1036-58-20 **Dana Fine** and **Stephen F Sawin*** (sawin@cs.fairfield.edu), MACS Department-Bannow, Fairfield University, 1078 North Benson Road, Fairfield, CT 06824. *Supersymmmetric Quantum Mechanics, Infinite-Dimensional Mathai-Quillen Formalism, and Gauss-Bonnet-Chern.* Preliminary report.

We restrict the action for $N = 1$ Supersymmetric Quantum Mechanics (SUSY QM) to the subset of all paths which are the concatenation of n short geodesic segments. On this subspace the path integral representing the time evolution operator is a perfectly rigorous finite-dimensional supersymmetric integral. Its kernel is represented by an n-fold kernel product of a simple kernel called the approximate kernel. The limit as n goes to infinity exists and can be naturally interpreted as the infinite-dimensional path integral that defines the time evolution operator and partition function of the theory. When applied to loops instead of paths, the action can also be interpreted as the infinite-dimensional Mathai-Quillen form one uses to get a "proof" of the Gauss-Bonnet-Chern theorem.

We prove that this large n limit converges to the heat kernel for the Laplace-Beltrami operator on forms. We use this convergence to give a rigorous version of the nonrigorous proof using the Mathai-Quillen formalism (or equivalently using SUSY QM) of Gauss-Bonnet Chern. We suggest how the same techniques may be used to make rigorous the SUSY QM "proof" of the Local Index Theorem and some other nonrigorous math integral arguments (Received November 19, 2007)