Archived Colloquia
2014/15

Friday, May 1, 2015, 4:00pm, PB 192:

Speaker: Dr. Mohammad Yahdi (Hartnell College/Ursinus College)

Title: ***Can Math Control and Prevent Antibiotic Resistance Infections?***

Abstract: The emergence of antibiotic-resistant bacteria (also known as super-bugs) in many intensive care units (ICU) is considered a major health problem (CDC). Infections caused by vancomycin-resistant enterococci (VRE) have been associated with high mortality rates and high costs, and have demonstrated resistance to many other classes of antibiotics. Therefore, with limited treatment options and the scarcity of new antibiotics in the pharmaceutical industry's pipeline, examining strategies to efficiently prevent and control those infections is becoming critically urgent (CDC). New advances in mathematical modeling, complex dynamical systems and computing capabilities, gave momentum to the importance of the role mathematics has been playing in breakthroughs investigating control strategies in epidemiology. This talk will present a mathematical framework for determining optimal control and cost-efficient strategies that incorporate up-to-date special preventive measures, without the risk and resources involved in a widespread clinical testing. Models are developed using deterministic and stochastic approaches, and validated using clinical data.

February 20, 2015: Hortensia Soto-Johnson (University of Northern Colorado)

Title: ***Reasoning on the Complex Plane via Inscriptions and Gestures*** (Flyer)

Abstract: Using a diagrammatic reasoning framework about inscriptions, we explored undergraduates' reasoning about complex-valued equations. Our findings suggest that reasoning geometrically requires first reasoning algebraically about algebraic inscriptions. We found students tended to create algebraic and geometric inscriptions when their verbiage could no longer support geometric reasoning. Furthermore, they incorporated similar iconic gestures for reasoning about their geometric inscriptions, which reduced to deictic gestures as they applied their previously developed reasoning to subsequent tasks. Contrary to other research, our participants' gestures did not taper off with future tasks. Rather, their gestures transformed as concepts were automatized. Moreover, our research suggests that gestures serve as a link between verbiage and inscriptions rather than inscriptions serving as a link between verbiage and gesture as other researchers claim. In promoting synchronicity of algebraic and geometric reasoning, teachers may want to capitalize on the fact that students tend to implement similar gestures as they reason.

February 19, 2014: Marat Markin (Fresno State)

Title: ***On the Smoothness of Weak Solutions of an Abstract Evolution Equation with a Normal Operator*** (Flyer)

Abstract: In this survey exposition representing a characteristic segment of the reporter's

research, we shall see that the use of the well-known exponential formula

$$y(t) = e^{tA} f$$

can be naturally extended to the case of a *normal operator* A in a complex Hilbert space H to describe generalized *(weak) solutions* of the evolution equation

$$y'(t) = Ay(t), \quad t \geq 0.$$

We are also going to consider conditions necessary and sufficient for the weak solutions, which a priori need not be differentiable, to be *infinite differentiable and ultradifferentiable in the Gevrey sense* (in particular, analytic or entire) on $[0, \infty)$ or $(0, \infty)$ and observe certain interesting effects of their *smoothness improvement.*

December 9, 2014: Marat Markin (Fresno State)

Title: ***On one amazing formula binding two branches of mathematics*** (Flyer)

Abstract: *Gelfand's spectral radius formula*, relating the purely algebraic concept of the spectrum of an element of a complex Banach algebra to the analytic entities of *limit* and *norm*, can be rightfully considered a vivid revelation of the intrinsic connection between the two branches of mathematics: algebra and analysis. We are going to consider a traditional proof of this fundamental result based on the generalization of Liouville's theorem in complex function theory to vector-valued functions and see how the formula works within the familiar framework of linear algebra and calculus.