

## Appendix R: REGRESSION, DUPLICATION and SECOND GRADE OPTION

The Department of Mathematics offers many introductory level courses; this raises questions of duplication. At the same time, many of our courses build on the introductory courses or others, so there are situations of regression. Finally, because students' interests may change, we need to be clear about when one course can be used as second-grade-only(SGO) for another course.

We hope you find this statement of current Mathematics Department policies clear and convenient. We very much welcome any comments or suggestions you may have on these (or other) matters, so that we can better serve the many students taking Math courses.

### GUIDING PRINCIPLES

We include some examples here; but these are just to illustrate the policies; the complete lists are given in the subsequent sections.

**1. We offer many service courses, and also have parallel tracks for majors; so course number is not a safe guide for which course is more advanced than which other.** This is why the Regression list looks complicated.

For example, 22M:28 is much more advanced than 22M:31 or 22M:35. On the other hand, 22M:10 is independent of nearly all other undergraduate courses, so there is no Regression in taking 22M:10 after taking 22M:100.

**2. There are groups of similar courses; within a group, usually, any two courses = *duplication*, and any course can be used as *SGO* for any other.** The courses really are different in subject emphasis and sometimes even a bit different in level, so students should be advised carefully in selecting courses. These approximate groupings are a compromise, to give students and advisors reasonable flexibility.

For example, any of the "short calculus" courses 22M:11, 16, 17 *duplicates* any other, and can be used to *SGO* any other.

**Note: Other departments may distinguish between these courses; for example, we do NOT encourage a biological science department to accept 22M:11 in lieu of 22M:16, nor a business program to accept 22M:11 or 16 in lieu of 22M:17.**

**3. The group-numbers DO represent increasing level.**

For example, taking any course in Group 2 after passing a course in Group 3 constitutes *regression*.

**4. Some courses have substantial overlap but are different enough to justify having students take both, with a reduction in total credits.**

The five cases of this are:  
22M:32 + 26 = 6 s.h. total,

$22M:32 + \{28 \text{ or } 56\} = 6 \text{ s.h. total,}$   
 $22M:32 + 26 + \{28 \text{ or } 56\} = 10 \text{ s.h. total,}$   
 $22M:\{33 \text{ or } 40\} + 27 = 4 \text{ s.h. total, and}$   
 $22M:\{37 \text{ or } 42\} + \{28 \text{ or } 56\} = 5 \text{ s.h. total.}$

Department of Mathematics POLICY ON *DUPLICATION AND SECOND GRADE*  
*OPTION*

To meet the needs of diverse students and other departments, we offer several approaches to Calculus at each of several levels. Each course is designed with a certain emphasis and sequencing of topics. We encourage students and advisors to be careful in selecting appropriate courses. And we encourage departments to maintain the course distinctions.

Students may change majors, and it is desirable to allow alternatives for SGOs. For example, a student moving from Biology to Business would be better served taking 22M:17 than repeating 22M:16. On the other hand, if the student intends to remain a Biological Sciences major, then the student should be required to SGO 22M:16 with 22M:16 (or a Group II course - see below). Similarly, a student cannot use 22M:11 to satisfy the College of Business requirement. *Our Department policy on SGOs is not intended to change any policies of other departments regarding which courses satisfy their requirements.*

**There are several groups of similar courses; within a group, taking any two courses constitutes *duplication*, and any course in a group can be used as *SGO* for any other in that same group.**

<u>Group 1: Math Primarily for Elementary Ed Majors</u>	
22M:004	Theory of Arithmetic (not offered after Spring 2004)
22M:006	Logic of Arithmetic (first offered Fall 2004)
22M:012	Theory of Arithmetic (first offered Fall 2004)
Note: 22M:012 is intended for Math specialists. Check with Elementary Ed Advisor as to whether 006 or 012 is the appropriate course.	

<u>Group 2: Pre-Calculus</u>	
22M:009	Elementary Functions
22M:013	Mathematics for Business
22M:015	Mathematics for the Biological Sciences

<u>Group 3: Short Calculus Courses</u>	
22M:011	Introduction to Calculus with Applications
22M:016	Calculus for the Biological Sciences
22M:017	Calculus and Matrix Algebra for Business

<u>Group 4: First Semester Calculus</u>	
22M:021	Calculus and Modeling I
22M:025	Calculus I
22M:031	Engineering Mathematics I: Single Variable Calculus
22M:035	Engineering Calculus I (no longer offered)
22M:045	Accelerated Calculus with Applications I (no longer offered)

<b>Group 5: Second Semester Calculus</b>	
22M:022	Calculus and Modeling II
22M:026	Calculus II
22M:032	Engineering Mathematics II: Multi-Variable Calculus
22M:036	Engineering Calculus II (no longer offered)
22M:046	Accelerated Calculus with Applications II (no longer offered)

<b>Group 6: Calculus of Several Variables</b> (special rules apply to this group – see following pages)	
22M:028	Calculus III
22M:037	Engineering Mathematics V: Vector Calculus
22M:042	Vector Calculus for Engineers (no longer offered)
22M:048	Vector Calculus for Scientists
22M:056	Fundamental Properties of Spaces and Function II

<b>Group 7: Differential Equations</b>	
22M:34	Engineering Mathematics IV: Differential Equations
22M:41	Differential Equations for Engineers (no longer offered)
22M:47	Linear Algebra and Differential Equations for Scientists

## DUPLICATIONS AMONG MATHEMATICS COURSES

The list below, derived from discussions between the Department of Mathematics and the Office of the Registrar, concerns duplication among mathematics courses.

### Department of Mathematics POLICY ON *REGRESSION*

In the courses 22M:001 - 22M:99, the general assumption is that {higher number course} → {lower number course} constitutes *regression*. The exceptions to this principle (i.e. it is OK to take the lower number course after the higher number course) are as follows:

<b>It is OK to take</b>	<b>even after</b>	<b>because</b>
22M:14 anything	anything 22M:14	Freshman Seminars are independent of other courses
22M:10  any of 22M: 4-9	anything except 22M:15  22M:10	the course 22M:10 is independent of the elementary functions, calculus, and algebra courses.
22M:4, 6, 12, or 22M:81  anything	anything  22M:4 or 22M:81	the material is specialized and independent of other courses. Can get credit for only one of 22M:4, 22M:6, or 22M:12.
[There used to be an item saying one can take 22M:1 or 22M:2	after taking 22M:3.	But since they all are remedial, and have no graduation credit, the issue of regression is moot.

22M:5	22M:6, 10, 11, 12, 13, 15, 16, 17	even though Trig. is supposed to be a high-school course, we and AAC want to enable students to prepare well for a full year Calculus sequence if their major or career goals evolve to make that appropriate.
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<b>It is OK to take</b>	<b>even after</b>	<b>because</b>
22M:11	22M:12, 13, 22M:15	22M:12 is specialized material; 22M:13 and 22M:15 are versions of pre-calculus, and 22M:11 is a version of calculus.
Any second-semester calculus course (i.e. 22M:22, 26, 36, 46)	any first semester calculus course (i.e. 22M:21, 25, 31, 35, 45)	while we do not generally encourage changing a student's "flavor" of calculus from one semester to the next, certainly there is no "regression" in going from Calc I to Calc II.
22M:26	22M:32	The student receives only 6 s.h. totals. However, $22M:32 + 22M:26 + \{22M:28 \text{ or } 56\} = 10$ total s.h. since $26 + \{28 \text{ or } 56\}$ covers all of 22M:32.
<p>22M:27, 22M:40, or 22M:33</p> <p><u>Note:</u> Taking 22M:27</p> <p>And 22M:27→22M:40 or 22M:33</p> <p>The rule is:  <math>27 + \{33 \text{ or } 40\}</math> in either order  <math>\Rightarrow</math> total 4 s.h.</p>	<p>Any other course 22M:28-48, 22M:70, 72, 81, except 47</p> <p>22M:40 or 22M:33</p> <p>IS <i>regression</i></p> <p>which allows the <math>40 \text{ or } 33 \rightarrow 27</math> for 2 additional s.h. and also accomplishes the regression rule that <math>27 \rightarrow 33 \text{ or } 40 \Rightarrow</math> no additional s.h.</p>	<p>The algebra courses are largely independent of the calculus courses.</p> <p>Is ok because there is much more material in 22M:27 than in 22M:33 or 22M:40.</p> <p>However, the student receives only 4 s.h. total credit, because the material of 22M:33 and 22M:40 is repeated in 22M:27.</p> <p>despite the higher number.</p> <p>Note that 22M:33 and 22M:40 are the same course.</p>

<b>It is OK to take</b>	<b>even after</b>	<b>because</b>
22M:28 or 22M:32	22M:31, 33, 35, 36, 41, 45, 46, 47	There is no "regression" in going from Calc I or Calc II to multivariable calculus; also 22M:41 does not assume multivariable calculus as 22M:100 does.
22M:28 or 22M:56	22M:32, 42	22M:28 and 22M:56 are 4 s.h.; there is more material, at greater depth, than in 22M:32 or 42. However, the student receives only 5 s.h. (resp. 6) total credit if 22M:42 (resp. 22M:32) is taken, because most of the material of 22M:42 is included in 22M:28 and in 22M:56.
And 22M:28 →22M:42 or 22M:32, 22M:37, or 22M:48	IS <i>regression</i>	despite the higher number.
22M:34, 41	22M:37, 42, 45, 46	There is no "regression" in going from Calc I or Calc II to differential equations; also vector calc (22M:42) does not assume diff. eq (22M:41).