- URMS -
Undergraduate Research Seminar in Mathematics and Statistics

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On the multiplicativity of the determinant: Where are Cauchy & Binet?

November 10, 2013, 1:00 - 2:00 PM, CW 307.20 (Math Lounge)

Abstract: In a first course on Linear Algebra, students are asked to learn about the determinant of a matrix, as a tool used to calculate the eigenvalues of a matrix. Typically, just some basic properties of the determinant are discussed, leaving the wrong first impression about this important function. Further, students often do not pick up on the fact that viewing eigenvectors as invariant subspaces helps to truly synthesize the concepts of eigenvalues and diagonalization.

Students are usually shown that $\det(AB) = \det A \cdot \det(B)$, for $n \times n$ matrices A and B – sometimes with a short sketch of the proof. One issue to consider, is what if A and B are rectangular, but AB is square, how then can we compute $\det(AB)$ in terms of A and B?

I will demonstrate how to do this, and I will show that the equation $\det(AB) = \det A \cdot \det(B)$ and conventional matrix multiplication (also defined for rectangular matrices), are both simple instances of a much more universal and beautiful identity on the determinant that, sadly, is not commonly taught at the undergraduate level...

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