Harvard University Extension School
Math S305 Mathematical Connections: Advanced Algebra and Trigonometry
Course Information Summer, 2014

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Classes: daily, 9 to 11:30 in Sever Hall room 106

Course Description and Goals: Algebra is often considered the language of mathematics for good reason. In this class we continue the journey that began for many of you in Math E-303 (Math for Teaching Algebra), exploring this rich, fascinating subject, taking on topics involving the algebra of polynomials, such as the division algorithm for polynomials, and touching on the idea of representing functions using infinite polynomials.

We also investigate sequences and series—arithmetic, geometric, as well as others; explore complex numbers and their geometry, and develop trigonometric functions, identities, and applications. Along the way we talk about general algebraic systems using the language of rings and fields (no prior experience with higher algebra is assumed).

The class is designed for teachers who will be teaching Algebra 2 classes, or for anyone who wants to learn more about this interesting subject.

Homework: As we all know, the best way to learn mathematics is by doing mathematics, and doing homework for this class is an important part of the course. To make sure that everyone is keeping up with the topics we are covering, there will be an assignment due at the beginning of each class. These will normally be graded and returned to you within several days, with comments so that you can learn from your work. In order to make sure that everyone tries to get the homework done before the following class there might be a small penalty (25%) for turning in homework one class late, and homework will normally not be graded for credit if it is more than one class late.

If you can't make it to class, you should still do your best to keep up with the homework assignments and you can always email your homework to me if you're unable to make it to class.

Homework assignments will normally be posted on our website, under the Assignments link, shortly after class. I like to post assignments after the class is over as the types of problems that are assigned depend on what was covered in class and on questions that might have come up during the actual class.

Exams: Along with homework, there will be one midterm test about halfway through the summer session, and a two-hour final will be held in class on the last day of class, on Friday, July 18th.

Course grade: Grades will be based on your homework performance (30%), midterm (20%), class participation (20%), and final exam score (30%).

Handouts, Class website: If you have to miss a class, then please make sure that you follow up to figure out what you missed! Try to catch up with another student in the class to check what was covered – to make this possible we will put together a contact list with everyone's email addresses so that you can get in touch with other students during the summer.

Textbook: The approach we will be using for this material, along with the types of in-depth coverage we will be doing with certain topics, means that no textbooks exactly align with this class. On the other hand a colleague, Al Cuoco, working at the Education Development Center (EDC) in Waltham Mass, wrote a wonderful book (*Mathematical Connections*, ISBN 0-88385-739-1) aimed at high school math teachers that we will be using a fair amount during the course. This book captures the spirit of discovery that we will use throughout the course. You can purchase a copy of this online, or at the Harvard Coop.

In addition to *Mathematical Connections*, during the summer we will also rely on handouts, online sources and other articles for supplementary reading, which will be handed out in class and/or posted online. I will try to post links to review material for certain topics (such as on polynomials and complex numbers) for those of you who would like to have more practice with particular topics, but otherwise we will be developing much of what we need in class, and through the daily assignments.

For class information, including the Powerpoint presentations that are used in class and any handouts, please visit the class website (please note the exact spelling of this address, for instance it's "engelwar" in this address, not "engelward"): **http://www.math.harvard.edu/~engelwar/MathS305.**

I look forward to getting a chance to meet everyone in class this summer!

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Summer 2014 Syllabus **(tentative - to be modified as needed)**

Class	***Date***	***Topic***
1	June 26	Introduction, History of algebra
2	June 27	Matching patterns using polynomial functions
3	June 30	Proving basic results about polynomials
4	July 1	The Binomial Theorem/Working with Mathematica
5	July 2	Sequences, off to infinity!
6	July 3	Recursive formulas, Introduction to Induction
Fourth of July – no class		
7	July 7	Polynomial division/the algebra of rational functions
8	July 8	Series, infinite series, and “infinite polynomials”
9	July 9	From the real to the imaginary – introducing complex numbers
10	July 10	**Midterm Test**
11	July 11	Matrices, complex numbers, and the “complex number line”
12	July 14	Introduction to trigonometric functions, a history
13	July 15	Trigonometric functions, trig identities
14	July 16	Conic Sections
15	July 17	No class meeting – time for reviewing for the final
15	July 18	**Final Exam**