Vector-Rechnung. By Dr. Max Lagally. Mathematik und ihre Anwendungen, II. Leipzig, Akademische Verlagsgesellschaft, 1928. xvii+358 pp. $5.50.

Punkt- und Vektor-Rechnung. By Alfred Lotze. Göschens Lehrbücherei. I Gruppe: Reine und angewandte Mathematik. Band 13. Berlin und Leipzig, Walter de Gruyter, 1929. 192 pp. Rm 12.

Vektor-Analysis. By Dr. Siegfried Valentiner. Sammlung Göschen. Berlin und Leipzig, Walter de Gruyter, 1929. Rm 1.50.

The first of these texts is the outcome of lectures covering some years, given by Dr. Lagally in the Technical High Schools of Munich and Dresden, before students who were familiar with physics and mathematics. It is therefore designed to furnish engineers with a rather complete reference book on this subject. The notation so far as possible is that of Gibbs. The book is divided into chapters as follows:

1. Elementary vector algebra, 55 pages; 2. Vectors dependent upon scalar parameters, 62 pages; 3. Theory of fields, 70 pages; 4. Dyads, 49 pages; 5. The most important dyads of mechanics, 37 pages; 6. Transformations, 25 pages; 7. Vectors in Riemann space, 47 pages; 8. Complex numbers, 15 pages.

Each chapter has several sections. The author has compressed into the book a great deal of the current methods labeled "vector." References are not too numerous but sufficient for the purpose. The author has arrived at dyads, or linear vector operators, early in the book, which he considers a desirable thing to do. He tries to give a brief exposition of quaternions and hypernumbers at the end, with ill success. The last chapter could have been omitted.

The claim is made in the preface that the approach is direct and intuitive, but when one finds that this approach is limited to a few diagrams and that the old familiar coordinate system is on the scene rather promptly, and from then on really dominates the development, the vector system sinking as usual to the mere shorthand expression for various coordinate forms, he is not ready to accede to the claim of an intuitive development.

The author recognizes the slow spread of vector methods in current literature, but he does not seem to realize that this slow spread is due to the persistent use of coordinates in at least the thought of those who would use the vector methods. There is not the slightest necessity to mention coordinates or the "Dreibein" (which may be translated *trisceles*, meaning trirectangular axes). Formulas for rotation of the trisceles and other transformations are not needed, and the invariantive character of the expressions is obvious. It seems strange that after these hundred years of ideas of Hamilton and Grassmann anyone should still be clinging to the antiquated methods and forms of coordinates. Anyone familiar with the literature and the discussions about vectors for the last forty years knows that vectors properly developed ("autonomously" in the language of Burali-Forti and Marcolongo) furnish an invariantive mode of thought and writing for geometry and physics. The mere fact that the laws of physics can be so stated shows them as invariants. This simplicity is destroyed as soon as the vectors are made to depend upon axes or coordinates. The only way such dependence should enter is in the representation of variable points, as for instance the vector ρ may depend upon a