Math 112 Instructor Syllabus   Fall 2015

Text: A University of Oregon custom edition of *Functions Modeling Change: A Preparation for Calculus, 4th ed.*, by Connally, Hughes-Hallett, Gleason, et al.

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.

Course Goals: A student successfully completing the course should, in a general sense, have…

- ✓ the tools necessary to succeed in a trigonometry-based calculus course or discrete mathematics,
- ✓ facility modeling the mathematical topics described among the learning outcomes in words, then solve or simplify the relevant equations and/or expressions, and finally write a summary statement of the solution. <u>In short, all of the learning outcomes should be incorporated with skill at mathematical modeling.</u>

Learning Outcomes: A successful student can…

- ✓ identify a function as periodic from its definition,
- ✓ describe characteristics of periodic functions such as period, as well as amplitude and midline where applicable,
- ✓ describe the sine, cosine, and tangent functions from both unit circle and right triangle perspectives,
- ✓ describe the characteristics of the sine, cosine, and tangent as functions,
- ✓ calculate all angles and side lengths of both right and oblique triangles, given appropriate information,
- ✓ compute using both degrees and radians as measures of angles,
- ✓ use identities relating to the period of sine, cosine, tangent as well as identities relating to negative angles and the Pythagorean Identity,
- ✓ construct functional models from trigonometric, exponential, polynomial and rational expressions,
- ✓ engage in computations of, and conceptual facility with, elementary operations, composition, and inverses of functions at a more sophisticated level than as expected of a college algebra student,
- ✓ describe vectors in a mathematical and physical science context,
- ✓ add, subtract, and perform scalar multiplication on vectors,
- ✓ express *n*-tuples as 1-by-*n* vectors,
- ✓ find and interpret the dot product of two vectors as a measure of agreement between vectors.

WEEK	SECTIONS TO COVER	Notes	
1	7.1, 7.2, 7.3	**7.1**	(1 hr) A formal definition of a periodic function only occurs in 7.3.
		7.2	(1 hr) Remember that radians aren't introduced (in the text) until Chapter 8. Until then the book is operating in degrees.
		7.3	(1 hr) It's hard to identify the purpose of this section other than "get students comfortable with the notion of graphing y = cos(θ)". You can also do some elementary function modeling here based on describing midline and amplitude.
Readiness Quiz Friday eve. or earlier			
2	7.4, 7.5, 7.6	**7.4**	(1 hr) The so-called "reciprocal" trigonometric functions (cosecant, secant, cotangent) are not defined until section 8.3. Tangent's interpretation as a slope is a useful tool.
		7.5	(1 hr) This is a much less thorough treatment of trig inverses than you

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		may have seen. Because it is done only on a right triangle, the domain/range of each inverse trigonometric function is restricted further than is absolutely necessary for the existence of an inverse. **7.6** (2 hr) This may be the first section in which the subtlety of $q = \sin(t)$ having multiple solutions explicitly comes up.
3	7.6, 8.1, 8.2	**8.1** (1 hr) **8.2** (2 hr) Horizontal transformations were hard in math 111, and they return for trigonometric functions. Fortunately, there are a number of applications of trigonometric functions that put the transformations in context. Don't skip getting them to build trig functions from a written description.
(Winter) *Martin Luther King Jr. Day Monday*		
4	8.3 *Review for Midterm* *Midterm 1*	**8.3** (1 hr) Part of the exercise set in this section asks for using graphs to make a guess about whether or not an equation is an identity. Determine how you feel about that and gauge that feeling versus the time/energy required to get students to prove the identities. 1st midterm (Chapter 7 and all/part of 8 exam) on Thursday/Friday
5	8.4, 9.3	**8.4** (2 hr) Here the more common definition of the inverse trig functions is revealed (versus the treatment in 7.5). Inverse trig functions should be used primarily in the process of solving a trigonometric equation. **10.1** (1 hr) This is more typical of the standard treatment of composition in college algebra courses. An important detail is that revisiting composition now includes trigonometric functions.
6	10.1, 10.2	**10.2** (2 hr) Similar to 10.1, this is the more typical treatment of inverse functions in college algebra. This is a good opportunity to refresh and reinforce inverses on restricted domains, like for sine, cosine, and tangent. **10.3** (1 hr) Like the development in the text, consider one big application problem to discuss the elementary operations on functions and what interpretations they have.
7	10.3 *Review for Midterm*, *Midterm 2*	**9.3** (2 hr) This is sensitive, being the only section covered from the chapter. Focus on the development of models like damped harmonic motion and acoustic beats. If necessary, define the sum/difference formulas for student in the midst of a problem and ask them to apply the identity, but there's no particular reason for them to memorize those. 2nd midterm (Remainder of Chapter 8 and Chapters 9, 10 exam) Have exam grades available by Sunday before the drop deadline
8	12.1, 12.2, 12.3	**12.1** (1 hr) Force diagrams are typical of vector applications in general physics (which has a prerequisite of Math 112). There are complicated vector diagrams included here, some of which might be easier to wait until components are defined in 12.2.

		12.2 (1 hr) Be careful of the projection questions, e.g. "What is the magnitude of vector *u* in the direction of vector *v*?" **12.3** (1 hr)
9	12.3, 12.4	**12.4** (1 hr) The dot product's applications for finding the angle between vectors and as a measure of 'agreement' between vectors should be accentuated.
(Fall) *Thanksgiving holiday Thursday/Friday.*		
10		This week is most responsibly dedicated to (1) finishing up content if necessary, and then (2) in-class individual or small-group review with students. Consider also reviewing 111 material in anticipation of students taking Math 251, in which algebra is key.
Catch-up, review (Spring) *Memorial Day holiday Monday*		

11 Final exam during scheduled time
(**http://registrar.uoregon.edu/calendars/final-exam-schedule?schedule=2015-2016**)

Additional Notes

- It is extremely important that the students know that Math 112 is a precalculus course. It is designed for students who have an understanding of college algebra content 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 trigonometry 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 need a solid conceptual understanding of the topics in a scientific context.

- Common areas of difficulty: Basic algebra (factoring, simplifying and operations on fractions), horizontal transformations, completing the square, applications of any sort. 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.

- A common complaint about this textbook from students is that it doesn't provide enough foundation for the student to do the problems. This is largely because the book makes a concerted effort to have many and varied applications, which are just hard, period. We can combat this with effective discussion of strategies for translating English into mathematics and providing them with lots of good examples of our own. Also, practice makes perfect.

- A common complaint about this textbook from mathematicians is that it's not rigorous enough (or doesn't provide complicated enough calculations). Students who are not math majors benefit from having applications and mathematical modeling used at every step (I've talked to most of the science departments to get their opinions about this). Our math majors, I'd argue, also benefit from having a conceptual and practical understanding of these concepts, and not as much with extraordinarily complex computations.

- 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, and keep it to refer to during the term. Ask if you have questions!

- Mike has lecture guide/worksheets, quizzes, exams, and practice packets available upon request.

Other Important Dates (http://registrar.uoregon.edu/calendars/academic?ts=Fall 2015):

Monday of 2nd week	Last day to drop without a "W" (but only 75% tuition refund)
Wednesday of 2nd week	Last day to add a class
Sunday after 7th week	Last day to drop --- period!

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