Text: "Modern Precalculus", AY2017-18 edition (College Algebra only), by Mike Price

Course Goals: A student successfully completing the course should, in brief, have a strong foundation in algebra and functions, as well as with mathematical modeling, such that they have a good chance of success in a trigonometry course, or a course in non-trigonometric-based calculus.

Learning Objectives: A successful student should be able to succeed at an exam which focuses on the major objectives, contains a lesser focus on supporting objectives, and may or may not contain content on the additional objectives. Remember that a single task can incorporate multiple learning objectives.

Application Objective − At least one third of the tasks on a given assessment should incorporate non-mathematical contexts in a non-trivial way (i.e. in a manner that requires the student read the description of the context and use it in order to receive full credit for the task).

Major Objectives − Each major objective should be represented roughly evenly and in total comprise more than half of the points on each assessment. These objectives include that a successful student can...

1. ... evaluate functions at numeric or symbolic inputs

2. ... identify the largest possible domain of functions containing division, radicals, or logarithms

3. ... compute the average rate of change in functions on an interval (including an interval of arbitrary constants, e.g. the difference quotient)

4. ... fit linear functions to data

5. ... fit exponential functions to data

6. ... find real solutions to exponential and logarithmic equations

7. ... compute the composition of two functions given formulas, table, or graphs of the functions

8. ... find the inverse of a function (when it exists)

9. ... interpret the result of mathematical processes in a non-mathematical context

10. ... express written descriptions between variables as the graph of or formula for a function

Supporting Objectives − Each supporting objective should be represented roughly evenly and in total comprise less than half of the points on each assessment. These objectives include that a successful student can...

1. ... solve equations resulting from setting a function output equal to a value

2. ... determine the practical domain of functions described in a non-mathematical context

3. ... model equations relating two variables in which proportionality or inverse proportionality are described

4. ... evaluate piecewise-defined functions and solve for input, given an output

5. ... construct elementary piecewise-defined functions

6. ... identify increasing and decreasing behavior in a function

7. ... determine from a formula, words, or a table if the function described is exactly linear or exponential

8. ... fit a quadratic, rational, power, or logarithmic function to data

9. ... find the location or value of the extremum of a quadratic function

10. ... identify long-term ($t \to \infty$) behavior of polynomial or rational functions

11. ... identify long-term ($t \to \infty$) behavior of exponential or logarithmic functions

12. ... identify the relative or continuous growth rates of exponential models

13. ... combine two functions (defined by formula, table, graph, or words) using arithmetic operations on functions

14. ... identify whether or not functions are one-to-one

Prerequisite Objectives $-$ Prerequisite skills to be incorporated into the course learning objectives include the ability to...

1. ... solve linear and quadratic equations

2. ... simplify expressions requiring combination of like terms or rules for exponents

3. ... sketch a graph of a relationship between two variables defined by formula, table, or words

4. ... identify horizontal axis and vertical axis intercepts of a graph

Additional Objectives $-$ *All* additional objectives together should represent $0 - 5\%$ of the points on an each assessment. A student exhibiting success at additional objectives can...

1. ... identify whether or not relationships define functions

2. ... compute and interpret the percentage change in a function over a specified interval

3. ... determine if a set of three or more points is collinear

4. ... use the defining characteristics of quadratic, polynomial, rational, power and logarithmic functions to identify which functions are of which type(s)

5. ... identify extraneous solutions of a logarithmic equation

6. ... use properties of logarithms to simplify expressions

7. ... identify the domain of composite or inverse functions

A Rough Schedule of Content: This should be viewed as a tentative schedule for discussing content. With as many as 40 contact hours total for the course, and less than 30 hours of content outlined in the schedule, there should regularly be time to do homework questions, assessments (e.g. quizzes, exams), review and in-class student work.

Week	Sections to Cover		Notes
1	Review, 1	Section 1: 2-3 hrs	Appendix Sections $10 - 13$ in text are review; Section 1 covers a lot of basics of functions, priority is getting them familiar with notation, solving equations/evaluating expressions with functions, and interpreting results
2	1, 2	Section 2: 2-3 hrs	In Section 2, make sure students can interpret "such-and-such decreases at a constant rate" as a linear phenomenon

3	2, 3	Section 3: 2-3 hrs	In Section 3, second differences are an interesting (and calculus-adjacent) way to discuss quadratics, but aren't strictly necessary; completing the square is unsupported as a solving strategy, so if you want to use it, provide all necessary resources
4	3, Review		**Exam 1** (approximately sections 1-3)
5	4, 5	Section 4: 1-2 hrs	Try to limit discussion of end behavior in Section 4 to comparisons of degree, true limiting behavior and notation can wait until calculus
		Section 5: 2-3 hrs	Revisit linear relationships in Section 5 to compare with the constant *relative* change in exponential relationships; percent change moved here
6	6	Section 6: 3-4 hrs	In Section 6, try to resist doing too much "write this expression as the logarithm of a single quantity", more useful are using logarithmic properties for some additional goal (e.g. solving an equation, rewriting an expression to see that it is actually a formula for a power function)
7	6, 7	Section 7: 2-3 hrs	**Exam 2** (approximately Sections 4-7); in Section 7 don't forget composition in context; also, it is fun to do composition with "mixed media" (e.g. $f(x)$ defined by formula while $g(t)$ is defined by table)
8	7, 8	Section 8: 2-3 hrs	Finding inverses in Section 8 is another excuse to reinforce good algebra skills; try to resist the temptation to "swap the x's and y's" at the beginning of the process, like many students are familiar with: variables in context have meaning which is eradicated by this practice
9	8	-	
10	9, Catch-up and Review	Section 9: 1-3 hrs	**Student course evals**; Section 9 is intended to be a review section, although it isn't really labeled as such. Please take the time to at least assign exercises for practice from this set, or additionally have students work on it in class or do additional examples of this ilk. Students need practice figuring out which processes are valid when they see some random problem, and they only get that practice when they don't know what section the exercise is from
11	Final Exam	Finals exam week	No classes; **Final exam** at scheduled time `http://registrar.uoregon.edu/calendars/final_exam?schedule=2015-2016`

Technology: If you require a graphing calculator, use it and recommend a TI-84, TI-83 Plus or TI-83. If you do not allow the use of a calculator, be prepared to a) not use one yourself (lest ye be accused of hypocrisy) and b) write exams so that the simplification of arithmetically complex problems does not overshadow the actual concept they are being tested on. If you're open to it, free and/or browser-based

programs like Wolfram|Alpha can be of tremendous use to you and to students.

Additional Notes:

- If you are covering content outside of the learning objectives, it is likely because you aren't doing justice to the listed course topics. Probably it is only if you can honestly state "my students have already mastered all of the content on the course objectives" that it would be time to incorporate more material. Otherwise, consider incorporating more interesting conceptual examples (in particular if additional applications seem onerous or not your style) to reinforce the existing content rather than expanding to additional subjects like formal limits, polynomial division, or the rational roots test.

- It is extremely important that the students know that Math 111 is a pre-calculus course. It is designed for students who have a basic arithmetic and algebraic understanding that is to be built upon in order to prepare them for calculus. Not all students fit this description, but nevertheless it is the assumption.

- The content of this class may be different than you've experienced in a precalculus course (either taking one or if you've taught it elsewhere). There are fewer topics than in many other college algebra curricula, with the goal of the topics being covered in depth and with lots of varying applications. Keep in mind that probably less than 5% of the students will go on to degrees in mathematics, and that the majority enrolled are better served by a solid conceptual understanding of the topics in a social science or "hard" science context.

- Common areas of difficulty: Basic algebra (factoring, simplifying and operations on fractions), completing the square (although not explicitly required), applications of any sort and modeling in particular. Be conscious of these facts when you approach each topic so that you can be ready for the confused looks, frustrated sighs, and eye rolling. Combat them with detailed examples and ample opportunities for practice. Basic algebra review is most effective when integrated into new concepts, so do it on an as-needed basis. Students complain about the abstract problems because they aren't relatable. Students complain about word problems because they're hard and/or contrived. It's a difficult situation to win, but a responsible math class for predominantly non-majors involves both "raw" mathematics and applications.

- Word problems should be a key feature of the course. Consider introducing new topics in a non-mathematical context (there is lots of evidence that this not only helps students learn the material to begin with, but also to retain it longer). E.g. Describing a function from the perspective of a machine like a wood-chipper or microwave oven; exponential functions from the notion of the thickness of paper after n foldings, and so on.

- There are no sections listed as optional − it is your responsibility to your students to cover the material listed. To further that end, please use this syllabus when preparing your class lecture schedule. Ask if you have questions!

- Mike has lecture guides (or in-class worksheets, if you aren't lecturing), quizzes, exams, practice packets, and word problems available upon request. These include some great lecture guides written by Leanne Merrill (note: these are written for a different book, so the section numbers don't match, but the content has a lot in common with the current text.