To: The Committee on Educational Programs

From: John Rafter, Director of Undergraduate Studies, Mathematics

Dept. Subject: A Change to the Undergraduate Mathematics Major

Date: September 30, 2016

We propose to require 15 credit hours of the math major be taken at Vanderbilt. The change was approved 5-0 by the Mathematics Department’s Undergraduate Committee and approved 17-2 at the September 29th Mathematics Department faculty meeting. There are three considerations that went into the decision.

1. Over the past several years, there has been a small, but growing, number of students who transfer the majority of the math major from a previous institution. As a result, some students have graduated with a math major after only taking one or two math courses at Vanderbilt.

2. The College of Arts and Science requires transfer students to take 60 credit hours at Vanderbilt out of the 120 credit hours required for graduation or half of the requirement. The Standard Track math major requires ten courses to complete, so in the spirit of requiring half of the courses be taken at Vanderbilt, we are proposing that fifteen credit hours (the equivalent of five classes) be taken at Vanderbilt for all three math major tracks.

3. There were discussions of having different requirements for the different tracks, but the consensus was that this requirement should not be part of the decision process when a student chooses a track. There was also a proposal at the departmental faculty meeting to reduce the requirement to 12 credit hours that was voted on, but the proposal failed.

**Mathematics**

THE Department of Mathematics offers an undergraduate major with a high degree of flexibility. A solid background in mathematics provides an excellent foundation for any quantitative discipline as well as many professions—many students go on to professional studies in law, medicine, or business.

**NOTE:** New course numbers took effect in fall 2015. Former course numbers are included in course descriptions in this catalog and at this website: registrar.vanderbilt.edu/faculty/course-renumbering/course-lookup/.

**Program of Concentration in Mathematics**

Three tracks are available.

Program I (Standard Track) is intended for most mathematics majors in the College of Arts and
Science, Blair School of Music, and Peabody College.

Program II (Applied Track) is intended for students in the School of Engineering who elect a second major in mathematics, but is also available for other students.

Program III (Honors Track) is intended for highly qualified students who either are preparing for graduate studies in mathematics or plan to graduate with departmental honors. Students who complete this program and, in addition, complete a senior thesis will graduate with departmental honors.

Requirements for the three tracks are summarized below.

**Program I (Standard Track).**

At least 32 credit hours in mathematics including at least 15 credit hours taken at Vanderbilt, as follows.

2. Linear algebra and differential equations: 2600 or 2500–2501, and 2610.
3. At least 15 additional credit hours from 2800 or above.
4. The remainder of the credit hours must be chosen from 2800 or above.

**Program II (Applied Track).**

At least 29 credit hours in mathematics including at least 15 credit hours taken at Vanderbilt and 6 credit hours outside the department, as follows.

1. A calculus sequence as in Program I.
2. Linear algebra and differential equations—one of the following:
   (a) one of 2410, 2600, or 2500–2501, and one of 2420 or 2610; or
   (b) 2400 and either 2600 or 2500–2501.
3. At least 12 additional credit hours from 2800 or above, excluding 3000.
4. The remainder of the credit hours in mathematics must be chosen from 2800 or above.
5. At least 6 credit hours of advanced, mathematically based science or engineering courses approved by the director of undergraduate studies. This requirement is automatically fulfilled by students who complete a physics major or a major in the School of Engineering.

**Program III (Honors Track).**

At least 38 credit hours in mathematics including at least 15 credit hours taken at Vanderbilt, as follows.

1. A calculus sequence as in Program I.
2. Linear algebra and differential equations as in Program I.
3. At least 21 additional credit hours of advanced course work,
   (a) including four courses taken from the following three categories, at least one from each category:
      1) Algebra: 3300, 4300, 4301.
      2) Analysis: 3100, 3110, 6100, 6101.
      3) Topology and Geometry: 3200, 3230, 4200, 4201, 4220, 6210.
   (b) The remainder of the 21 credit hours must be chosen from 2800 or above, excluding 4999.
4. The remainder of the credit hours must be chosen from 2800 or above.

Students who complete Program III and, in addition, complete a senior thesis fulfill the Honors requirements listed below, will graduate with departmental honors.

Students planning to teach in secondary school should contact the director of secondary education programs in the Department of Teaching and Learning at Peabody College for course recommendations.

**Honors Program**

The Honors Program in Mathematics is designed to afford superior students the opportunity to pursue more intensive work within their major field. The program requires:

1. Completion of all the requirements of Program III (Honors Track).
2. Graduate with a minimum grade point average of 3.6 in courses that count toward the mathematics major.
3. Completion of a senior thesis in Math 4999 (3 credit hours) in the second semester of the senior year. With approval of the director of undergraduate studies, the thesis may be based on research initiated or completed at another academic institution, such as during an
NSF-sponsored REU program.

4. Oral examination on the senior thesis. A committee of at least three faculty members—at least two from the Department of Mathematics, one being the thesis adviser—shall evaluate the thesis and the oral examination. Exceptional achievement on the thesis will earn highest honors.

Interested students may apply to the director of undergraduate studies for admission to the Honors Program in their junior year or the first semester of their senior year. Applicants must meet college requirements for entry to the Honors Program, and must carrymaintain a minimum grade point average of 3.6 in courses that count toward the mathematics major.

The application includes a one- to two-page proposal of the planned thesis and the signature of the faculty member who will be the thesis adviser.

The thesis must be submitted no later than two weeks before the end of classes in the semester of graduation. The oral examination will take place by the last day of classes in the semester of graduation. Highest honors will be awarded for a thesis that contains original high-quality research results in combination with an oral defense at the highest quality level.

Students may sign up for Math 4999 during one semester of their senior year. Math 4999 will not count toward the 21 credit hours requirement in Program III.

Please consult the director of undergraduate studies for details.

Minor in Mathematics

The minor in mathematics requires at least 15 credit hours in mathematics, including:

1. Completion of a calculus sequence: 2300 or 2500–2501.
2. Linear algebra and differential equations: as in the Program II major.
3. At least 6 credit hours not used to satisfy item 2 from 2800 or above.

Completion of a single-variable calculus sequence (1200–1201–2200 or 1300–1301) is a prerequisite for the minor, but does not count toward the credit hours of the minor.

Licensure for Teaching

Candidates for teacher licensure at the secondary level in mathematics should refer to the chapter on Licensure for Teaching in the Peabody College section of this catalog.

Calculus

Several calculus sequences are available:

1100; 1200–1201; 1300–1301–2300.

The courses in these sequences cover similar material, but at different rates, and therefore overlap in content and credit. Students should not switch from one to another without approval of the department. Such switching may result in loss of credit. Students intending to take mathematics classes beyond one year of calculus are advised to enroll in the 1300–1301–2300 sequence.

First-year students with test scores of 5 on the Calculus BC advanced placement examination, thereby earning AP credit for 1300–1301, may choose to enroll in the 2500–2501 sequence. The combination of 2500–2501 is a blend of multivariable calculus and linear algebra, with an emphasis on rigorous proofs.

Duplicate Credit Policies

Deduction of credit caused by duplication proceeds as follows. Students who earned math credit

1. through Advanced Placement/International Baccalaureate in one sequence and complete a course at Vanderbilt from another sequence that duplicates this credit will lose credit from the Advanced Placement/International Baccalaureate earnings.
2. by transfer in one sequence and complete a course at Vanderbilt from another sequence that duplicates this credit will lose credit from the Vanderbilt course.
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Course descriptions begin on page 182.
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