

# Math 111 Overview and Guidelines

Dear instructor,

Thank you for accepting the offer to teach Math 111 this term. This overview and guideline packet gives more information about the course than the department syllabus alone provides.

## **Mission**

Students *can* learn this material. However, Math 111 is one of the most failed courses at the University. It is within our power to change that trend for the better, without compromising the value of the course and our integrity as instructors. Students deserve every opportunity to show us that they are insightful, dedicated, and competent.

If there was one sentence to describe the student goals from course, it is the following: *A successful college algebra student can demonstrate proficiency in a small set of essential algebraic skills and be able to take a statement in words, translate it into mathematics, and apply these essential skills to achieve the desired result.*

## **Pre-requisites**

The pre-requisite for Math 111 is Math 095. Math 095 is an Intermediate Algebra course that parallels the 8<sup>th</sup>-9<sup>th</sup> grade “Algebra I” course taught in many middle and high schools. This course covers the properties of basic algebra, introduction to functions, polynomials, factoring, solving linear and quadratic equations, inequalities, radicals, and rational expressions. While this pre-requisite may seem to be easy to meet and extremely low for a course satisfying the Bachelor of Science requirements, many students lack even a basic knowledge of this level of algebra.

Unfortunately, Math 095 is not a pre-requisite that is enforced at the UO. That said, students need to understand that algebraic thinking and mathematical reasoning will be covered in the course and the more solid their basic skills are, the more they will be able to build on that foundation.

To gauge the preparation level of the students, a readiness quiz is given in the first week of the course. This is a 15-question quiz given on WebWork with a 30-minute time limit. Review sheets are available and are recommended to be posted to Blackboard (or another course website) as well as handed out on the first day. The readiness quiz should count as the first quiz of the term to encourage students to take it seriously. Encourage your students to complete the ‘WebWork Practice’ homework set before attempting the readiness quiz. They are less likely to do poorly solely due to unfamiliarity with the system if they have a little practice with it first. Students will know their score on this quiz immediately after they complete it, giving low-scoring students the weekend to decide whether or not they want to drop. The last day to drop without receiving a W (Withdrawal) on a student’s transcript is usually the Monday of Week 2.

## **Purpose of the Course**

The class is designed with precalculus as its focus. There is no course named “Precalculus” at the UO, but Math 111 and 112 together provide that background. Math 111 is a prerequisite for Math 241 (Business Calculus), Math 112 (Trigonometry), and Math 425 (Statistics for Non-Majors). Some students will complain that the course material does not have any bearing on their major. Avoiding the obvious objection that they are probably wrong in this assertion, courses that require thought can always be beneficial. Many people do calisthenics without the expectation that one day a push-up will have an important practical application in the real world. Mental exercises like those presented in Math 111 are just as good at conditioning the brain as calisthenics are at conditioning muscles.

A note about students who have taken higher math courses: If someone already has credit for Math 112, 241-242, 251-253, 246-247, 261-263, or 231 they are *ineligible* for credit in Math 111. If a student takes Math 111 when they already have credit for one of those courses, the credit for 111 will be subsequently removed.

## **Typical Students**

This course is taken by approximately three different kinds of students.

First: the math major. This will likely be the easiest category of student to deal with, since their goals are similar to your goals in the course (complete understanding, mathematical rigor, applications to calculus, etc.). This student is not likely to balk at having to simplify the difference quotient, and when you explain its use in calculus, s/he will appear honestly interested. Unfortunately, many math majors begin their college careers in calculus or above, so you will see relatively few in 111 courses (but you can still try to convert talented students!).

Second: the science/business major. This student will likely be focused on the specific aspects of the course that pertain to his/her major, and may be resistant to learning outside of that context. You should be obliging in the sense that you can adjust your application problems to be pertinent for this student, but stress that s/he needs to exhibit competency in the course overall, not just the area s/he is interested in.

Last: the student taking the course simply as part of satisfying the Bachelor of Science math requirement (proficiency in one year of college level mathematics). If a student has a weak record in mathematics and does poorly on the Math 111 Readiness Quiz (given during the first week of class), but has already taken Math 095, you should encourage him/her to take the University Math courses, Math 105-106-107.

## **Materials Required for Students**

Student requirements for the course are:

- Textbook We are currently using a custom edition of *Precalculus: A Prelude to Calculus*, by *Sheldon Axler*. Students can use the regular version of the text (if bought online or at a store other than the UO bookstore), but caution them that the section and page numbers will not match up with the custom version that the UO uses.
- WebWork. WebWork is a browser-based system for homework dissemination and grading. It is free to the students and no access code is necessary. You will need to set up a course in WebWork and upload your class roster. Your course will be created as a copy of a base course in which homework assignments have already been created. You are free to add to and delete from these homework sets, but they serve as a baseline and especially if you are teaching for the first time, do not make any radical adjustments to the homework sets.
- Scientific calculator; graphing calculator. It is your choice to what degree a calculator is used in the course. It is reasonable to decide to disallow the use of a calculator on quizzes/exams. If you do so, you will need to be especially careful when designing problems for tests. Poorly planned questions can bog students down in computation and fail to address the algebraic reasoning on which you would really like to test them.
- Internet access for Blackboard and email. Stress that the email address on file with UO is the primary means of the University, including you, their instructor, contacting the student. They should check their email regularly (as should you!).
- Pencils and paper. They should be taking daily notes in class, and while using a pen might be more fashionable, it can make for messy notes. Errors are not easy to correct in pen and it tends to bleed through pages.

## **Time Commitment for Students**

Students are expected to spend at least 2 hours outside of class for each hour in class. For a 4-credit course, this amounts to about 4 hours in class each week, and at least 8 hours outside of class spent doing homework, reviewing notes, studying, reading the textbook, etc. Students should be made aware of this expectation in the syllabus, as a 4-credit course will require a minimum commitment of 12 hours per week. Over the course of a term, this is a time commitment of at least 130 hours (assuming a standard 10-week course with an additional week for finals). With a minimum of 12 hours per week per 4 credit course, a load of 16 credits would be 48 hours per week in time investment. Students need to understand your expectations for their time as they often have a job, family commitments, social life, and other courses to deal with.

## **Blackboard Academic Suite**

Use Blackboard unless you use your own website and a secure means of making grades available. One of these strategies should be employed by all instructors as a way to communicate with students, post grades, post syllabus and supplementary information, and send announcements. I also recommend adding a link to your WebWork course in the main menu of the Blackboard intro screen.

Blackboard is where grades are set-up and students can see their scores. Using Blackboard can help avoid emails asking whether or not an assignment has been graded, and what current standing a student has in the class. It is also a moderately effective instructor gradebook during the term.

You should be careful to regularly download grades from Blackboard to a spreadsheet of some sort. You don't want to have student grades unavailable to you just because Blackboard is down for maintenance or online data becomes lost.

## **Structure of the Class**

While lecture is the safest style to make sure you are able to cover all of the course curriculum in the available time and with the degree of depth necessary, there are other strategies you can employ in order to keep students engaged and processing. Some combination of individual problems, small group work, and discussion should take place during the term. Make sure your students have the opportunity to ask clarifying questions during lecture. If one student asks a reasonable question, it's very likely there are others who silently bear the same concern.

## **Major Concepts of the Courses**

Ideologically, Math 111 is a precalculus course. Functionally, Math 111 a course about functions (excuse the pun). Chapter 1 introduces the idea of functions, of which many students already have a rudimentary understanding. This chapter deals with basic definitions and notation, function graphs, composition, transformations, and inverses of functions. Chapters 2, 3, and 4 deal with new types of functions. Chapter 2 begins with linear function, then quadratics and then works into polynomials in general, ending with a brief discussion of rational functions. Chapter 3 tackles exponential and logarithmic functions, and is important. The sections of Chapter 4 covered in this course expand logarithmic and exponential functions with the use of  $e$ . Over a third of the course time is reserved for exponential and logarithmic functions, so try to avoid rushing to finish them at the end of the term.

## **Appropriate Level of Difficulty/Rigor**

Keep the difficulty of the material at a "college algebra" level. That may seem obvious, but it is tempting for all of us to want to bring our own mathematical experience into the course. As excited as instructors may be about splitting fields, asking 111 students to prove the Fundamental Theorem of Algebra is not where they need to be. On the other hand, making the course look too much like its prerequisite course does not do any favors for students who need the skills in subsequent courses.

Recall that students who simply want credit in 100-level mathematics can take the 105-106-107 sequence. Students in Math 111 should be expected to use parentheses, equal signs, inequalities, interval notation and function notation appropriately. They ought to (but often don't) have mastery of

fractions and basic arithmetic without the use of a calculator. Make sure you are modeling good behavior for them, so that you can expect the same in return. They should finish the course with a greater understanding of common functions, ways to manipulate those functions, and overall improved algebraic literacy.

### **Exams – Length and Type of Questions**

Weekly (around 5-7 total during the term) 15- to 20-minute quizzes should be administered, preferably shortly after homework has been submitted. Whether you choose to treat these quizzes as diagnostic (not for much course credit) or as mini-exams (for a greater proportion of course credit) is up to you. Keep in mind, however, that a student's engagement in a particular task is largely a function of that task's overall effect on their grade. A quiz that is worth little to nothing toward the class grade may not merit the attention of most students, and thus may not be as effective a diagnostic tool.

Two midterm exams should be given during the term, one during Week 4 (To cover Chapter 1) and another during Week 7 (to cover Chapter 2). Reserve the full class period for these exams. New GTFs will be discussing their exams ahead of time during the fall term Teaching Seminar. Neither returning GTFs nor adjunct instructors are required to submit midterm exams. It is strongly recommended that the exams be graded and returned to students within one week of the exam date. Taking longer than two weeks to return an exam is unacceptable.

The final exam should take place at the scheduled time (according to the final exam calendar on the registrar's website). No final exams can be given outside of finals week, and students should only be given exceptions according to a limited set of conditions (also available on the registrar's website). Your syllabus should mention the final exam date, so if the exam conflicts with a student's non-academic event, you can recommend at the beginning of the term that they take a different course. Each term the Math 111 coordinator may request drafts of final exams well in advance (2-3 weeks) of finals week in order to be checked and returned with comments in time to make changes.

You should be able to write the key to an exam in approximately one fifth the time that you give your students to take the exam. Thus you should be able to complete your own quizzes in about three or four minutes, and your midterms in ten. This should allow most students to finish in a timely fashion. If your exam takes you significantly longer to finish, you will not end up assessing student understanding as well as you will assess which students are able to write quickly.

Put more effort into making sure that the essentials are being addressed at a high level of quality, and less time assessing more complicated, esoteric problems. We want to be able to argue to students who are not succeeding that they are missing fundamental concepts, rather than getting bogged down trying to grasp the details of an atypical question.

Actively monitor the room as you give all exams, especially in cramped classrooms. If cheating takes place, you want to be in as strong a position as possible to defend your awareness of the situation.

## Grading Policies

Your syllabus should clearly state the means by which a student's grade will be calculated and any relevant rules about grading that you plan to adhere to during the term. If you do not accept late homework or quizzes, you should so state. Be as clear as possible. E.g., if homework is to be turned in each Friday, is it due in class? Can it be submitted to your mailbox or office later in the day? Be prepared to make exceptions for extreme circumstances (for example hospitalization or death in the family), but hold to your policy in the event of the frequent "I slept through class" or "I forgot we had a quiz that day" excuses. Consider dropping the lowest homework and/or quiz grade to provide a buffer for those students and make complaints easier to deal with.

My general rule for grading percentages is Homework %  $\leq$  Quiz %  $<$  Midterms %  $\leq$  Final Exam %. I like 15% HW, 25% Quizzes, 30% Midterms, 30% Final.

You cannot allow students to drop an exam score (although in some instances substituting the final exam score for a midterm score is appropriate). You cannot allow students to keep their current grade and then not have to take the final exam.

The syllabus is your initial, informal contract with a student. Include more information there than you think they will need. It is almost impossible to write a syllabus that is too comprehensive.

Incompletes, withdrawals and drops should be handled by the student directly. Deadlines are posted online in the Class Schedule link (by clicking on the CRN). Students who do not complete the paperwork by the appropriate time may approach you with forms to sign as they petition for an exception to be made. Use your judgment, but realize that students need to be held responsible for completing these changes by the deadlines and that the decision is largely up to the committee.

Further, incompletes are a very rare situation and should be used sparingly. The only time an incomplete is allowed is when a student who is currently performing well misses a small, but significant part of the grade. Often this will occur when the student has some issue arise and cannot take the final exam. Make sure that a contract is created for this situation to protect yourself – have it include dates and consequences for not finishing by the dates stated. There is a built in fail-safe for incompletes, in that they revert to an F after one year. The onus is on the *student* to get materials from you and arrange make-up times. A contract should never require that a student retake the course, it is against school policy to ask a student to take the class a second time and only receive credit once. If you are a GTF, you need the assistant head's signature before the contract is complete.

Also, a grade of "Y" is extremely rare. This should be used only when a student is enrolled in your course but does not complete any work. A "Y" grade does not affect a student's GPA, and it stands for "No Basis For Grade." Sometimes students will think they dropped a course, but forget to actually go into Duckweb and drop– this is the grade to assign them.

Ultimately, grade with an eye on the big picture. Is it to the department's and/or student's benefit that they receive a D+ versus a C- and are not able to continue to the next course in the sequence? There are clear situations in which the answer is "yes", more where the answer is "no", and a great deal where the answer is "maybe". Consider the student's numerical grade first, and if there is any question consider their dedication to the course, attitude, and subjective likelihood of success in future courses when making your final determination.

## **Required Course Topics**

A final exam in college algebra should at the very least include all items listed below. Items included in parentheses are optional, but relevant, topics. You are free to focus on areas in the course that you stressed in class or on assignments, but all of the required topics must be covered on the two-hour exam. True/False questions are a good way to deal with topics you did not stress heavily.

Each line represents a topic, so multiple concepts in one line only need to be represented once on the exam. For instance, finding where a function is increasing and decreasing, but not elsewhere asking for the maxima/minima of a function; finding the equation of a perpendicular line, but not elsewhere asking if two lines are parallel.

There does not need to be a single problem for each line item, synergy is a good thing (e.g. one rational function problem could deal with 'find asymptotes of rational functions', 'find domain', and 'solve a quadratic equation' (assuming the divisor is quadratic)).

### Topic list:

Solve absolute value equations/inequalities

(Absolute value as distance on the number line)

(Simplify absolute value expressions)

Use functional notation

Find domain of rational, root, or piecewise-defined functions

(Evaluate or graph piecewise-defined functions)

Simplify complex rational expressions

Evaluate functions given graphs

Find intervals of increase/decrease, maxima/minima of functions given graphs

Apply vertical graph transformations for functions

(Apply horizontal graph transformations for functions)

(Determine even/odd-ness of functions)

Compose two (or three) functions

(Find domain of composite functions)

Find/Verify inverse functions

Find equations of lines

Determine whether two lines are parallel/perpendicular or find equations of parallel/perpendicular lines

Solve quadratic equations with factoring and/or quadratic formula

Find vertices of quadratic functions (using completing the square)

(Solve quadratic function applications)

Determine roots of polynomials by factoring

Relate factors to roots of a polynomial

(Analyze graphs of polynomial functions)

Determine end behavior of polynomial functions

Simplify expressions containing rational exponents and/or radicals

Find vertical and horizontal asymptotes of rational functions

(Find holes, slant asymptotes, analyze graphs of rational functions)

Compute periodic or continuously-compounded interest

Evaluate logarithmic expressions

(Use rules of logarithms to find the number of digits in a number)

Solve logarithmic equations

Set up and solve exponential equation applications