1037-53-67 **Dana Fine** and **Stephen F Sawin*** (sawin@cs.fairfield.edu), 1078 North Benson Road, Fairfield, CT. *Supersymmetric Quantum Mechanics and the Gauss-Bonnet-Chern Theorem.* Preliminary report.

We restrict the action for $N = 1$ Supersymmetric Quantum Mechanics (SUSY QM) to 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. Using Gaussian techniques, the kernel representing the integral over two-piece paths is estimated as the kernel for the one-piece paths plus an error term with Gaussian bounds. Using a general argument, these bounds give bounds on the kernel for the n-piece paths, which allow us to show that the large n limit exists and is the time-evolution operator of $N = 1$ SUSY QM. In turn, when applied to loops instead of paths, where it gives the supertrace of the heat kernel, the action can be interpreted as the infinite-dimensional Mathai-Quillen form.

These bounds make the limit sufficiently robust as to make rigorous the "proof" using the Mathai-Quillen formalism (or equivalently using SUSY QM) of Gauss-Bonnet Chern. Specifically the bounds allow one to exchange the large n and small t limits. We conclude by suggesting how the same techniques may be used to make rigorous the SUSY QM "proof" of the Local Index Theorem and some other nonrigorous path integral arguments. (Received February 02, 2008)