Math & Computer Science Colloquium

Presents:

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Speaking on:

Differential Equations and Projective Geometry

After a quick introduction to the projective plane, we show that extending a differential equation to the projective plane is a quick and effective way to study the asymptotic behavior of its solutions. The simplest approach leads to equations with ugly singularities, so we also show how to use the method of rescaling time to desingularize them.

The main theorem is as follows:
Theorem: Let x' = f(x,y), y' = g(x,y) be a polynomial differential equation in R2 of degree N.
Then either
there are at most N+1 possible slopes "at infinity" for the unbounded trajectories, or
there are at most N-1 slopes which are omitted: all other slopes "at infinity" actually occur.
The theorem is proved by exhibiting the polynomial whose roots are the possible slopes in case (1), or the possibly omitted slopes, in case (2).

It is simple to apply and gives information that would otherwise be difficult to extract.

The only real prerequisite will be differentiation and integration of functions of one variable. The approach to differential equations will be qualitative and intuitive, so the talk could also serve as a good introduction to the geometric point of view on differential equations.

The audience will be left with an open ended list of examples and applications to explore

Thursday January 26, 2012
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3:30 PM

Everyone is Welcome!