

MICHIGAN STATE UNIVERSITY

March 4, 2016

MEMORANDUM

TO: Dr. Douglas Estry, Associate Provost for Undergraduate Education
and Dean of Undergraduate Studies

FROM: Dr. John Gaboury, Associate Provost for Academic Services
and Enrollment Management

RE: Request for Revision of the MSU Graduation Requirement for
Mathematics

For Transmittal to the University Committee on Undergraduate
Education (UCUE)

The request referenced above is being sent to you for action by the University
Committee on Undergraduate Education (UCUE).

UCUE Response Requested:

Please ask the UCUE to consider the request referenced above and provide
consultative commentary. Please mail the related materials referenced under the
heading Attachments at the end of this memorandum to UCUE members.

The UCUE alone will consider this request and its consultative commentary will be sent
to the Provost for determination and possible further governance consultation.

If you have any questions about this memorandum or the attached materials, please
contact Joy Speas, University Curriculum Administrator, at 5-8420.

Thank you.

Attachments:

1. Request for Revision of the MSU Graduation Requirements for
Mathematics dated March 4, 2016 and attachments.

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University Curriculum and Catalog

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517-355-8420
Fax: 517-353-1935

Speas, Joy

From: Mark Voit <voit@msu.edu>
Sent: Friday, March 04, 2016 12:40 PM
To: Speas, Joy
Cc: Promislow, Keith S.; Vince Melfi; Estry, Doug
Subject: QL and MSU's UG graduation requirement in mathematics
Attachments: MSU_math_grad_requirement.pdf

Hello Joy-

In partnership with MTH and PRIME, the College of Natural Science has developed a two-course sequence in Quantitative Literacy that we would like considered as an alternative pathway for satisfying the MSU undergraduate graduation requirement in mathematics.

To that end, we have prepared the attached memo, which Associate Provost Doug Estry has advised us to address to you.

Thanks, and please let us know if you have any questions.

-Mark

Mark Voit
Professor, Department of Physics and Astronomy
Associate Dean, College of Natural Sciences
Michigan State University
voit@msu.edu

Request to revise the MSU undergraduate graduation requirement in mathematics

To: Joy Speas, University Curriculum Administrator

From: G. Mark Voit, Associate Dean, College of Natural Science
Vince Melfi, Director of PRIME and Mathematics Education Graduate Program
Keith Promislow, Chair, Department of Mathematics

Cc: Doug Estry, Associate Provost for Undergraduate Education
R. James Kirkpatrick, Dean, College of Natural Science
R. Sekhar Chivukula, Associate Dean, College of Natural Science

We would like to request a revision of the university's undergraduate graduation requirement in mathematics. The first sentence describing the requirement currently reads:

The university Mathematics requirement consists of college algebra plus one additional mathematics or statistics course beyond college algebra.

All undergraduate students must therefore demonstrate proficiency in college algebra before they can receive a degree from MSU. Most of our students do this by passing a course that covers college algebra (primarily MTH 103, but alternatively MTH 110 or MTH 116), while our more mathematically inclined students satisfy the requirement by placing into calculus through a proctored placement examination. Our request seeks to broaden and diversify the requirement so that it can be satisfied by two newly developed and piloted courses in quantitative literacy: MTH 101 and MTH 102.

Making quantitative literacy a major goal of our undergraduate curriculum has been discussed at MSU for over a decade. For example, the 2005 Quantitative Literacy Task Force report, commissioned by then-Provost Lou Anna Simon and co-authored by Joan Ferrini-Mundy and Doug Estry, endorsed that goal and defined it with the following statements:

Quantitative literacy is the ability to formulate, evaluate, and communicate conclusions and inferences from quantitative information.

Quantitative literacy employs analytical arguments and reasoning built upon fundamental concepts and skills of mathematics, statistics, and computing.

Quantitatively literate MSU students will be more empowered members of a global society through their ability to represent and critique their world.

That report went on to recommend integration of quantitative literacy into the education of all MSU students through both foundational general-education courses in mathematics and quantitative upper-level disciplinary courses in every major. While we endorse the intentions of that recommendation, we recognize that the magnitude of the proposed changes may have exceeded the willingness of our faculty to change, because the envisioned Quantitative Literacy program has not yet been implemented.

We are proposing a more modest change to the undergraduate curriculum that still represents a fundamental shift in philosophy. The shift is to frame the mathematics

graduation requirement in terms of quantitative literacy instead of college algebra. For example, we suggest replacing the first sentence of the requirement with

The university Mathematics requirement ensures that all students build a foundation of quantitative literacy.

Such a change would allow undergraduates to satisfy the graduation requirement in mathematics by taking MTH 101 and MTH 102.

In our view, quantitative literacy should be the centerpiece of MSU's mathematics graduation requirement for two reasons. First, a graduation requirement with quantitative literacy at its core would succinctly communicate to both students and faculty that our general education aims to help students apply quantitative reasoning to real-life problem solving, thereby supporting two important dimensions of our undergraduate learning goals:

ANALYTICAL THINKING: Identifies and applies, as appropriate, quantitative methods for defining and responding to problems.

INTEGRATED REASONING: Uses a variety of inquiry strategies incorporating multiple views to make value judgments, solve problems, answer questions, and generate new understanding.

Second, courses that focus more directly on pragmatic applications of quantitative reasoning than on algebra itself are likely to be better lifetime preparation for students intending to pursue non-quantitative majors and careers. These are the students for whom our new courses in quantitative literacy were designed.

A more concrete expression of our intentions for student learning can be found in these five Learning Goals for MTH 101, along with some examples of how they were assessed during Fall Semester 2015:

1. Students will demonstrate quantitative literacy as a habit of mind.
 - Interpretation and discussion of graphs on gapminder.org that compare public-health statistics from various nations
 - Creation and presentation of infographics about health-related topics
 - Interpretation and discussion of graphs from UNHCR (The UN Refugee Agency) website showing the scale and movement of the global refugee population
2. Students will demonstrate proficiency in the domain of algebra and finite mathematics.
 - Calculations of percentages, rates of change, and unit conversions.
 - Distinguishing between absolute change and relative change
3. Students will demonstrate proficiency in the domain of mathematical modeling.
 - Modeling the spread of influenza
 - Interpreting online simulations of a measles outbreak
4. Students will demonstrate proficiency in the domain of statistical thinking.
 - Interpretation of confidence intervals in polling data
 - Distinguishing between appropriate uses of means and medians.

- Collection and analysis of statistical data on the relationship between pollution and natural selection.
5. Students will demonstrate proficiency in the domain of analytical arguments and reasoning.
- Critical analysis of sampling strategies, particularly in the context of political polling data.
 - Detecting biases in the presentation of graphical data.

MTH 102, which is being piloted in Spring Semester 2016, shares the same learning goals but focuses on different sets of applications. Both MTH 101 and MTH 102 are modular, and can be taken in either order, because MTH 101 concentrates primarily on applications of quantitative reasoning to science/health/environment issues while MTH 102 concentrates on economic/political/sociological issues.

By allowing students to satisfy the mathematics graduation requirement through these new quantitative literacy courses, we are also hoping to improve the graduation rates and time to degree of MSU undergraduates. Our college algebra course (MTH 103) has historically been a barrier to graduation for a significant number of MSU students, and some attempt the course multiple times without success. For example, during the 2010-2014 period, 240 students failed MTH 103 twice, 46 more students failed three times, 16 failed four times, and four failed five times.

The content and pedagogy of MTH 101 and 102 were designed to provide an alternative pathway to quantitative literacy for such students. During FS15 the pass rate in MTH 101 was over 90%, and the class included many students who had failed MTH 103 at least once. Student comments on MTH 101 show that many of them found the course content applicable to their daily lives and a more satisfying capstone to their mathematical experience at MSU than a terminal algebra course.

Because MTH 101 and MTH 102 are designed for students in other colleges, we have requested feedback from the rest of the university and met with faculty from the colleges of Arts and Letters, Social Science, and Communications. They strongly endorse the new Quantitative Literacy courses and therefore support this proposal to change the language of the MSU graduation requirement. They have also passed along strong endorsements of MTH 101 from students who have taken it.

In closing, we would like to suggest how a mathematics requirement that “ensures that all students build a foundation of quantitative literacy” would play out in practice. For maximum flexibility, we would like to allow any two courses among MTH 101, MTH 102, and MTH 103 to satisfy the requirement. The following language would permit that to happen:

The university Mathematics requirement ensures that all students build a foundation of quantitative literacy.

Each student must complete the requirement by fulfilling one of the options below:

1. Complete two of the following courses
 - a. Mathematics 101, 102, 103

2. Complete both of the following
 - a. Mathematics 103; *and*
 - b. *One* of the following courses: Mathematics 112, 114, 124, 132, 152H, or 201; or Statistics and Probability 200 or 201. Students who place into any course in 2.b. via the Mathematics Placement Exam need only complete the course in 2.b. in order to fulfill the University Mathematics requirement
3. Complete one of the following:
 - a. Mathematics 110 or 116.
4. Waiver through a *proctored* Mathematics Placement Exam yielding a score resulting in placement in Mathematics 132 (calculus).

For additional information, refer to the statement on *Academic Placement Tests – Mathematics (Algebra)* in the *Undergraduate Education* section of this catalog

Students who transfer one of the following: Mathematics 112, 114, or 201; or Statistics and Probability 200 or 201 alone, with no other mathematics course above the level of MTH 1825, must take the Mathematics Placement Exam. Based on the score achieved, additional course work may be required to fulfill the university Mathematics requirement.

Incoming freshmen who have taken a College Board Advanced Placement Examination in Mathematics should consult the statement on *Academic Placement Tests*. Transfer students should consult the statement on *Transfer Student Admission*.

For students who are enrolled in Lyman Briggs College, the completion of Lyman Briggs 118 satisfies the university Mathematics requirement.

Mathematics Requirement

The University Mathematics requirement consists of college algebra plus one additional mathematics or statistics course beyond college algebra. Each student must complete the university Mathematics requirement by fulfilling one of the options below:

- 2 - 1. Complete both of the following:
- Mathematics 103; and
 - One of the following courses: Mathematics 112, 114, 124, 132, 152H, or 201; or Statistics and Probability 200 or 201.

Students who place into any course in 1.b. via the Mathematics Placement Exam need only complete the course in 1.b. in order to fulfill the University Mathematics requirement.

- 3 - 2. Complete one of the following:

- Mathematics 110 or 116.

- 4 - 3. Waiver through a *proctored* Mathematics Placement Exam yielding a score resulting in placement in Mathematics 132 (calculus).

For additional information, refer to the statement on *Academic Placement Tests – Mathematics (Algebra)* in the *Undergraduate Education* section of this catalog.

Students who transfer one of the following: Mathematics 112, 114, or 201; or Statistics and Probability 200 or 201 alone, with no other mathematics course above the level of MTH 1825, must take the Mathematics Placement Exam. Based on the score achieved, additional course work may be required to fulfill the university Mathematics requirement.

Incoming freshmen who have taken a College Board Advanced Placement Examination in Mathematics should consult the statement on *Academic Placement Tests*. Transfer students should consult the statement on *Transfer Student Admission*.

For students who are enrolled in Lyman Briggs College, the completion of Lyman Briggs 118 satisfies the University Mathematics requirement.

ensures that all students build a foundation of quantitative literacy.

1. Complete two of the following courses:

- Mathematics 101, 102, or 103.

Integrative Studies, Mathematics, and Writing Requirements

Transfer students are expected to meet Michigan State University's Integrative Studies, Mathematics, and Tier I Writing requirements which are similar but not identical to general education requirements at other institutions, either by completing appropriate Michigan State University courses or by transferring courses and credits which are evaluated as acceptable equivalents for Michigan State University courses. Michigan State University is a member institution of the Michigan Association of Collegiate Registrars and Admissions Officers (MACRAO) and a participant in the Michigan Transfer Agreement (MTA). For further information regarding the MTA, please visit the MACRAO Web site, www.macrao.org.

During the early stage of their academic work, students who anticipated transferring to MSU should consult the Office of Admissions Web site at www.admissions.msu.edu/transfer.asp.

Evaluation of Credits for Transfer Students for Michigan State University Integrative Studies, Mathematics, and Tier I Writing Courses

Information on courses that will fulfill Michigan State University General Education requirements is found on the Office of Admissions Transfer Guide Web site at www.admissions.msu.edu/transferguide.

Courses from postsecondary accredited institutions of comparable academic quality considered as acceptable equivalents that may be used by transfer students for Michigan State University Integrative Studies, Mathematics, and Tier I Writing courses include:

1. **Tier I Writing, (4 credits)**
This requirement is satisfied with completion of a course (or combination of courses) equivalent to MSU WRA 101 or 195H.
2. **Integrative Studies in Biological and Physical Sciences, (8 credits)**
May be satisfied by completion of a combination of one biological science and one physical science course, and 2 credits of equivalent laboratory course work.
A number of science-based programs require alternate tracks with specified disciplinary courses. Consult requirements for the major or contact the Office of Admissions.
3. **Integrative Studies in Social, Behavioral, and Economic Sciences, (8 credits)**
May be satisfied by completion of:
200 level: One Integrative Studies in Social Science (ISS) course numbered 200 to 299. Students matriculating at Michigan State University for the first time have additional options within the Social, Behavioral, and Economic Sciences to satisfy this requirement. Visit www.admissions.msu.edu/admission/transfer_integrativestudies.asp or contact an academic advisor for additional information.
300 level: Interdisciplinary social science courses from four-year institutions may be transferable. Community college transfers must complete this requirement through Michigan State University.
4. **Integrative Studies in Arts and Humanities, (8 credits)**
1st Integrative Studies in Arts and Humanities course:
May be satisfied by a completion of one IAH course numbered below 211 or equivalent plus completion of one year of English composition. Completion of this requirement also fulfills the Tier I writing requirement referenced in item 1. above.
2nd Integrative Studies in Arts and Humanities course:
One additional IAH course numbered 211 or higher. Stu-

dents matriculating at Michigan State University for the first time have additional options within the Arts and Humanities to satisfy this requirement. Visit www.admissions.msu.edu/admission/transfer_integrativestudies.asp or contact an academic advisor for additional information.

5. **Mathematics (3-5 credits)**

May be satisfied by completing courses equivalent to those in the options below:

A. Complete both of the following:

1. MTH 103 College Algebra; and
2. One of the following courses: MTH 112 Finite Mathematics: Applications of College Algebra, MTH 114 Trigonometry, or MTH 201 Elementary Mathematics for Teachers I; or STT 200 Statistical Methods or STT 201 Statistical Methods.

B. Complete one of the following:

1. MTH 110 Finite Mathematics and Elements of College Algebra, MTH 116 College Algebra and Trigonometry, MTH 124 Survey of Calculus I, MTH 132 Calculus I, or MTH 152H Honors Calculus I.

Mathematics requirements for certain majors are more extensive than the university requirement. Consult requirements for the major or contact the Office of Admissions for more information.

Mathematics (Algebra)

All students entering MSU are required to take the un-proctored Mathematics Placement Service (MPS) examination online, before attending AOP with the following exceptions: students who *will* take a mathematics course at MSU and have either an ACT Math sub-score of at least 28 or an SAT Math sub-score of at least 640; students with credit for MTH 103 and also credit for either MTH 112, 114, 124, 132, 152H or 201, or STT 200 or 201; students with credits for MTH 110 or 116. Those transfer students who must take introductory mathematics or statistics courses to meet university or program requirements are required to take the placement test. Students who are transferring specific college course credit should enroll in the next level course, as appropriate to their program.

Students are urged to take the test via the web before their Academic Orientation Program, preferably by mid-May. The test can be accessed through www.math.msu.edu/mps. However, a student who wishes to complete the university mathematics requirement by waiver must complete the test in a *proctored* setting at an Academic Orientation Program or one of the Michigan State University Testing Centers to be eligible for the waiver.

Each student whose score on the MPS examination indicates the need for additional pre-college preparation in mathematics must either successfully complete Mathematics 1825 prior to fulfilling the University graduation requirement in mathematics or degree program requirements or demonstrate readiness for college mathematics by repeating the MPS examination, prior to matriculation at MSU, and receiving an appropriate score.



Michigan State University - Office of the Registrar

Course Descriptions: Subject/Course Search Results

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Course: MTH 101 Quantitative Literacy I
Semester: Fall of every year
Credits: Total Credits: 3
Prerequisite: (MTH 1825) or designated score on Mathematics Placement test
Description: Quantitative literacy including applications to health and risk, science, and the environment.
Effective Dates: FALL 2015 - Open

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Course Descriptions: Subject/Course Search Results

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Course: MTH 102 Quantitative Literacy II
Semester: Spring of every year
Credits: Total Credits: 3
Prerequisite: (MTH 1825) or designated score on Mathematics Placement test
Description: Quantitative literacy including applications to finance, economics, and politics.
Effective Dates: SPRING 2016 - Open

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