

MATHEMATICS

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ABSTRACTS

Some metric spaces into which pseudo-planar-quintuples can be congruently imbedded. PAUL M. PEPPER, University of Notre Dame.—A pseudo-planar-quintuple is a set S of five points and mutual distances such that (1) S is not congruent to any five points of the Euclidean plane, and (2) each four-point subset of S is congruent to a set of four points in the Euclidean plane. This paper deals with certain convex metric spaces into which these pseudo-planar-quintuples can be congruently mapped. A first metric space, convex in the sense of the metric, is formed by three Euclidean half-planes, joined along their boundary lines and metricized so that the distance between two points in the same leaf is the Euclidean metric in that half-plane, and the distance from a point in one leaf to a point in another is the minimum of the sum of the distances from the two given points to a common point on the line of junction. Into this space all pseudo-planar-quintuples are imbeddable.

A second type of convex metric space into which a two-parameter family of pseudo-planar-quintuples is congruently imbeddable can be formed by joining two congruent triangles of the Euclidean plane along corresponding edges, retaining the Euclidean metric between points in the same face of the dihedron so formed and assigning to two points, one in each face, the distance equal to the minimum of the sum of their distances from a common point on the edge of the dihedron. And what is perhaps more important is that each pseudo-planar-quintuple is congruently imbeddable into at least one such triangular dihedron.

Cubic hypersurfaces symmetric with respect to hyperplanes of a linear system. DARRELL R. SHREVE, Purdue University.—This paper gave a discussion of the determination of the finite number of hyperplanes of linear systems of dimensions 1, 2, 3, ..., $r+1$, with respect to which the cubic hypersurfaces in projective space of r dimensions can be symmetric. The finite numbers of coplanar and non-coplanar generalized Eckardt points on the hypersurface for $r = 4, 5, 6, 7, 8, 9$, are determined.

Variations of the Peaucellier cell and other linkages. M. H. AHRENDT, LaPorte.—The standard arrangement of the Peaucellier cell consists of a rhombus attached to two bars equal to each other but either longer or shorter than the bars composing the rhombus. Thus we have two standard arrangements, the positive form and the negative form. An analysis of the cell, however, shows that it is possible for it to take many other forms. The Peaucellier cell may be thought of as being composed of a kite and a spearhead. Any combination whatever of these two linkages which will keep them equally deformed and the lettered

points collinear will have the same properties as the standard cell. Furthermore, it is not necessary that the kite and spearhead be made of the same dimensions. Either part may be enlarged or diminished in size. More surprising yet, it is not necessary that any form of the cell be symmetrical with respect to a line through the collinear points. Either side of any form of the cell may be elongated. Thus it is possible to produce a cell which, instead of being composed of bars of two lengths, has no two equal bars or segments. Models of several forms of the cell have been constructed and were demonstrated. Eleven models of linkages were demonstrated two years ago. It is possible to demonstrate now several additional ones; namely, two or three 7-bar straight-line models; two models each capable of drawing all the conic sections; models for tracing the lemniscatoid, ellipse, and cardioid; and a model for finding the cube root or the cube of a number.

A three dimensional blackboard. O. H. OLSON, Valparaiso University.—The blackboard consists of three pieces of five-ply plywood, each two feet square. These three are hinged together to form three mutually perpendicular faces. The inside surfaces of the three boards are finished with three coats of liquid slate upon which two inch cross sectioning is drawn in white paint. An auxiliary square board, two feet on a side and finished as above with a handle on the other side, completes the apparatus. The author claims nothing original in this blackboard, but has found a definite need for such an apparatus in his teaching and has failed to find anything on the market to fill that need.

The comparative factor in measurement. WALTER O. SHRINER, Indiana State Teachers College.—This was a report of a study to determine the influence that a large number of student-examination papers have on the reliability of teachers' marks. Subjective type examinations of one hour length were given twenty-five students in algebra, English, and geometry, respectively. In the statistical treatment of the data a "best set of marks" for each set of papers was obtained by computing the arithmetic mean of the grades given by the twenty-five teachers on each of the papers. Each teacher's set of marks was then correlated with the "best or mean set of marks". The studies in algebra, English, and geometry, were in reality independent studies since they involved different sets of students and different sets of teachers. An analysis of the correlation coefficients in each of the studies showed that there existed little difference in the ability of algebra, English, and geometry teachers to grade their respective sets of papers accurately. The coefficients of correlation were practically all above .800 and many of them above .900. This would indicate that most teachers are quite able to rank student-papers with a high degree of accuracy when they have at least twenty-five papers for rating purposes. However, the study revealed that these teachers did not use the same scale in their ratings. Some teachers, although ranking the papers with high degree of accuracy, were consistently high graders while others, equally reliable in ranking papers, were low graders. There were also some teachers who spread their marks from "extreme high" to "extreme low". There also appeared

wide differences in judgment as to how many of the papers were to be considered "failing papers". The chief conclusion to be drawn from the study is that while teachers can rank student-papers with a high degree of accuracy, they need to give more attention to the determination of reasonable standards of achievement, when using the non-standardized type of examinations.

Operational methods for solving certain differential equations.

JONATHAN D. YOUNG, Muncie.—This paper gives a discussion of the use of symbolic operators in solving differential equations. The method is applied to homogeneous differential equations of various linear types. Applications of the two basic theorems, the "shifting theorem" and the extended Leibnitz rule, were demonstrated.