78. J. W. Peters: *The euclidean geometry of the n-dimensional simplex.*

In this paper theorems associated with the triangle and the tetrahedron are extended to the n-dimensional simplex formed by $n+1$ points in a euclidean space of n dimensions. The centroid and Monge point of the simplex as well as the centroids and Monge points of the faces are defined. The following extension of Mannheim's theorem for a tetrahedron is proved. The $n+1$ planes determined by the $n+1$ altitudes of the simplex and the Monge points of the corresponding faces meet in the Monge point of the simplex. A hypersphere on the centroids of the faces is discussed. It is shown that this hypersphere passes through $3(n+1)$ points associated with the simplex and has a number of properties similar to the nine point circle associated with a triangle and with the twelve point sphere associated with a tetrahedron. (Received November 8, 1941.)

79. J. L. Vanderslice: *Invariant theory of vector pencil fields.*

At each point $(x^1, \cdots, x^n)$ of a space subject to general coordinate transformations is associated a pencil of contravariant vectors, $\xi^i(x^1, \cdots, x^n, u)$. The parameter u of the pencil is normalized to give an invariant metric parameter x^0 associated with each coordinate system x^i and transforming like the gauge variable of generalized projective geometry. The principal result is the discovery of an affine connection with components which are functions of x^α $(\alpha=0, 1, \cdots, n)$ and a method of covariant differentiation of tensor functions of x^α. A study of the equivalence problem then leads to a complete set of tensor invariants for the vector pencil field. (Received November 17, 1941.)

80. André Weil and C. B. Allendoerfer: *A general proof of the Gauss-Bonnet theorem.*

The following generalized Gauss-Bonnet theorem was recently proved independently by Allendoerfer and Fenchel: If a closed Riemann manifold R_n of even dimension can be made a subspace of an euclidean space then $\int KdO = 1/2\omega_n\chi$ where K is the total curvature of the manifold, ω_n is the area of an n-dimensional sphere, and the integration is over the manifold. The present paper removes the restriction that R_n be a subspace of an euclidean space. To do this R_n is subdivided into simplices each of which is small enough to have an isometric euclidean imbedding. The method of tubes is applied to these subdivisions separately, special attention being paid to their boundaries. The terms resulting from the boundaries are found to be intrinsic and drop out when the simplices are reassembled to form R_n. (Received November 26, 1941.)

Logic and Foundations

81. E. C. Berkeley: *Application of symbolic logic to punch card operations.*

This paper discusses the analysis of operations with punched tabulating cards, and also to some extent operations with handwritten cards, as taking place in a large life insurance company, for purposes of valuing policies, computing, recording, and summarizing payments, and so on. The chief instrument of analysis is a system of coding, constructed using symbolic logic and other techniques. The system of coding is exhibited in part, and examples of the coding are given. Some related problems of