

**Speaker:** David Galvin  
University of Notre Dame

Friday, October 8, 2010  
4:30 pm  
231 Hayes-Healy Hall

**Title:** Unimodality, log-concavity and the real roots property

**Abstract:**

In combinatorial applications, one often encounters families of sequences. For example, for each  $n$ , we have the sequence  $\{S(n,k)\}$  counting the number of equivalence relations on a set of size  $n$  with  $k$  classes, and for each graph  $G$  we have the sequence  $\{m(G,k)\}$  counting the number of matchings of size  $k$  in  $G$ . It is of interest to be able to identify global properties satisfied by all sequences in a given family. I'll introduce three important global properties that a sequence might have (unimodality, log-concavity, and real roots), discuss the connections between them, and present a few results and open problems.

**Speaker:** Brian Hall  
University of Notre Dame

Friday, October 8, 2010  
5:00 pm  
231 Hayes-Healy Hall

**Title:** Complex and geometric methods in mathematical physics

**Abstract:**

Abstract: Classical mechanics for a particle in  $R^3$  is best described in the phase space  $R^6$ , consisting of pairs  $(x, p)$  with  $x$  representing the particles position and  $p$  representing its momentum. Quantum mechanics for a particle in  $R^3$ , by contrast, is typically described by a "wavefunction that is a function on  $R^3$  a function of the position variables only. For comparison to classical mechanics, it is useful to reformulate quantum mechanics in terms of a wavefunction on the phase space. This phase-space wavefunction, however, cannot be an arbitrary function on  $R^6$ , for this would violate the uncertainty principle. The solution is to take a wavefunction that is a holomorphic function on  $R^6 = C^3$ . I will describe how this holomorphic function is constructed and discuss generalizations to more geometrically interesting situations, such as a particle moving in a (compact or noncompact) symmetric space.

There will be pizza provided by the department following the lectures.