Ilan Vardi introduced a probabilistic model for the distribution of Gaussian primes, thought of as a point cloud in \( \mathbb{R}^2 \). We compare patterns in the persistent homology of the Gaussian primes versus Vardi’s probabilistic model, as well as two additional models, for the primes out to \( |z| \leq 200 \). The first homology provides statistical evidence that the models miss geometric features of the Gaussian primes. (Received July 28, 2017)