New Math Courses
April 4, 2014

Math 1014 – Precalculus with transcendental functions (3 credits.)
Math 1025-1026 – Elementary calculus (1025: 3 cr.; 1026: 3 cr.)
Math 2024 – Intermediate calculus (3 cr.)

Math 1225-1226 – Calculus of a single variable (1225: 4 cr.; 1226: 4 cr.)
Math 2114 – Introduction to linear algebra (3 cr.)
Math 2204 – Introduction to multivariable calculus (3 cr.)

I. Sequence for life sciences, etc.

Old sequence	New sequence
1015	1014
1016	1025
2015	1026
2016	2024

Each course in the new sequence is mathematically essentially equivalent to the course on the same row in the old sequence. We recommend that, for all purposes, an old and a new course on the same row play exactly the same role. These purposes include degree requirements, prerequisites, Math 1225 Readiness (was Math 1205 Readiness), and substitutions. A student who passes either course in one row can progress to either course in the next row. For that reason the new courses will replace the old courses quickly. Math 1026 will replace Math 2015 in spring 2015. The other three replacements will occur in fall 2014.

Advice for students. If you have credit for a course in either column of a row in the above table, you may proceed to a course in either column of the next row.

Advice for advisors and curriculum committees. We recommend that wherever a course in the old sequence was a prerequisite or degree requirement, the course on the same row in the new sequence should play the same role. It may be a good idea to use (old number OR new number) statements until all the students who earned credits in the old sequence have left the university. The university may be able to automate changes in prerequisites and degree requirements.

For students entering in summer 2014 or after, we will evaluate AP, IB, etc. credit in the new sequence, we will evaluate transfer credit in the new sequence where possible, and we will consider transfer credit in the old sequence where that is advantageous. The essential equivalence between the old and new sequences will govern what credit is awarded. For information about credit to be awarded for other new courses, see the discussion of the engineering, etc. sequence below.

Warning. A student who needs a **year of calculus** on a transcript must take Math 1025-1026. In the past the sequence Math 1015-1016 was called calculus, but 1015 covered precalculus only, so the sequence included only one semester of calculus. The names in the new sequence align correctly with the content.

We have requested **CLE Area 5** status for Math 1014, 1025, and 1026. Math 2016 had CLE Area 5 status solely because it was in a sequence with Math 2015, for which CLE Area 5 status was appropriate. Math 2024 will not have CLE Area 5 status, but the path that brings a student to Math 2024 will meet CLE Area 5 requirements.

The new courses will include more life sciences applications than the old courses.

II. Sequence for engineering, etc.

Math 1225 (4 credits), 1226 (4 credits), and 2204 (3 credits) will cover the calculus material covered in the 11 credits of Math 1205, 1206, 1224, and 2224.

Prerequisite dependence in lower division classes for engineers, etc.

Math 1225. A student must be Math 1225 Ready. The criterion is the same as the old Math 1205 Ready.

Math 1226. The prerequisite is Math 1225.

Math 2114. The prerequisite is Math 1226 or a B or higher in VT Math 1225.

Math 2204. The prerequisite is Math 1226.

Math 2214. The prerequisite is Math 1226 and (Math 1114 or Math 2114).

Advice for students

If you have credit for Math 1205 before fall 2014, you should continue in the old sequence, Math 1205, 1114, 1206, 1224, 2224, and 2214. Courses in this sequence will continue to be offered during the semesters in which students making good progress will require them.   A student who progresses slowly should take Math 2224 before taking Math 2214 because Math 2224 will phase out eventually, but Math 2214 will continue indefinitely.

If you have credit for Math 1114 before fall 2014, you should not need to take Math 2114. As long as you make timely progress, Math 1114 will satisfy the lower division linear algebra prerequisite for every course you take. As a precaution against getting caught in a transition, if you plan to take Math 3144, you should take Math 3144 as soon as possible after completing Math 3034.

If you enter VT with math credit (transfer, AP, IB, etc.), your choice of math class is often determined by your in-major requirements and by the prerequisite relationships among math courses. There is one situation where the prerequisites leave choices. **If you enter VT with Math 1225-1226 credit** and you want to continue in the sequence for engineers, etc., your first-semester choices are the following. (a) Take Math 1114 or 2114 (depending on your in-major requirements and your interest in taking the more challenging 2114). You will be able to take Math 2204 and/or Math 2214 in any subsequent semester. (b) Take Math 2204. You will be able to take Math 1114 or 2114 next and to take Math 2214 after that. (c) Take Math 1114 and 2204 (if your major accepts Math 1114 as meeting its lower division linear algebra requirement).   You will be able to take Math 2214 in any subsequent semester. The combination of Math 2114 and Math 2204 is also possible, but in order to balance our enrollments across semesters, we ask

students not to take Math 2114 and Math 2204 simultaneously in their first semester if that first semester is a fall semester. Regarding the choice between starting in 2204 and starting in 2114: the advantage of starting in 2204 is that 2204 is likely to feel like a gentler introduction to university math; while the advantage of starting in 2114 is that doing so creates the possibility of finishing the 2000-level courses more quickly by taking both 2204 and 2214 in the following semester.

For a student who must switch from the old calculus (1205, 1206, 1224, 2224) **to the new calculus** (1225, 1226, 2204):

If you have credit for Math 1205 only, you must start in Math 1225.

If you have credit for Math 1205 and 1206 only, you must take Math 1226 next.

If you have credit for Math 1205, 1206, and 1224, you must take Math 1226 next.

If you have credit for Math 1205, 1206, 1224, and 2224, you have completed the equivalent of Math 1225, 1226, and 2204.

Try to avoid switching from the old calculus to the new calculus. The new calculus is for students who do not have credit for Math 1205.

Advice for advisors

For students entering in summer 2014 or after, we will evaluate AP, IB, etc. credit in the new sequence, we will evaluate transfer credit in the new sequence where possible, and we will consider transfer credit in the old sequence where that is advantageous.

Where we used to award AP, IB, etc. credit for Math 1205, we will award AP, IB, etc. credit for Math 1225. Where we used to award AP, IB, etc. credit for Math 1205-1206, we will award AP, IB, etc. credit for Math 1225-1226.

If you have a degree requirement for which you accept Math 1205 as a substitution you should accept Math 1225 as a substitution.

If you have a degree requirement for which you accept Math 1206 as a substitution you should accept Math 1226 as a substitution.

If you have a degree requirement for which you accept Math 1224 as a substitution you should accept Math 2204 as a substitution.

If you have a degree requirement for which you accept Math 2224 as a substitution you should accept Math 2204 as a substitution.

Math 1225-1226 will satisfy **CLE Area 5** requirements.

Advice for curriculum committees

Until students from the old sequence have graduated, you may wish to include OR statements in prerequisites and degree requirements. For example, if Math 1205 is a prerequisite now, that prerequisite should change to (Math 1205 or Math 1225), and years from now it should become

Math 1225. The university may be able to automate changes in prerequisites and degree requirements.

If Math 1205 is currently a prerequisite or degree requirement, in the new sequence that prerequisite or degree requirement should be Math 1225.

If Math 1206 is currently a prerequisite or degree requirement, in the new sequence that prerequisite or degree requirement should be Math 1226.

In most cases where Math 1224 is currently a prerequisite or degree requirement, in the new sequence that prerequisite or degree requirement should be Math 2204. In a few cases, the topics required may all be in Math 1226.

If Math 2224 is currently a prerequisite or degree requirement, in the new sequence that prerequisite or degree requirement should be Math 2204.

Math 1114 will continue to be offered as long as there is demand. If Math 1114 is sufficient for your purposes, there is no compelling reason to replace Math 1114 by Math 2114 in your prerequisites or degree requirements.

Explanation

Math 1225 includes all of Math 1205 and some material from Math 1206.

The sequence Math 1225-1226 covers all the material from the old sequence Math 1205-1206.

Topics from the old Math 1224 and 2224 are distributed into Math 1226 and Math 2204. A student will not have seen all of Math 1224 or Math 2224 until that student has taken both Math 1226 and Math 2204.

Math 2114 will include all the topics covered by Math 1114 but will do so in a more conceptually sophisticated context. Math 2114 will also include some topics not covered in Math 1114. Mathematics B.S. requirements will change from Math 1114 to Math 2114 for students entering in the future. After current students making good progress have left the university, many upper division math classes taught primarily for math majors will have Math 2114 as an explicit or implicit prerequisite. Math 2214, Math 4564, and Math 4574 will not require Math 2114; either Math 1114 or Math 2114 will suffice for those courses.

Math 1225 and Math 1226 mesh well with the AP distinction between the AB and BC curricula.

In many cases the new courses will match up better with the courses students transfer from other post-secondary institutions. Transfer credits require a course-by-course analysis, which has already begun.

III. Switching from the life sciences, etc. sequence to the engineering, etc. sequence

Advice for students. Regardless of the credits you have in the life sciences, etc. sequence, if you wish to switch to the engineering, etc. sequence, you must start the engineering sequence in Math 1225.

Advice for advisors and curriculum committees. None of Math 1014, 1025, 1026, and 2024 should substitute for any course in the engineering calculus sequence, just as was the case for Math 1015, 1016, 2015, and 2016.

IV. Switching from the engineering, etc. sequence to the life sciences, etc. sequence

Advice for students

If you have credit for Math 1225 or 1205 (but not 1206 or 1226) and you wish to switch to the life sciences, etc. sequence, you may take Math 1026 or Math 2015.

If you have credit for Math 1225-1226 or Math 1205-1206 (but not 2204 or 2224) and you wish to switch to the life sciences, etc. sequence, you may take Math 2024.

Substitution for Math 2024 is at the discretion of the department requiring Math 2024.

Remark. The passage from Math 1225 to Math 1026 will require a rewording of the 1026 partial duplication statement. The Math Department plans to get approval of that rewording before the partial duplication statement affects any student.

Advice for advisors and curriculum committees

Math 1225 may substitute for Math 1025, just as Math 1205 substituted for Math 1016.

Math 1226 may substitute for Math 1026, just as Math 1206 substituted for Math 2015.

Substitution for Math 2024 is at the discretion of the department requiring Math 2024.

Explanation

Math 1025 and Math 1225 are mostly differential calculus. Math 1225 is more conceptually and technically sophisticated.

Math 1026 and Math 1226 are mostly integral calculus. Math 1226 is more conceptually and technically sophisticated.

Math 2024 combines multivariable calculus, sequences and series, and differential equations, all treated in less depth than in Math 2204, 1226, and 2214, respectively.