MATH 431 An Introduction to Algebraic Geometry

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This is an announcement about the contents of MATH 431 for the Spring semester of 2014.

Objects of algebraic geometry are curves, surfaces and higher dimensional spaces. The main research problem in algebraic geometry is to classify these objects. Present day research deals with finding invariants of such spaces which distinguish them from other similar objects. Surprising interactions with physics make algebraic geometry more than a play tool of mathematicians only.

In complex analysis we discover that the only meromorphic functions on the entire plane having a pole at infinity, as opposed to having an essential singularity, are the rational functions. In geometry we are always interested in what happens at infinity. Remember that "Two parallel lines meet at infinity."

Therefore algebraic geometry uses only polynomials, and hence rational functions, of several variables. This gives a surprisingly precise and powerful link to commutative algebra. We discover much to our surprise that most geometric problems have a translation into algebra where a solution already exists in the algebra books. We exploit this correspondence to discover the geometric panorama.

I intend to devote the first half of the course to learning the basic terminology and the tools of the trade. After that I will discuss some classical problems and constructions.

Also I want to include a topic which is not found in any textbook; Arf rings and Arf closure. The official textbook for the course will be: Hartshorne's Algebraic Geometry, first chapter only. I will distribute course notes to expand what is written in Hartshorne. Since the only source for the classical Arf rings is Arf's own article which is written in French and never been translated, my notes will provide detailed coverage of Arf rings, not to be found anywhere else!

The grading will depend on several take-home exams and a final exam. Take-home exams may be tailored differently for each student to reflect his or her personal tendencies.

Traditionally, in algebraic geometry you learn what you need as you go along. i.e. *Göç yolda toplanır*. We will follow this tradition and therefore I will not impose any prerequisites on the course.

However a certain degree of curiosity and eagerness to learn, and an altruistic quest for knowledge, though not officially required, will be extremely useful in extracting a joy of discovery from the course material.

For further introductory information about algebraic geometry I suggest that you browse through the beautiful entry "Algebraic Geometry" in Wikipedia.

If you are still undecided, I suggest you finally read
`http://www.bilkent.edu.tr/~sertoz/courses/math431/2011/whatisit.htm`

Do not hesitate to contact me if you have any questions.

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Course web page is:
`http://www.bilkent.edu.tr/~sertoz/courses/math431spring2014.htm`