1163-47-984   **J E Pascoe*** (`pascoej@ufl.edu`). *Algebraic geometry and topology arising from tracial and determinantal free noncommutative functions.*

We give an elementary method determining whether or not two expressions in noncommuting indeterminants have the same determinant when evaluated on matrices. Our method uses the canonical implementation of the Weil divisor given by the logarithmic derivative. The divisor of a free rational function is always the difference of two polynomial divisors, and hence, via factorization results of Helton-Klep-Volcic, the set of rational divisors form a free abelian group generated by the polynomials. Determining which functions arise as principal divisors, or more generally as gradients of tracial free functions, motivates a theory of tracial cohomology and fundamental groups. The natural fundamental group is given by the equivalence classes of "paths" taking some base point to itself which can be distinguished by analytic continuation. Surprisingly, the tracial fundamental group is abelian and isomorphic to a direct sum of copies of the rationals. Finally, time permitting, we will note that our methods can be adapted to a sheaf theoretic formulation and work on thin sets, such as noncommutative varieties, and hence bear insight into problems on domains of commuting tuples of matrices. (Received September 14, 2020)