568H (Honors Linear Algebra) and Math 3345H (Honors

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[6]This change may require slightly different syllabi for Fall and Spring Honors Multivariable Calculus. The two courses will likely be called Math 2182.01H and Math 2182.02H.

Foundations of Higher Mathematics) in the spring semester of their freshman year before taking Math 4181H in their sophomore year. As noted in Table 7, it is possible to obtain a *with distinction in Mathematics* degree by beginning with Math 1181H.

Finally, students who aim for the *Masters Option* of the *Honors Track* are strongly encouraged to begin with Math 4181H in their freshman year.

With this staggering of the Math *Honors Programs*, students who struggle with Math 4181H could then switch to Math 2182H (Honors Multivariable Calculus) and still complete the *with honors in the Arts and Sciences* or even the *with distinction in Mathematics* designations.

7 Actuarial Science *Honors Program*

The actuarial science major in the Mathematics Department has offered an *Honors Program* for many years. Some demographic information from that program is given in Table 10. As can be seen, the percentage of female actuarial sciences majors is virtually identical to the percentage of females in the actuarial science *Honors Program*.

Table 10: Demographics for Actuarial Science *Honors Program*

	Total	Female	Male	% F
Actuarial Science Major	354	134	218	37.9%
Actuarial Science Honors	40	15	25	37.5%

The current actuarial science *Honors Program* for the designation *with honors in Arts and Sciences* requires five 5000 level courses in actuarial science. Since some of these courses are designed for actuarial exams, students can fulfill the course requirement by passing the corresponding actuarial exam.

With the creation of the 2000 and 3000 level honors math courses, we can provide actuarial science majors with more options to get the *honors in Arts and Sciences* designation. We propose the following revision of the honors requirement for actuarial science.

(a) Complete the requirement for an actuarial science major.

Table 11: Honors Eligible Courses for Actuarial Science

Math 2182H	Honors Multivariable Calculus
Math 2568H	Honors Linear Algebra
Math 4181H, 4182H	Analysis I, II
Math 5630, 5631	Life Contingencies I, II
Math 5632	Math Methods in Financial Economics
Math 5633, 5634	Loss Models I, II
Math 5635, 5636	Stochastic Calculus for Finance
Math 5637	Topics in Quantitative Risk Management
Math 5638	Topics in Predictive Modeling

(b) Complete at least five (5) honors eligible courses from Table 11.

(c) Among the five (5) honors eligible courses, complete a one-year sequence such as Analysis (Math 4181H-4182H), Life Contingencies (Math 5630-5631), Loss Models (Math 5633-5634), or Stochastic Calculus for Finance (Math 5635-5636).

(d) Complete an honors contract.

8   Diversity, Recruitment, and Retention

Historically, the *Honors Program* in the Math Department has been tailored to students aspiring to graduate school in mathematics. However, this program is less well suited for students who are double-majoring or planning to apply mathematical techniques to other disciplines. By expanding the *Honors Program* to students with interests beyond traditional research mathematics while also retaining our excellent traditional program as the *Honors Track*, we aim to create a welcoming environment and supportive community to all students who wish to pursue challenging studies in the mathematical sciences.

8.1 Recruitment and Advertising

There are several student populations available for recruitment to the *Honors Program*, and efforts are needed to inform and attract students to the new program. Regardless of the student population being targeted, recruitment materials should be developed that include a glossy brochure with an overview of the new *Honors Program* as well as a presentation template with the program highlights that can be customized for the speaker and the audience. Such outreach efforts must give students a sense the following: the curriculum; how honors math classes fit in other programs; the workload; and a sense of difficulty. This will give students a chance to make an informed decision taking into account their time-commitments and eventual goals. Specific recruiting efforts may include the following:

Non-honors math majors: These are students who are interested in studies in mathematics but did not consider the current *Honors Track* as suitable. The new *Honors Program* includes interdisciplinary options which correspond to the math major tracks, and may be of interest to this population of students. To reach these students, in class presentations can be given in Math 2153 (Calculus 3), Math 2568 (Linear Algebra) and Math 3345 (Foundations of Higher Mathematics), along with distribution of brochures to interested students. Targeted emails, based on recommendations of instructors, can also be used to inform this population of students about the new *Honors Program*.

Students in Honors & Scholars: These are high achieving students admitted to OSU but who may not have explicitly declared an interest in pursuing an honors degree in math. There are a number of different ways that these students can be reached. Students with high SAT scores and AP credit are currently contacted with information about our *Honors Program*. Additional information could be included in that mailing. Students are also currently informed of honors opportunities at Orientation. Printed material should be made available to students at that time, and if possible, a presentation could be made at an orientation event. Since students will now be able to join the *Honors Program* after their first year, we may also wish to advertise the math *Honors Program* to students living in the Honors or Scholars dorms.

Freshman: All students are required to take a one credit hour orientation class during their first year. A combination of printed materials and

an in class presentation could be used to inform these students about the new *Honors Program.*

8.2 Retention

Once students attempt the new *Honors Program*, additional efforts are needed to ensure students can successfully navigate the new program, while building a sense of community. The following features of the new *Honors Program* may help in student retention.

Peer mentoring program: The *Honors Program* has employed successful honors math majors as mentors to students in 4181H and 4182H. These students lead two 2-hour homework support sessions per week. The support sessions have been held in honors dorms or in other on-campus locations. They cover specific problems, problem-solving techniques, and review material from the class. This program has also been successful in building community among the undergraduate honors math majors. We propose that the peer mentoring program be expanded to provide support for certain basic *Honors Courses*, such as Math 3345H and Math 5520H.

Flexibility and alternate degree paths: The new *Honors Program* will provide several routes to successful completion of department requirements for a *with honors in Arts and Sciences* degree designation. Students who wish to explore broader applications of mathematics now have a challenging program to follow, while students who wish to accelerate their education can pursue dual degrees with the *Masters Option.* It is expected that greater flexibility and increased choice in the *Honors Program* will aid in student retention.

8.3 Diversity

Gender diversity in the current *Honors Track* has lagged well below the proportions found in other math major tracks. See Table 1. We expect the expanded options in the new *Honors Program* will attract a more diverse student population, reflecting broader student population composition in the University as a whole.

- The actuarial science major offered by the Department of Mathematics has almost identical gender balance in both the major and the *Honors Program* (approximately 35% female students). See Table 10.

- We expect the new *Honors Program* to attract a wide variety of students based on current enrollment in the various math major tracks. Approximately 30% of students in the math major tracks are female, and based on the historical performance of the actuarial science program, we believe it is feasible (and desirable) to increase the proportion of female students in the new *Honors Program* to be similar to the proportion found in the major tracks.

- Emphasis will be placed on recruiting female students to be Peer Mentors, thus providing positive modeling for all incoming students.

9   The Math Department Honors Committee

The current Honors Committee is described in Section 13. The proposed new charge follows.

The Honors Committee will oversee both mathematics and actuarial science major *Honors Programs*. The Honors Committee consists of at least six Math tenure-track faculty. This committee should include a representative for the *Honors Track* and a representative for the math College *Honors Program*. Each Spring semester, the Chair of the Department will appoint at least three members to two year terms. In addition, the Chair of the Department and the Director of Undergraduate Studies will be ex-officio non-voting members of the committee. The responsibilities of the Honors Committee include:

(a) Oversee the staffing of honors courses.

(b) Designate faculty who may be honors student advisors.

(c) Approve Honor Student contracts.

(d) Recommend changes in departmental Honors Program requirements.

(e) Designate a representative to the College's Honors Committee when necessary.

(f) Oversee curricula of honors (Math $\cdots\cdot$H) courses.

(g) Oversee the university-required four-hour examination for non-thesis Masters Option students.

(h) Oversee the Honors Peer Mentoring program.

The Chair of the Department will designate a committee member to be the Chair of the Honors Committee. The HC Chair will preside over meetings and represent the departmental Honors Program in meetings of the UGC.

Ad Hoc Honors Committee Report

Part II: Reference Material

The reference material includes uses of the term 'honors' (Section 10); a partial description of *Honors Contracts* (Section 11); *Honors Programs* in Physics, Psychology, and Spanish (Section 12); A&S Honors Committee (Section 13); College rules for obtaining *honors* and *honors distinction* (Section 14); the 1998 requirements for *with distinction in Mathematics* (Section 15); and the requirements for each math major track (Section 16).

10 Math Department 'Honors' and 'Tracks'

The term *honors* is used in the Math Department in many different ways and this multiple use often causes confusion. We discuss the word *honors* by focusing on four different uses of the word.

(a) The Math Department has 14 lecture courses from the 1000 level to the 5000 level that are designated as *Honors Courses* with a 15th course on *Beginning Scientific Computing* under construction. These courses, listed in Table 12, are quite demanding. Twelve (12) of the *Honors Courses* are 5 credit hours. The Math Department also has five special one credit hour honors courses listed in Table 13.

Table 12: Math Honors Courses: Most are 5hr Courses; Bold are 3 hr Courses

Math 1181H	Calculus I	Math 2182H	Honors Calculus II
Math 2568H	**Linear Algebra**	Math 3345H	**Found Higher Math**
Math 4181H	Analysis I	Math 4182H	Analysis II
Math 3607H	**Scientific Computing**	Math 5520H	Linear Algebra & Diff Eqns
Math 5529H	Combinatorics	Math 5530H	Probability
Math 5590H	Abstract Algebra 1	Math 5591H	Abstract Algebra 2
Math 5522H	Complex Analysis	Math 5540H	Differential Geometry
Math 5576H	Number Theory		

(b) The College of Arts and Sciences has an *Honors Program* open to any major in any department in the College. Students in this program

Table 13: Math Department Special One Credit Hour Honors Courses

Math 1187H	Problem Solving	Math 1194H	Group Studies
Math 4998H	Undergraduate Research	Math 4999H	Undergraduate Thesis
Math 5194H	Group Studies		

must sign an *Honors Contract* with a faculty advisor and that *contract* must be approved by the Department and the College. The *contract* commits the student to taking a variety of General Education courses, maintaining a sufficiently high grade point average, and succeeding in a number of designated Department *Honors Courses*. The *contract* also asks the student to plan when he or she will take the courses that will satisfy the College *Honors Program* requirements.

(c) The Math major has seven tracks including the *Honors Track*, which is a very advanced version of the *Traditional Track*. In addition there are the *Math Biology Track*, the *Math Finance Track*, the *Math for Educators Track* (often called the *Math Ed Track*), and the *Applied Track* (which has a *Chemistry Option* and a *Physics Option*). We will sometimes call these two options the *Chemistry Track* and the *Physics Track*. The choice of track determines the requirements that the student must satisfy in order to graduate with a math major degree. The detailed requirements for each track are listed in Section 16.

Note that the Department *Honors Track* and the College *Honors Program* are currently bureaucratically unrelated, though they do both require successful completion of a certain number of *Honors Courses* and an *Honors Contract*.

The (approximate) number of math majors in each track is given in Table 14. There is a complication when counting how students populate the various tracks. Typically 30% of math majors are *undeclared*; they have not yet designated a track. Therefore, they do not know precisely which courses they will need to pass in order to graduate.[7]

(d) There is a fourth use of the term *honors*, namely, in a designation that

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[7]The figures in Table 14 are assembled by math advisors and undercount math majors by about 200 (because math advisors only count currently enrolled students and not recently inactive students). This table does not count Actuarial Science majors.

Table 14: Math Department Majors by Track and Gender

Major Tracks	Au 16	Au 17
Applied Math	64	57
Males	51	45
Females	(20%) 13	(21%) 12
Financial Math	289	226
Males	176	124
Females	(39%) 113	(45%) 102
Math Biology	23	26
Males	9	13
Females	(61%) 14	(50%) 13
Math for Educators	27	32
Males	17	20
Females	(37%) 10	(38%) 12
Theoretical Math (Traditional)	141	163
Males	109	115
Females	(23%) 32	(29%) 48
Honors Track	49	49
Males	43	45
Females	(12%) 6	(9%) 4
Undeclared	348	448
Males	223	284
Females	(36%) 125	(37%) 164
Total Math Majors	941	1001
Males	628	646
Females	(33%) 313	(35%) 355

can appear on a diploma. As noted previously the ones that we are focusing on are:

- *with honors in the Arts and Sciences*
- *with distinction in Mathematics*
- *with honors distinction in Mathematics*

Remarks: (i) Currently, the only way for a math major to obtain the designation *with honors in the Arts and Sciences* is to complete a large part of the *Honors Track*, which requires substantially more effort than honors designations in other College departments.

(ii) The designation *with distinction in Mathematics* is currently used for students who complete the *Honors Track* for their undergraduate

major requirements and, in addition, complete two 6000 level two-course sequences.

(iii) The actuarial sciences major, which is also administered by the Math Department, has a College *Honors Program* that is similar in effort to those in other departments.

There are other requirements (such as grade requirements) that are demanded for these designations. A list of college diploma designations is given in Section 14.1.

11 Advising and *Honors Contracts*

Each student in the *Honors Program* will have two or more advisors: a college honors office advisor and one or more Math Departmental honors advisor.

(a) The college honors advisor provides advice on general education, graduation requirements and degree planning, academic and career opportunities, university policies and procedures, and other related areas.

(b) The departmental honors staff advisor provides advice on issues related specifically to the math *Honors Program*.

(c) The departmental honors faculty advisor provides advice on specific math issues related to the Math Department *Honors Program* and signs the student's *Honors Contract*.

(d) Students in the *Honors Program* have to finish their *Honors Contract* by the end of the spring semester of their second year of study at OSU.

(e) Honors students work with their departmental honors advisor in the math major portion of the *Honors Contract*, and work with college honors advisor to complete the rest of the *Honors Contract*.

12 Requirements for Honors in Other Majors

In general the *Honors Contract* allows the student to construct an especially challenging curriculum by incorporating strong course work, such as *honors classes* and 4000-level classes, throughout the student's program of

study. When approved by the Arts and Sciences (ASC) Honors Committee, an *Honors Contract* admits the student to candidacy for graduation *with honors in the Arts and Sciences*. If the student completes his or hers *Honors Contract* curriculum with a minimum 3.4 cumulative grade point average on at least 60 graded semester credit hours at Ohio State, the student will graduate *with honors in the Arts and Sciences*, which will be noted on the student's diploma and transcript.

In the three subsections we summarize the minimum honors requirements for Physics, Psychology, and Spanish.

12.1   Physics *Honors Courses* Requirements

The Physics Department requires their honors majors to take the *Honors Courses* and other 5000 level non-honors courses in Table 15. Note that Honors Physics 1250H-1251H appear to be at a similar level as the Math Department Honors Math 1181H-2182H

Table 15: Honors Courses in Physics

Physics 1250H-1251H	Introduction to Physics I, II
Physics 5500H-5501H	Honors Quantum I, II
Physics 5400H-5401H	Honors E&M I, II
Physics 5600	Statistical Mechanics
Physics 5300	Theoretical Mechanics

12.2   Psychology *Honors Courses* Requirements

In order to graduate with a major in Psychology and the designation *with honors in the Arts and Sciences*, a student must have an *Honors Contract* signed by the Psychology Honors Advisors, and approved by the Arts and Sciences Honors Committee. Honors students declaring psychology as a major follow the same content and credit hour requirements as non-Honors students. However, Psychology Honors students are strongly encouraged to take Psychology 1100H and are expected to select challenging psychology coursework, including Psychology Honors courses.

In regards to the psychology major, an *Honors Contract* must include either of the following combinations of coursework:

- 4 psychology honors courses (2000 to 5000-level, EXCLUDING the honors thesis course)

- 3 psychology honors courses (2000 to 5000-level, EXCLUDING the honors thesis course) PLUS at least 4 credit hours AND at least 2 semesters of Psychology 4998.

The first combination appears to be the non-thesis option and consists of four honors courses.

12.3   Spanish *Honors Courses* Requirements

The Spanish Honors major consists of a minimum of 33 credit hours. A minimum grade of "C-" in all courses comprising the major is required. Students must maintain a minimum CPHR of 3.4 throughout the *Honors Program.* (H) and (E) denotes Honors and Embedded Honors versions. Students are required to take the two *honors courses* in the upper part of the table, one of the three courses in the middle part, and two of the ten courses in the lower part.

13   Current Honors Committees

The Math Department Honors Committee: From the Department POA

The Mathematics Honors coordinator oversees the Department's honors undergraduate program, supervises honors advising in consultation with the Math Counseling Office, acts as a liaison with the University Honors and Scholars Program, and advises the Chair on deserving recipients of Departmental scholarships.

G. The Undergraduate Advising Committee The members of this committee advise Math Majors who are not taking the standard Math Honors sequence and are not Actuarial Majors.

Undergraduate Math Advising Office This office advises students on a variety of issues, including math placement and course options, math courses

Table 16: *Honors Courses* in Spanish

3401H	Advanced Grammar
3450H	Introduction to the Study of Literature & Culture
5680.01H	Honors Seminar in Hispanic Linguistics
5680.02H	Honors Seminar in Iberian Literatures and Cultures
5680.03H	Honors Seminar in Latin American Literatures and Cultures
	Iberian Studies Concentration
4551E	Spanish Golden Age Literature
4552H	Modern Spanish Literature
4561H	The Culture of Spain
4567H	Spanish Mosaic: Catalonia, Basque Country, Galicia and Andalusia
	Latin American Studies Concentration
4555E	Indigenous and Colonial Literature of Spanish America
4560H	Spanish American Culture
4565H	Latin American Indigenous Literatures & Cultures
4590H	Interdisciplinary Protocols (taught in English**)
	Hispanic Linguistics Concentration
4430H	Introduction to Linguistics
4534H	Spanish Phonology

/ sequences for various programs, math study skills, and long-range goals. It also assists the department administration and various university offices in providing information concerning math related issues. The office develops and maintains the Math Advising Office web pages, which include updated information on courses and syllabi, honors opportunities, information about placement tests, GEC requirements, and related data. It assists faculty advisors with math majors, prepares literature for orientation of new students, writes and grades math proficiency exams, helps the Undergraduate Admissions Office with recruitment and with evaluation of transfer credit, and oversees processes needed to get University approval of curricular changes.

The UGC includes several members with special roles: representative of the Mathematics *Honors Program* to the UGC.

The Arts and Sciences Honors Committee: From the College POA

c. Honors Committee

i. Membership: 15 faculty members, 5 from each division, appointed by the Associate Executive Dean, and 6 student voting members, two from each division. Each division will be represented by two regular student members and one alternate. When not present, students will be replaced by the alternate from their division. If the alternate is not available, a student alternate from another division may vote in their place. The Chair of the Committee shall be elected in the spring from among the continuing members.

Non-Voting Member: The Associate Executive Dean, to serve as Vice-Chair.

Liaisons: The Associate Provost for Honors and Scholars The Director of the Office of Undergraduate Research

ii. Duties and Responsibilities: To study the existing *Honors Program* in the College of Arts and Sciences and to make recommendations to the ASC Faculty Senate and the Executive Dean regarding its future development; to establish criteria, in consultation with the ASCC for honors courses and honors versions of existing courses, and to act as the body that approves these courses for honors use; to establish and monitor expected standards of academic attainment leading to "with honors in the Arts and Sciences" and "Distinction" designations, and to recommend to the ASC Faculty Senate additional honors-related undergraduate degree designations for its consideration; to award undergraduate research scholarships to Arts and Sciences students; to work cooperatively with Arts and Sciences and University Honors to develop suitable honors experiences for all students; to consider and develop other special programs as the need may arise. The committee shall submit an annual report to the ASC Faculty Senate and to the Executive Dean during spring semester.

iii. Terms: Faculty members shall serve for three-year rotating terms. Student members shall serve one-year terms.

14 The University and College Honors

The *College Honors Program* has requirements from the Department, the College, and the University. The *College Honors Program* have three graduation accolades (noted on diplomas and transcripts). They are:

1. Graduation *with honors in the Arts and Sciences* (administered by ASC) requiring:

    (a) minimum cumulative 3.4 grade-point average,

    (b) 60 graded semester hours at The Ohio State University, and

    (c) completion of an approved *Honors Contract*;

    (d) **other department-specific requirements**

    Typical ASC honors requirements consist of general education honors courses and departmental honors courses (often five (5)).

2. Graduation *with honors research distinction* (administered by ASC) requiring

    (a) minimum 3.4 cumulative grade-point average,

    (b) 60 graded semester hours at The Ohio State University,

    (c) membership in the Arts and Sciences *Honors Program* (completion of *Honors Contract* curriculum),

    (d) successful defense of an undergraduate thesis project, and

    (e) **successful completion of any departmental grade-point, course-work, and examination requirements.**

3. Graduation *with honors distinction in Mathematics* (**administered by the Department of Mathematics**) requiring:

    (a) The successful completion of a mathematics major with a minimum 3.4 cumulative grade-point average in mathematics courses,

    (b) minimum 3.4 cumulative grade-point average,

    (c) membership in the Arts and Sciences *Honors Program* (completion of *Honors Contract* curriculum),

(d) The completion of all eight (8) math *Honors Courses* at the 5000-level,

(e) One of

    (A) senior thesis written under the direction of a faculty member,

    (B) The completion of two 6000-level math 2-course sequences with a grade of B+ or better in each course.

The *Honors Contract* allows students to construct a more challenging curriculum by incorporating honors and upper division (4000 and above) classes. The *Honors Contract* must be approved by the Arts and Sciences (ASC) Honors Committee and admits students to candidacy for graduation *with honors in the Arts and Sciences*. To graduate *with honors in the Arts and Sciences*, students must complete the *Honors Contract* curriculum with a minimum 3.4 cumulative grade point average on at least 60 graded semester credit hours at Ohio State.

The *Honors Contract* should be submitted to the ASC Honors Office for approval by the end of the student's second year of study. Failure to submit the *Honors Contract* by the end of the second year may result in dismissal from the ASC *Honors Program*. While a student may reapply to the *Honors Program* if dismissed, they must do so no later than the end of their third year of study or the semester before they plan to graduate (whichever comes first) to be considered for graduation *with honors in the Arts and Sciences*. Unless there are extenuating circumstances, an *Honors Contract* will not be accepted for review by the ASC Honors Committee after the third year of study. An *Honors Contract* should be signed by the departmental honors advisor(s) for the major(s) and any minors.

With honors distinction in Mathematics is awarded only after approval by the faculty advisor, the Math Honors Committee, and the ASC Honors Committee. Under current departmental guidelines, graduation *with honors distinction in Mathematics* requires the eight (8) math *Honors Courses* listed in Table 17 and two yearlong math sequences at the 6000 level for a total of 12 courses. In addition, the student must write a senior thesis under the direction of a faculty member and take Math 4998H or 4999H when writing that thesis.

To apply, students in their junior year submit appropriate forms to the Math Honors Committee. Once approved, those forms are forwarded to the ASC Honors Office for approval. Students pursuing the thesis option must

Table 17: Courses that must be used for the current *with honors distinction in Mathematics* designation.

Math 5520H	Honors Linear Algebra and Differential Equations
Math 5522H	Honors Complex Analysis
Math 5529H	Honors Combinatorics
Math 5530H	Honors Probability
Math 5540H	Honors Differential Geometry
Math 5576H	Honors Number Theory
Math 5590H	Honors Abstract Algebra 1
Math 5591H	Honors Abstract Algebra 2

sign up for one to three semester hours of Math 4998H or 4999H (a maximum of six hours, or two completions of independent research or coursework, are applicable to the *honors with distinction* project). For the thesis option, the student may not begin honors research coursework until the semester in which she or he attains senior standing, unless the faculty project adviser provides a document explaining that the student has sufficient background to begin research prior to the senior year.

14.1   Arts and Sciences Designations

We note that the College of Arts and Sciences has six possible designations that students can earn on their undergraduate diplomas. Only the first two are to be included in the Math Department *Honors Program.*

- *with honors in the Arts and Sciences*

  For students who complete an *Honors Contract.*

- *with honors distinction in Mathematics*

  For students majoring in mathematics who choose the graduate-level course work option to graduate with this designation.

- *with distinction in Mathematics*

  For students who complete the Math Department *Honors Track*

- *with honors research distinction in [major field]*

For students who demonstrate excellence in the study of a discipline both through major course work and by completing an independent research project culminating in an undergraduate thesis.

- *with honors research distinction*

  For students who complete and successfully defend an undergraduate thesis in a discipline other than their major.

We note that there are two additional non-honors designations that students can obtain on their bachelors degree:

- *with research distinction in Mathematics*

  This designation occurs when a math major writes a thesis in mathematics.

- *with research distinction*

  This designation occurs when a math major writes a thesis in another topic such as economics.

There are other requirements (such as grade requirements) that are required for all of these designations.

15 Honors in 1998

Quarter to Semester Course Conversion

Page 1: Web Honors Information from 1998

HONORS OPPORTUNITIES AND OPTIONS

Honors work is the enhancement of the basic liberal arts degree structure through challenging and enriched courses to ensure gaining the best possible undergraduate education available. For those students who wish to undertake a total honors education, the curriculum will include honors courses, upper division courses for meeting basic requirements, especially challenging sequences, the most rigorous courses offered when choice is involved, honors seminars, and a strong major which includes a significant research component. Although not all students will have the time and intellectual inclination

Table 18: Course Conversion

Quarter Course	Name	Semester Course	Name
H161-H162-H263	Accelerated Calculus	1181H-2182H	H Calculus
H187	Problem Solving	1187H	H Problem Solving
H190-H191-H264	Elementary Analysis	4181H-4182H	H Analysis
H487	Problem Solving		
H520-H521-H522	Lin. Alg.-ODE-Complex An.	5520H-5522H	Lin. Alg.-ODE-Complex An.
H540-H541	Geometry of Manifolds	5540H	H Differential Geometry
H590-H591-H592	Algebra	5590H-5591H	H Abstract Algebra
670-671-672	Algebra	5111-5112	Algebra
651-652-653	Real Analysis	5201-5202	Real Analysis
655-656-657	Elementary Topology	5801 - 6801	Topology
700 level (10 hrs)		6000 level	

to enhance every portion of their undergraduate degree, all students who become members of the *Honors Program* ought to have, as a goal, the constant enrichment of their areas of academic strength. Information regarding the Arts and Sciences *Honors Program* and the membership requirements for the program can be obtained in Room 208, Denney Hall.

The Department of Mathematics offers a strong sequence of honors courses as well as enrichment courses and problem solving seminars. These courses are accelerated, more concept-oriented versions of the regular sequences designed to challenge the well-prepared, highly motivated student. The *Honors Program* in mathematics, however, is not intended for mathematics majors alone. The honors curriculum is designed to benefit every participant with a serious interest in a discipline which utilizes mathematical ideas and methods (engineering, science, mathematics, and even the social and life sciences). In the years past, some of our best mathematics honors students have had majors other than, or in addition to, mathematics.

DEGREE WITH HONORS OR WITH DISTINCTION

A student may submit an Honors Contract proposal to the ASC Honors Committee to become a candidate for graduation *with honors in the Liberal Arts.* The Honors Contract should reflect a total liberal arts program of exceptional strength and breadth as demonstrated by a strong major program and rigorous coursework outside of the major. A student may also graduate *with*

distinction in mathematics, an honor recognizing students who have achieved excellence in the study of mathematics. In our department, the minimum requirements to receive this designation are to write a senior thesis under the direction of a faculty member, or to choose the following coursework option:

- Math 651-652-653 [5201-5202], or

- Math 655-656-657 [5801-6801], or

- Math 675-676-677 [no current equivalent], or

- 10 hours of coursework in a 700-level [6000 level] sequence.

Please note that one of these sequences must be completed in addition to the 40 hour major.

Students requesting the *with distinction* designation via the coursework option must have the approval of their faculty advisor and the Math Honors Committee even though they have met the above minimum requirement. During their junior year these students should pick up the appropriate form from the Math Counseling Office and submit it, together with a copy of their major program and their Advising Report, to the Math Honors Committee. Students hoping to receive approval of the Math Honors Committee should have a coherent program.

There are several additional requirements or procedures that must be followed to graduate with distinction in mathematics via either the thesis or the coursework option.

1. Point-hour requirements

   (a) The student must have at least a 3.3 CPHR overall.

   (b) The student must have at least a 3.3 CPHR in all courses taken in the field of distinction. The field of distinction is minimally equivalent to the courses listed on the official Major Program. Students may not exceed the maximum number of credit hours allowed in one discipline under their respective curriculum except by petition. (1980: B.A., 65 hours; B.S., 75 hours; 1983: B.A. and B.S., 80 hours).

   (c) For the coursework option, the student must have a B+ or better in each course within the option.

2. Credit hour requirements

   (a) The student must generally complete a full 40 hour major in addition to credit hours received for the research and thesis project. The ASC Honors Conunittee, however, will consider exceptions in cases where the faculty project adviser provides a statement of explanation to the effect that the breadth component of the with distinction candidacy has been met in some alternate way.

   (b) The student pursuing the thesis option must sign up for a minimum of eight hours under the course number Math H783 (a maximum of fifteen hours of independent research and/or coursework are applicable to the with distinction project).

   Application forms for the degree with distinction are available in the Honors Office. The student should complete the form the quarter before she/he intends to begin either option. This form must be signed by the student, faculty adviser and the chairperson of the Mathematics Honors Committee. Some departments also require the signature of the department chair or department honors adviser. The completed application is retumed to the ASC Honors Office, which represents the ASC Honors Committee, for approval by the coordinator of the Arts and Sciences graduation with distinction program. The student and faculty adviser receive copies of the approved application. The original is kept on file in the Honors Office. The student may not begin Honors research coursework until the quarter in which she/he attains senior (rank 4) standing, unless the faculty project adviser provides a statement or explanation to the effect that the student has sufficient background to begin research prior to the senior year. Before she/he register for Math H783 or the 600 level sequences, the application form for graduation with distinction must be completed and approved by the Honors Office.

Page 2

HONORS OPPORTUNITIES

The *Honors Program* at The Ohio State University is a unique opportunity to live and learn in a small community of dedicated scholars and students, while at the same time enjoying the advantages of being part of a major research university. Training in mathematics is at the core of any outstanding *Honors Program* in the engineering, physical, biological or social sciences. With this in mind, the Ohio State Department of Mathematics has developed a unified four year program of honors courses in mathematics serving the needs of a wide spectrum of honors undergraduate students.

The foundation of the program is a one year sequence in the calculus of one and several variables. The Department's appreciation of the varying levels and abilities of entering students is reflected in the availability of two honors sequences at this level. For those who are ready and eager to explore the deeper theoretical underpinnings of the calculus, the department offers the sequence Math H190-H191-H264 [4181H-4182H]. This enriched sequence, which is the most rigorous of the calculus options, is intended to stimulate the development of mathematical thinking. It is designed to challenge talented, highly motivated students who enter the University already familiar with differential and integral calculus, regardless of their chosen major area of study. The typical student will have Advanced Placement Credit and will have a Math ACT score > 32, or a Math SAT score > 700. For those who have demonstrated technical mastery of calculus and who would like deeper insights into some of the theory that makes it all work, we offer the sequence Math H161-H162-H263 [1181H-2182H]. Although not as rigorous as H190 [4181H], both of these options assume mastery of differentiation of polynomial and trigonometric functions, and compress the typical four quarter calculus sequence into three quarters.

Students successfully completing either H263 [2182H] or H264 [4182H] and interested in an in-depth study of the mathematics which forms the mathematical heart-and-soul of chemistry, physics and engineering will want to enroll in the second year sequence: Math H520-H521-H522 [5520H-5522H]. This sequence presents linear algebra, differential equations and complex analysis for honors students. While these courses are theory-and-proof oriented, they do not neglect the fundamental skills needed in scientific applications.

Successful completion of H520 [5520H] qualifies a student for either the two-quarter sequence Math H540-H541 [5540H] or the three-quarter sequence Math H590-H591-H592 [5590H-5591H]. Math H540, H541 [5540H] are courses on the geometry and topology of n-dimensional spaces and manifolds. This material is key to understanding the world of modern physics and is valuable for students pursuing advanced degrees in mathematics, physics and engineering.

Math H590-H591-H592 [5590H-5591H] is a sequence in algebraic theory covering the major structures of groups, rings and fields. This background is a prerequisite to advanced study in mathematics and also provides an understanding of the mathematical language of symmetry and invariants essential to chemistry, quantum physics and electrical engineering. It also provides the context for exploring coding theory, modern electrical engineering and the world of computer and information science.

For students who love the challenge of brain-teasing mathematical problems, we offer two honors problems courses: H187 [1187H] (for students without a calculus background) and H487 [??] (for students with calculus expertise). These courses also serve as a training ground for the national Putnam Exam in Mathematics (see also), with the course instructor coaching the Putnam team. They also help prepare students for our in-house Rasor-Bareis-Gordon Math Competition, which is held each February.

Students who wish to test their creative skills in the context of a genuine research problem in mathematics will want to pursue a senior honors thesis in mathematics under the direction of one of our regular faculty members. The University Honors Center offers funding for summer research internships for juniors wishing to test the

Yet another attractive alternative for exceptionally talented students is the Arts and Sciences Graduate Combination Program, jointly coordinated by the Colleges of the Arts and Sciences and the Graduate School. **This program permits a student simultaneously to earn a B.S. and M.S. degree. A student who completes our honors undergraduate program in three years (or fewer) may choose to enroll in some of our excellent graduate sequences and earn a joint B.S./M.S. degree.** Recent graduates who pursued this program have gone on to successful doctoral studies at Princeton, Yale, M.I.T., Cal Tech and other leading universities.

All honors courses are taught in small classes (25 or fewer students) with faculty instructors who are committed to the needs of each student. Your classmates will be among the best students at The Ohio State University, all

eager to learn and explore new ideas. Recent honors students have received national and international recognition for their scholarship. Our students have won National Science Foundation Graduate Fellowships, a Goldwater Scholarship, a Marshall Scholarship for two years of study at any university in the United Kingdom, a Harry S. Truman Scholarship, a scholarship to attend the J. F. Kennedy School of Government at Harvard University, and Second Prize in the Courant Institute Mathematical Talent Competition. Within this University, our honors majors have been elected to Phi Beta Kappa and earned *Excellence in Scholarship Awards*, Undergraduate Research Scholarships and other distinctions.

This is the cornucopia of possibilities available in the *Honors Program* in Mathematics at the Ohio State University. We hope you will join us and share the honors experience!

For further information, contact:

> Professor Vitaly Bergelson, Honors Chair
> Department of Mathematics
> 231 W. 18th Avenue
> Columbus, Ohio 43210
> (614) 292-9591 or
> Mathematics Counselors - (614) 292-6994

Honors in 1998: From page 2 we see that the *Honors Track* in 1998 required the following (translated into semester) courses: 4181H, 4182H, 5520H, 5522H, 5540H, 5590H, and 5591H in addition to problem solving courses. From page 1 we see that *with honors distinction in Mathematics* required in addition a yearlong PhD sequence.

16 Requirements of Math Major Tracks

The Math Department has seven different math major tracks (*Traditional, Physics, Chemistry, Biology, Math Finance, Math for Educators*, and *Honors*). Overviews of these tracks are described in this section with precise details given in the tables in Section 16.7.

16.1 *Honors Track Requirements*

The *Honors Track* currently requires the honors courses in Table 19

(see https://math.osu.edu/undergrad/current-majors/requirements/honors)

Table 19: Nine Required Courses for current *Honors Track*

Math 4181H	Analysis I	Math 4182H	Analysis II
Math 5520H	Linear Alg &DiffEq	Stat 4202	Math Statistics II
Math 5529H	Combinatorics	Math 5530H	Probability
Math 5590H	Abstract Algebra I	Math 5591H	Abstract Algebra II
	Choose one of 5540H, 5522H, 5576H	Math 5540H	Differential Geometry
Math 5522H	Complex Analysis	Math 5576H	Number Theory

Students who start with Math 1181H will also need to take Math 2182H and Math 3345H for a total of 12 required honors courses.

The current requirements for *with honors distinction in Mathematics* include the 10 Math honors courses in Table 19 and two 6000 level two-course sequences. In short, *with honors distinction in Mathematics* requires 6 additional PhD level or 5000 level honors courses beyond those required for completion of the *Honors Track*.

16.2 *Traditional Track* Requirements

To major in the traditional mathematics track, students must take the prerequisites listed in Table 20, the required courses listed in Table 21, and a choice of elective courses listed in Table 22. A total of 49-51 credit hours are required to major in mathematics.

16.3 *Applied Math Track* Requirements

Majors in applied mathematics are required to complete the following coursework, with prerequisites in both math and natural science subject areas.

After completing the required courses, students pick electives that highlight the focus of their track (either *Physics Option* or *Chemistry Option*). Many of the elective options students will take have been pre-selected by faculty in order to fully align this math major to the industrial and applied science careers of the future.

The prerequisites needed for an *Applied Math Track* major specializing in chemistry or physics are listed in Table 23. The courses that are required for an applied major in chemistry or physics are given in Table 24. Possible

electives are given in Tables 24 and 25. The total credit hour requirements for an applied math specialization in chemistry or physics is 70-71.

16.4   *Math Biology Track* Requirements

The prerequisites needed for Math Biology are listed in Table 26. The required and elective courses are listed in Tables 27 and 28. The total credit hours required for a math biology specialty is 60-61.

16.5   *Financial Mathematics Track* Requirements

The prerequisites needed for Financial Mathematics are listed in Table 29. The required courses are listed in Table 30. The total credit hours required for a financial math specialty is 71.

16.6   *Math for Educators Track* Requirements

The prerequisites needed for *Math for Educators Track* majors are listed in Table 31. The required courses are listed in Table 32. The total credit hours required for a math education specialty is 53-55.

16.7   *Math Track* Requirements

Table 20: *Traditional Track*: Prerequisites

Math 1151	Calculus I	5
Math 1152	Calculus II	5
Math 1295	Introductory Seminar	1

Honors courses may be substituted for their non-honors counterparts (for example, Math 1181H for Math 1151).

Table 21: *Traditional Track*: Requirements (Min grade C- & GPA 2.0)

Math 2153	Calculus III	4
Math 2568 or 2568H	Linear Algebra	3
Math 3345 or 3345H	Foundations of Higher Mathematics	3
Math 4530	Probability	3
	or	
Stat 4201	Introduction to Mathematical Statistics I	4
Stat 4202	Introduction to Mathematical Statistics II	4
Math 2255	Differential Equations and Their Applications	3
Math 4547	Introductory Analysis I	3
Math 4548	Introductory Analysis II	3
Math 4580	Abstract Algebra I	3
Math 4581	Abstract Algebra II	3
	Total Hours	32-33

Table 22: *Traditional Track*: Electives (Min grade C- & GPA 2.0): Choose at least 6 hours

Math 3589	Introduction to Financial Mathematics	3
Math 3607	Beginning Scientific Computing	3
Math 3618	Theory of Interest	3
Math 4350	Quantitative Neuroscience	3
Math 4504	History of Mathematics	3
Math 4507	Geometry	3
Math 4556	Dynamical Systems	3
Math 4557	Partial Differential Equations	3
Math 4551	Vector Analysis	3
Math 4552	Complex Analysis	3
Math 4573	Elementary Number Theory	3
Math 4575	Combinatorial Mathematics	3
Math 4578	Discrete Mathematical Models	4
Math 5632	Financial Economics for Actuaries	3

Honors eligible courses may be substituted for their non-honors counterparts (for example, Math 2568H for Math 2568 or Math 5590 for Math 4580).

Table 23: *Chemistry* and *Physics Tracks*: Prerequisites

Math 1295	Introductory Math Major Seminar	1
Math 1151	Calculus I	5
Math 1152	Calculus II	5
Chem 1210	General Chemistry I	5
Chem 1220	General Chemistry II (only for chemistry)	5
Physics 1250	Mechanics, Thermal Physics, Waves	5
Physics 1251	E&M, Optics, Modern Physics	5
Bio 1113	Biological Sciences: Energy Transfer and Development	4
	or	
Bio 1114	Biological Sciences: Form, Function, Diversity, and Ecology	4
CSE 1222	Introduction to Computer Programming in C++	3
	or	
CSE 1223	Introduction to Computer Programming in Java	3
	Total	**38**

Table 24: *Chemistry* and *Physics Tracks*: Requirements

Math 2153	Calculus III	4
Math 3345 or 3345H	Foundations of Higher Mathematics	3
Math 2568	Linear Algebra	3
Math 4530	Probability	3
	or	
Stat 4201	Introduction to Math Statistics I	4
Stat 4202	Introduction to Math Statistics II	4
Math 2255	Differential Equations and Their Applications	3
Math 4557	Partial Differential Equations	3
	Choose two of the following three courses	
Math 3607	Beginning Scientific Computing	3
	or	
Math 4552	Complex Analysis	3
	or	
Math 4556	Dynamical Systems	3
	Total	**26-27**

Table 25: *Chemistry & Physics Tracks*: Electives (6 credit hr min)

Math 4551	Vector Analysis	3
Math 5101	Linear Math in Finite Dimensions	3
Math 5102	Linear Math in Infinite Dimensions	3
Math 4547	Introductory Analysis I	3
Math 4548	Introductory Analysis II	3
Math 5756	Methods in Relativity Theory I	3
Math 5757	Methods in Relativity Theory II	3
Math 5451	Calculus of Variation and Tensors	3
	Also the following if not used toward Applied Math Courses	
Math 3607	Beginning Scientific Computing	3
Math 4552	Complex Analysis	3
Math 4556	Dynamical Systems	3
	Applied Area Options (6 credit hour minimum)	
	For Chemistry Option	
Chem 2210	Analytical Chemistry I: Quantitative Analysis	5
Chem 4300	Physical Chemistry I	3
Chem 4310	Physical Chemistry II	3
	For Physics Option	
Physics 2300	Intermediate Mechanics I	4
Physics 2301	Intermediate Mechanics II	4

Table 26: *Math Biology Track*: Prerequisites

Math 1295	Introductory Math Major Seminar	1
Math 1151	Calculus I	5
Math 1152	Calculus II	5
Bio 1113	Biological Sciences: Energy Transfer and Development	4
Bio 1114	Biological Sciences: Form, Function, Diversity, and Ecology	4
Chem 1210	General Chemistry I	5
	Total	**24**

Table 27: *Math Biology Track*: Requirements

Math 2153	Calculus III	4
Math 3345 or 3345H	Foundations of Higher Mathematics	3
Math 2568	Linear Algebra	3
Math 4530	Probability	3
	or	
Stat 4201	Introduction to Math Statistics I	4
Stat 4202	Introduction to Math Statistics II	4
Math 2255	Differential Equations and Their Applications	3
Math 3350	Introduction to Mathematical Biology	3
Bio 3401	Integrated Biology	4
	or	
MolGen 4500	General Genetics	3
Math 3607	Beginning Scientific Computing	3
	or	
Math 4556	Dynamical Systems	3
	or	
Math 4557	Partial Differential Equations	3
	Total	30-31

Table 28: *Math Biology Track*: Electives (6 credit hour minimum)

Math 4350	Quantitative Neuroscience	3
Math 4551	Vector Analysis	3
Math 4552	Complex Analysis	3
Math 5101	Linear Math in Finite Dimensions	3
Math 5102	Linear Math in Infinite Dimensions	3
Math 4547	Introductory Analysis I	3
Math 4580	Abstract Algebra I	3
Math 5421	Mathematics of Infectious Disease Dynamics	
Math 5540H	Honors Differential Geometry	5
	Also the following if not used toward Applied Math Courses	
Math 3607	Beginning Scientific Computing	3
Math 4556	Dynamical Systems	3
Math 4557	Partial Differential Equations	3
Biochem 4511	Introduction to Biological Chemistry	4
EEOB 3310	Evolution	4
EEOB 3420	Behavioral Ecology	4
EEOB 4520	Comparative Physiology	3
Chem 2510	Organic Chemistry	4
MolGen 5601	Eukaryotic Molecular Genetics Lab	4

Table 29: *Math Finance Track*: Prerequisites

Math 1295	Introductory Math Major Seminar	1
Math 1151	Calculus I	5
Math 1152	Calculus II	5
Acct 2000	Foundations of Accounting	3
Econ 2001.01	Principles of Microeconomics	3
Econ 2002.01	Principles of Macroeconomics	3
CSE 2111	Modeling and Problem Solving with Spreadsheets and Databases	3
CSE 1222	Introduction to Computer Programming in C++	3
	or	
CSE 1223	Introduction to Computer Programming in Java	3
	Total	**29**

Table 30: *Math Finance Track*: Requirements

Math 2153	Calculus III	4
Math 3345 or 3345H	Foundations of Higher Mathematics	3
Math 2568 or 2568H	Linear Algebra	3
Math 4530	Probability	3
	or	
Stat 4201	Introduction to Math Statistics I	4
Stat 4202	Introduction to Math Statistics II	4
Math 2255	Differential Equations and Their Applications	3
Math 3589	Introduction to Financial Math	3
Math 3607	Beginning Scientific Computing	3
Math 3618	Theory of Interest	3
Math 4557	Partial Differential Equations	3
	or	
Math 4512	Partial Differential Equations for Science and Engineering	3
Math 4547	Introductory Analysis I	3
Math 5632	Financial Economics for Actuaries	3
BusFin 3120	Foundations of Finance	3
	or	
BusFin 3220	Business Finance	3
	Total	**42**

Table 31: *Math for Educators Track*: Prerequisites

Math 1295	Introductory Math Major Seminar	1
Math 1151	Calculus I	5
Math 1152	Calculus II	5
CSE 1222	Introduction to Computer Programming in C++	3
	or	
CSE 1223	Introduction to Computer Programming in Java	3
	or	
CSE 2221	Software I: Software Components	4
	Total	**14-15**

Table 32: *Math for Educators Track*: Requirements

Math 2153	Calculus III	4
Math 3345 or 3345H	Foundations of Higher Mathematics	3
Math 2568 or 2568H	Linear Algebra	3
Math 4530	Probability	3
	or	
Stat 4201	Introduction to Math Statistics I	4
Stat 4202	Introduction to Math Statistics II	4
Math 4547	Introductory Analysis I	3
Math 4548	Introductory Analysis II	3
Math 4580	Abstract Algebra I	3
Math 4581	Abstract Algebra II	3
Math 4504	History of Mathematics	3
Math 4507	Geometry	3
Math 4578	Discrete Mathematical Models	4
	Total	**39-40**