Other papers, by A. H. Taub, S. O. Rice, A. F. Stevenson, R. Truell E. G. Ramberg, M. Kac, N. Wiener, Y. W. Lee, H. Wallman, E. Feenberg, are short abstracts of articles published in different scientific reviews.

L. BRILLOUIN

The real projective plane. By H. S. M. Coxeter, New York, McGraw-Hill, 1949. 10+196 pp. $3.00.

This book is an admirable introduction to the subject for students who know a fair amount of ordinary plane geometry, including at least something about conics, but have no idea at all of projective geometry. It begins by the introduction of points and the line at infinity by means of the "vanishing line" or horizon of a central projection from one plane onto another, and goes on to illustrate the distinction between affine and projective geometry by proving Desargues' theorem by projection, from the properties of similar and similarly situated triangles. In the second chapter a set of five axioms of incidence (one of which is Desargues' theorem) is given, the principle of duality explained, and the quadrilateral and quadrangle and the harmonic relation studied in an elementary manner. The perspective relation between two lines is defined, likewise its dual (also called perspective). Chapter III introduces the idea of order, defined in terms of the separation relations of two pairs of points, and its properties deduced from six simple axioms, of which one states that order is invariant under perspective correspondence. The familiar separation properties of the harmonic relation are very simply deduced. Then as a temporary expedient Enriques' theorem to the effect that an ordered correspondence which relates an interval to an interior interval has a first invariant point in the interval is introduced as an axiom of continuity.

Chapter IV is on one-dimensional projectivities, defined as correspondences that preserve the harmonic relation. The fundamental theorem is proved from the axiom of continuity; Pappus' theorem and the axis of projectivity follow simply. Projectivities are classified into direct and opposite according to their effect on sense and into elliptic, parabolic, and hyperbolic, according to the number of their invariant points. Involutions are studied, and the involutory property of the quadrangular set proved.

Chapter V is a similar treatment of two-dimensional projectivities, both collineations and correlations, a collineation being defined as any point-to-point correspondence that preserves collinearity. It is shown from the fundamental theorem that there cannot be more than one collineation in which one given quadrangle corresponds to another, but curiously it is never shown, though constantly taken for granted in the sequel, that there is always one such collineation. The proof of this, though a simple consequence of Desargues' theorem, is surely not sufficiently self-evident to be passed without even a mention. Oddly enough, the corresponding result for correlations is proved with care, using the fundamental theorem.

Polarities are introduced, as symmetrical correlations, and are classified in the next chapter as hyperbolic or elliptic according as there are points lying in their own polars or not. This leads to the definition of a conic as the locus of such points. Early in the chapter this is shown to be equivalent to Steiner's definition of the conic as locus of intersections of corresponding lines of projectively related pencils. Chapters VI and VII contain a quite full account of conics, pencils of conics, and projectivities on conics, and a hint at the transformation by conics through three points (in the form of "polarity" with respect to a triangle).

Chapters VIII and IX give an illuminating account of the derivations of affine and metrical from projective geometry, by the special treatment of a particular line and a particular elliptic involution on it. This is carried as far as the circles connected with a triangle and the focal properties of conics.

Chapter X is probably the best in the book. It is a reexamination of the problem of continuity, based on the axiom that every monotonic sequence of points has a limit; from this it is proved that the line is perfect. The chapter concludes with proofs of the fundamental theorem, Dedekind's axiom, and Enriques' theorem, which was temporarily taken as an axiom in Chapter III.

The last two chapters deal with the introduction and use of coordinates. The addition and multiplication of points on a line or on a conic are defined by the conditions that (P_∞, P_∞), (A, B), $(P_0, A+B)$ and (P_0, P_∞), (A, B), (P_1, AB) are three pairs of an involution, and the ring obtained is shown by continuity methods to be isomorphic with the field of real numbers. In the plane, homogeneous coordinates are defined by the ingenious but rather baffling method of drawing a conic through the vertices of the triangle of reference, the unit point, and the point whose coordinates are required; the coordinates of the point are then the parameters, on the conic, of the vertices of the triangle with regard to a triad consisting of the remaining two points and an arbitrary sixth point of the conic, whose choice provides the arbitrary coefficient of homogeniety. This is remarkably neat, but is it really the best way to show a student new to the business what homogeneous coordinates really mean geometrically? In the last chapter the start is made at the other end. A point is defined by a set of coordinates and a line by a linear equation; it is verified that this system obeys all the axioms, and the general collineation and correlation are expressed as linear transformations.

It will be seen from the foregoing that the work is severely and carefully argued from beginning to end, and that within its limitations to the real field and to two dimensions it covers just about everything that one could think of including. The shelving of the serious discussion of continuity to a late stage, by assuming one of its chief results as a temporary axiom, probably makes greatly for the intelligibility of the book to beginners. A great number of admirably clear diagrams (probably more than one to every page on an average) illustrate the ideas. The proofs are lucid, and in nearly every case lay bare the fundamental ideas that are being used rather than obscuring these in a mass of detail. The whole book, indeed, is most readable; there are interesting historical notes on the genesis of the ideas presented and a very good bibliography. An appendix of only a couple of pages briefly indicates the nature of the step from real to complex geometry.

PATRICK DUVAL

Extrapolation, interpolation, and smoothing of stationary time series with engineering applications. By Nobert Wiener. Cambridge, Technology Press of Massachusetts Institute of Technology, and New York, Wiley, 1949. 10+163 pp. $4.00.

This is the second book by Professor Wiener on time series and communication engineering published since 1948. While the first book, *Cybernetics*, treated the subject from a general standpoint and was more philosophical than mathematical, the present book is more technical than theoretical, and is intended to give a useful tool for engineers working in the field of electrical communication and related subjects. This book is essentially a reproduction of a pamphlet which had limited circulation during the war.

The main problem discussed in this book is the following: Let $\{x_t\}$ be a stationary time series of class L^2, where the parameter t runs through all integers (discrete case) or all real numbers (continuous case); given a random variable y of class L^2 and a set T of the values of the parameter t, how can we approximate y by finite linear combinations of x_t with t from T?

In the terminology of Hilbert space, this problem can be formulated in a different manner. Let $\{x_t\}$ be a "sequence" (discrete case)