Dear Jonathan;  

Please find enclosed a revised version of our proposal for Faculty Council. As discussed in our meeting on Monday, the following changes have been implemented:

1. Single-variable calculus counts for Program III (rather than being a pre-requisite).

2. (a) We have slightly changed the wording in item 3 of the requirement for Program III.
   (b) We have added item 4 in Program III. A brief rationale is included in the proposal.

3. We have changed the wording "from 200, or 210 and above" to "from 200, 210, or above 210" throughout the whole proposal (to address concerns expressed by some members of Faculty Council).

4. We added a brief text to clarify the role of Math 205a-205b (Multivariable Calculus and Linear Algebra) in order to address concerns expressed by some members of Faculty Council; see the last paragraph before the overlap chart.

5. We believe that the credit overlap chart included in the proposal provides helpful information for students and advisors to navigate our single-variable sequences. (Inclusion was in fact suggested by the CEP committee).
   At the recommendation of CEP we also included the credit loss table, but we note that the table could be omitted, as it contains some redundant information.

Please forward this email to the members of Faculty Council if you deem appropriate. Many thanks for taking the time to meet with us on Monday.

Best,
Gieri Simonett
--

Gieri Simonett
Professor of Mathematics
Director of Undergraduate Studies
Vanderbilt University phone: (615) 322-6658 or 322-6672
TO: Gregg Horowitz, Chair Faculty Council  
FROM: Dietmar Bisch, chair  
Gieri Simonett, DUS  
Re: Changes to Math Major  

April 28, 2010

The Department of Mathematics proposes three changes to its major program. These are:

(A) introduction of a new track (called Honors Track). Changes in the requirements for the Departmental Honors Program,

(B) modification of the linear algebra requirement for Program II,

(C) inclusion of course overlap information for calculus sequences in the catalog.

(A) Introduction of a new track.  
Changes in the requirements for the Departmental Honors Program

Currently, two tracks are available in mathematics.

Program I (Standard Track) is intended for most mathematics majors in the College of Arts and Science, the Blair School of Music, and Peabody College. Program I requires a minimum of 32 hours in the department.

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 II requires a minimum of 29 hours in the department in addition to 6 hours outside the department.

The Department of Mathematics proposes to introduce the following additional NEW TRACK:

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

The rationale for introducing a new track lies in the fact that we are seeing more and more highly talented and motivated students in our major program. The new track provides an incentive for superior students to go beyond the requirements of Programs I or II and enroll in a well-balanced selection of higher-level, proof-based core classes in mathematics. It also serves as a co-requisite for our Departmental Honors Program, which, in addition, requires the completion and successful defense of a senior thesis.
The following chart gives a brief outline of the requirements for the different tracks:

<table>
<thead>
<tr>
<th>Standard Track</th>
<th>Applied Track</th>
<th>Honors Track</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Calculus sequence</td>
<td>• Calculus sequence</td>
<td>• Calculus sequence</td>
</tr>
<tr>
<td>• Linear algebra and differential equations</td>
<td>• Linear algebra and differential equations</td>
<td>• Linear algebra and differential equations</td>
</tr>
<tr>
<td>• 5 classes above 200</td>
<td>• 4 classes above 200</td>
<td>• 7 classes above 200 with specific requirements</td>
</tr>
<tr>
<td></td>
<td>• 2 mathematically advanced classes outside the department</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• the Honors Track is a co-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>requisite for the Honors Program</td>
</tr>
</tbody>
</table>

The specific requirements for Program III (Honors Track) are:

At least 38 hours in mathematics, 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 hours of advanced coursework,
   a) including 4 courses taken from the following 3 categories, at least one from each
category:
   1) Algebra: 223, 283a, 283b.
   b) The remainder of the 21 hours must be chosen from 200, 210, or above 210, excluding 269.
4. The remainder of the hours must be chosen from 200, 210, or above 210.

Students who complete Program III and, in addition, complete a senior thesis will graduate with departmental honors.

Rationale for item 4.
Students taking all their math classes at Vanderbilt have satisfied the requirements of Program III with items 1-3. Students with transfer credit (from study abroad programs, for instance) may have satisfied the requirements in items 1-3 with fewer than 38 hours. The provision stated in item 4 then stipulates in what way the reminding hours have to be made up.

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. A minimum grade point average of 3.6 in mathematics.
3. Completion of a senior thesis in the second semester of the senior year. With approval of the director of undergraduate studies, the thesis may be based on research work initiated or completed at another academic institution, such as during a NSF sponsored REU program.
4. Oral examination on the senior thesis. A committee of at least 3 faculty members – at least two from the department of mathematics, one being the thesis advisor - 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 carry a minimum grade point average of 3.6 in mathematics.

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 advisor.

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 269 during one semester of their senior year. Math 269 will not count toward the 21 hours requirement in Program III.

Students who declared their mathematics major prior to Fall 2010 may complete the Honors Program under the old regulations. Please consult the director of undergraduate studies for details.

(B) Modification of the linear algebra requirement for Program II.

The following text reflects the current requirements and the proposed change (in red ink) for Program II.

Program II

At least 29 hours in mathematics and 6 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 194, 204, or 205a–205b, and one of 198 or 208; or
   (b) (Not recommended) 196 and one of 204, 205a–205b, 226, 253, or 288.
3. At least 12 hours not used to satisfy item 2 from 200, or 210 and above, from 200, 210, or above 210, excluding 252.
4. The remainder of the hours in mathematics must be chosen from 200, or 210 and above, 200, 210, or above 210.
5. At least 6 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.

Rationale:

Students who take Math 196 have satisfied the differential equations requirement for the math major. In order to satisfy the linear algebra requirement, currently a student has several options, namely: 204, 205a–205b, 226, 253, or 288.

Instructors teaching higher level math classes (including 226, 253, 288) have expressed their concern that those students not taking linear algebra before enrolling in other 200 level classes are at a severe disadvantage.

We therefore propose that only 204, or the combination 205a–205b, can be used to satisfy the linear algebra requirement (while 196 counts for the differential equations requirement).

(C) Inclusion of course overlap information for calculus sequences in the catalog.

Due to the change in the content of the calculus courses, the overlap of credit and credit loss has been revised. Adding this information to the program description in the catalog will add clarification for both students and advisors.
THE Department of Mathematics offers an undergraduate major with several types of emphasis. Students planning to continue in graduate study may choose an emphasis in pure mathematics. Students with other interests emphasize applied mathematics, statistics, or preparation for teaching. A solid background in mathematics provides an excellent foundation for several professions—many students go on to professional studies in law, medicine, or business.

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.

Program of Concentration in Mathematics

Two Three programs of concentration tracks are available.

Program I (Standard Track) is intended for most mathematics majors in the College of Arts and Science, the 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 plan 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 hours in mathematics, as follows.
1. A calculus sequence: 150a–150b–170–175, or 155a–155b–175, or 155a–155b–205a–205b.
2. Linear algebra and differential equations: 204 or 205a–205b, and 208.
3. At least 15 additional hours from 200, or 210 and above 200, 210, or above 210.
4. The remainder of the hours must be chosen from 200, or 210 and above, 200, 210, or above 210.

Program II (Applied Track).
At least 29 hours in mathematics and 6 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 194, 204, or 205a–205b, and one of 198 or 208; or (b) Not recommended) 196 and one of 204, 205a–205b, 226, 253, or 288. 196 and either 204 or 205a-205b.
3. At least 12 additional hours not used to satisfy item 2 from 200, or 210 and above, from 200, 210, or above 210, excluding 252.
4. The remainder of the hours in mathematics must be chosen from 200, or 210 and above, 200, 210, or above 210.
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Program III (Honors Track).
At least 38 hours in mathematics, 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 hours of advanced coursework,
   (a) including 4 courses taken from the following 3 categories, at least one from each category:
   (1) Algebra: 223, 283a, 283b.
   (2) Analysis: 260, 261, 330a, 330b.
   (3) Topology and Geometry: 242, 243, 270, 272a, 272b.
   (b) The remainder of the 21 hours must be chosen from 200, 210, or above 210, excluding 269.
4. The remainder of the hours must be chosen from 200, 210, or above 210.

Students who complete Program III and, in addition, complete a senior thesis will graduate with departmental honors.

CS 255 (co-listed as Math 226) and CS 257 (co-listed as Math 288) will count toward all major tracks and the minor in the same way as the co-listed Math classes.

To help students plan their programs, the department offers the following suggestions for those who plan to teach, work in the computer field, or go to graduate school.

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.

The programs of students planning to work in the computer field should include 226 with 198, 218, (or 247–248), 274, and 286 strongly recommended; computer courses should be selected in consultation with the student’s adviser (the student is reminded that credit in these courses does not count toward a mathematics major). Preparation for graduate work in mathematics should include at least 12 hours from 260, 272a–272b, 280, 283a–283b, 330a.

Honors Program
The Department of Mathematics offers honors work for qualified majors. To enroll in the Honors Program, a student should normally apply at the time of declaration of the major. Honors students include independent study in their schedules, and they are required to submit a senior thesis. The department may be consulted for further details.

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. A minimum grade point average of 3.6 in mathematics.
3. Completion of a senior thesis 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 a NSF sponsored REU program.
4. Oral examination on the senior thesis. A committee of at least 3 faculty members -- at least two from the department of mathematics, one being the thesis advisor -- 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 carry a minimum grade point average of 3.6 in mathematics.

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Students may sign up for Math 269 during one semester of their senior year. Math 269 will not count toward the 21 hours requirement in Program III.

Students who declared their mathematics major prior to Fall 2010 may complete the Honors Program under the old regulations. Please consult the director of undergraduate studies for details.

Minor in Mathematics
The minor in mathematics requires at least 15 hours in mathematics, including:
1. Completion of a calculus sequence: 175 or 205a–205b.
2. Linear algebra and differential equations: as in the Program II major.
3. At least 6 hours not used to satisfy item 2 from 200, 210, or above 200, 210, or above 210.

Completion of a single-variable sequence (150a-150b-170, or 155a-155b) is a prerequisite for the minor, but does not count toward the 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.

Several calculus sequences are available: 140; 150a–150b–170a–170b; 155a–155b–175; 205a–205b. They differ in content and credit hours, and students should not switch from one to another without approval of the department. Such switching may result in withdrawal of credit.

Several calculus sequences are available: 140; 150a–150b-170-175; 155a–155b–175. 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 155a-155b-175 sequence. The chart below shows how these sequences relate to each other.

First-year students with test scores of 5 on the Calculus BC advanced placement examination, thereby earning AP credit for 155a-155b, may choose to enroll in the 205a-205b sequence. The combination of 205a-205b is a blend of multivariable calculus and linear algebra, with an emphasis on rigorous proofs.
For example, students who earned credit for 150a (3 cr.) and also complete 155a (4 cr.) will lose 2 hours of duplicate credit (see Duplicate Credit Policies to understand which credits would be affected).

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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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Below is a chart that outlines the credit loss based on the courses taken:

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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>140</td>
<td>4</td>
<td>150a</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
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<td>150b</td>
<td>3</td>
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<td>155a</td>
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<tr>
<td>6</td>
<td>150b</td>
<td>3</td>
<td>140</td>
<td>4</td>
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<tr>
<td>7</td>
<td>150b</td>
<td>3</td>
<td>155a</td>
<td>4</td>
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<tr>
<td>8</td>
<td>150b</td>
<td>3</td>
<td>155b</td>
<td>4</td>
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<tr>
<td>9</td>
<td>155a</td>
<td>4</td>
<td>140</td>
<td>4</td>
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<tr>
<td>10</td>
<td>155a</td>
<td>4</td>
<td>150a</td>
<td>3</td>
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<tr>
<td>11</td>
<td>155a</td>
<td>4</td>
<td>150b</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>155b</td>
<td>4</td>
<td>150b</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>155b</td>
<td>4</td>
<td>170 or old 170a</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>170 or old 170a</td>
<td>3</td>
<td>155b</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>old 170a</td>
<td>3</td>
<td>170</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>old 170b</td>
<td>3</td>
<td>175 (before F08)</td>
<td>3</td>
</tr>
<tr>
<td>17</td>
<td>old 170b</td>
<td>3</td>
<td>175 (F08 or later)</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>175</td>
<td>3</td>
<td>old 170b</td>
<td>3</td>
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<thead>
<tr>
<th>140</th>
<th>150a</th>
<th>150b</th>
<th>170</th>
<th>175</th>
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<tr>
<td>1 cr</td>
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<tr>
<td>155a</td>
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</tr>
<tr>
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<td>150a</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
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<td>4</td>
<td>150b</td>
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<tr>
<td>12</td>
<td>155b</td>
<td>4</td>
<td>150b</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>155b</td>
<td>4</td>
<td>170 or old 170a</td>
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<tr>
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<td>170 or old 170a</td>
<td>3</td>
<td>155b</td>
<td>4</td>
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<tr>
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<td>175 (F08 or later)</td>
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<td>old 170b</td>
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Counts as repeat credit

Counts as repeat credit

ALL 3