any one college or university, the team of three must be named on the application. Fewer than three from one college or university may compete as individuals.

The examination may be given at any place where a team, or at least three candidates, can be assembled. Exceptions to this rule may be made by the Director in cases where it would entail unusual inconvenience to a contestant. Sealed copies of the examinations will be sent to the supervisor of the examination in time for the examination day and are not to be opened before the hour set.

The prizes to be awarded to the departments of mathematics of the institutions with the winning teams are $400, $300, $200, and $100, in the order of their rank. In addition, there will be prizes of $40, $30, $20 and $10 awarded to the members of these teams according to the rank of the team; a prize of $50 to each of the five highest contestants and a prize of $20 to each of the succeeding five highest contestants. Each of the winners will receive a suitable medal. Honorable mention will be given to several teams next in order after the four winning teams and to several individuals next in order after the ten individual winners. For further encouragement of the Competition, there will be awarded at Harvard University (or at Radcliffe College in the case of a woman) an annual $1500 William Lowell Putnam Prize Scholarship to one of the first five contestants, this to be available either immediately or on the completion of the student's undergraduate work.

Reports on the nine previous competitions and examination questions will be found in this MONTHLY for May, 1938, 1939, 1940, 1941, 1942, October, 1946. August–September, 1947, December, 1948, and August–September, 1949.

THE MATHEMATICAL ASSOCIATION OF AMERICA

Official Reports and Communications

THE APRIL MEETING OF THE ROCKY MOUNTAIN SECTION

The thirty-second annual meeting of the Rocky Mountain Section of the Mathematical Association of America was held at the Colorado School of Mines, Golden, Colorado, April 22 and 23, 1949. There were three sessions with Professor I. L. Hebel presiding at each.

Among the ninety-eight persons who registered were the following forty-nine members of the Association: R. V. Anderson, W. G. Brady, Leonard Bristow, G. L. Burton, F. M. Carpenter, Nancy V. Cheney, A. G. Clark, G. S. Cook, G. A. Culpepper, David DeVol, Mary C. Doremus, W. R. Eikelberger, O. J. Falkenstern, F. N. Fisch, Katherine C. Garland, R. H. Glass, H. T. Guard, Leota C. Hayward, I. L. Hebel, H. K. Hilton, Ruth I. Hoffman, LeRoy Holubar, R. J. Howerton, Burrowes Hunt, J. A. Hurry, C. A. Hutchinson, B. W. Jones, A. J. Kempner, Claribel Kendall, A. J. Lewis, M. L. Madison, W. K. Nelson, Greta Neubauer, K. L. Noble, O. H. Rechard, A. W. Recht, L. W. Rutland, Nathan Schwid, S. R. Smith, W. N. Smith, L. C. Snively, K. H. Stahl, J. M. Staley, J. F. Stockman, E. P. Tovani, V. J. Varineau, W. W. Varner, J. F. Wagner, Lillie C. Walters.

At the business meeting, the following officers were elected for the coming year: Chairman, Professor A. J. Lewis, University of Denver; Vice-Chairman, Professor A. E. Mallory, Colorado State College of Education; Secretary-Treasurer, Professor J. R. Britton, University of Colorado.

The program of papers presented was:

1. *The Lill circle*, by Professor (Emeritus) W. J. Hazard, University of Colorado, introduced by A. J. Kempner.

The Lill circle for finding the roots of $ax^2+bx+c=0$, mentioned by Maurice d'Ocagne in his "Calcul Simplifie et Nomographie" as a special case of a general graphic approximation to the roots of the nth degree equation, is here shown to be the XY-plane section of the paraboloid of which the XZ section is the usual parabola plotted from $y=f(x)=x^2+bx/a+c/a$. Both the circle and the parabola show the roots of the equation as the points where the X axis pierces the surface of the paraboloid.

2. *A four-number game*, by Mr. Burrowes Hunt, University of Colorado.

In *Scripta Mathematica* (March 1948) Benedict Freedman showed that if from an ordered set of four positive integers one forms the set of the absolute values of their differences taken in cyclic order, and repeats this process, one arrives at the set 0, 0, 0, 0, in a finite number of steps. Mr. Hunt considered the same game for sets of four positive real numbers. The result is that, in general, any set of real numbers leads to the set 0, 0, 0, 0, but there is a double infinity of exceptional sets all of whose differenced sets consists of positive numbers. If x is the positive root of either of the equations $x^3=1\pm(x^2+x)$, then the set $0,\ 1,\ 1+x,\ 1+x+x^2$ is exceptional, as is any set derived from it by replacing each element a by $ka+m$.

3. *Is mathematics practical?* by Mr. R. J. Howerton, Regis College.

The author discussed the question of "pseudo-practicality" of problems in textbooks, and the growing tendency for mathematics teachers to be on the defensive with respect to their subject. The problem of teaching the "why" of mathematics rather than the "how" from elementary classes through college work was discussed. Placing mathematics on a plane with history, psychology, literature, and other cultural subjects was proposed. The author maintained that, for the average liberal arts college student, mathematics was highly impractical, and that the only true justification for the subject was on a cultural basis.

4. *The construction of a statistical quality control chart and some interpretations to be made from it*, by Professor J. F. Wagner, University of Colorado.

The bases of a statistical quality control chart are these: (1) Variation in the manufacture or measure of a product quality is to be expected; (2) The data themselves determine the expected spread of the data; (3) The control, or action, limits are then set at such values as to minimize, economically, the waste of looking for trouble when there is none and not looking for trouble when there is some; (4) We shall use the so-called 3σ limits which include all but about one out of every 400 variates in the distribution, unless there is a significant departure from normalcy; (5) The occurrence of a point outside the control limits shall then be the signal to look for an assignable cause of variation beyond the natural variability of the process.

With the aid of a table of data and a control chart grid which was distributed to each member of the audience, an actual example of this technique taken from industry was discussed. The points lying outside of the control limits were identified with their assignable cause. The meaning of a run or loss of random scattering of the points on a control chart was presented.

5. *A construction for a monoidal quartic*, by Mr. W. G. Brady, University of Wyoming.

In this paper a 4:1 correspondence between the points of two conics is shown to lead to a monoidal quartic, and configurations leading to various types of triple points are discussed.

6. *The central limit concept in an elementary course in statistics*, by Professor H. T. Guard, Colorado A. and M. College.

The author discussed some of the pedagogical problems encountered in the teaching of elementary statistics to students having little mathematical background. Sampling experiments for the verification of the central limit theorem were discussed.

7. *Delta-V, a conical shell*, by Professor F. M. Carpenter, Colorado School of Mines.

For certain types of volumes of revolution the use of a cylindrical element leads to the correct numerical result because of compensating errors. Often an exercise can be analyzed and solved correctly in cartesian coordinates by using a conical shell for the element of volume.

8. *Degenerate conics*, by Professor A. J. Lewis, University of Denver.

The author shows some of the elementary methods of determining when the general equation of the second degree in two variables will give a degenerate conic.

9. *Linkages in relation to certain aspects of college geometry*, by Professor M. L. Madison, Colorado A. and M. College.

The author gave a brief historical sketch of linkages from the time James Watt patented his "parallel motion" in 1874. The use of linkwork models, a number of which were exhibited, as aids in teaching college geometry, analytic geometry, and plane geometry was discussed.

10. *Materials for teaching mathematical meanings in the elementary school*, by Professor Lucy L. Rosenquist, Colorado State College of Education, introduced by A. E. Mallory.

The mathematical meanings that need to be taught in the elementary school are the various relationships between "groups." These groups are the chance groupings met in everyday experience, and the standard groupings of our number system. The processes of addition, subtraction, multiplication, and division are methods of changing chance groupings into standard groupings. Children learn to handle groups with progressively more mature methods as their understanding of groups and group relationships develops. Concrete materials which aid in developing this understanding should have the following characteristics: (1) Compact contours; (2) Patterned arrangement, or capability of being easily arranged in patterns; (3) Freedom from elements that embed the number ideas. These materials are not to be used as demonstration materials by the teacher. Pupils should have opportunities to manipulate materials in discovering solutions to their problems, and in recognizing constant relationships between groups. The explanation of these individual discoveries to the class affords opportunity for clarification of the ideas, and stimulates insight into the meaning of the number system and the computational processes.

11. *Looking backward and forward*, by Professor A. J. Kempner, University of Colorado.

After the program of papers, a joint meeting was held with the Mathematics Section, Eastern Division, Colorado Education Association. There were raised problems relating to the reorganization of mathematics training in the schools of Colorado. Later, a panel, consisting of representatives from elementary, secondary, and college levels attempted to give solutions to these problems.

W. K. NELSON, *Acting Secretary*

THE APRIL MEETING OF THE KANSAS SECTION

The thirty-fourth annual meeting of the Kansas Section of the Mathematical Association of America was held at Kansas State College in Manhattan, on Saturday, April 2, 1949. Sessions were held in the morning and afternoon. Professor R. G. Sanger presided at these sessions. The morning session was a joint meeting with the Kansas Association of Teachers of Mathematics.

The attendance was one hundred fifty-five including the following forty-two members of the Association: Sister M. Nicholas Arnoldy, R. W. Babcock, Wealthy Babcock, Florence L. Black, Frances N. Breneman, Virginia L. Chatelian, W. R. Cowell, L. E. Curfman, Lucy I. Dougherty, Paul Eberhart, Walter Fleming, Albert Furman, W. H. Garrett, Laura Z. Greene, Edison Greer, J. R. Hanna, K. C. Hsu, Emma Hyde, W. C. Janes, L. E. Laird, C. F. Lewis, Anna Marm, Margaret E. Martinson, Thirza A. Mossman, E. P. Northrop, S. T. Parker, P. S. Pretz, G. B. Price, O. M. Rasmussen, C. B. Read, C. A. Reagan, L. M. Reagan, R. G. Sanger, G. W. Smith, R. G. Smith, W. T. Stratton, C. B. Tucker, Gilbert Ulmer, E. B. Wedel, A. E. White, Ferna E. Wrestler, P. M. Young.

At the business meeting the following officers were elected for next year: Chairman, R. G. Smith, Kansas State Teachers College; Vice-Chairman, L. M. Reagan, University of Wichita; Secretary-Treasurer, Anna Marm, Bethany College.

The following papers were presented:

1. *The role of mathematics in general education*, by Professor E. P. Northrop, College of the University of Chicago.

The speaker deplored the fact that teachers of mathematics, in attempting to formulate courses within a program of general education, are in the habit of thinking in terms of subject-matter (content) alone, or at most of deriving ends (aims, objectives) from subject-matter. He pointed to general lack of agreement among teachers concerning what subject-matter is most appropriate, and expressed skepticism of the meaningfulness of courses constructed from the standpoint of subject-matter. He proposed an approach to the problem through initial consideration of ends—of the kinds of abilities and understanding the student ought to acquire from a general education. He listed those ends which he regarded as important and which he felt could best be achieved through the study of mathematics, and pointed out that at least some of them could be served equally well by alternative choices of subject-matter. Briefly put, the speaker argued for an ends-to-means rather than a means-to-ends (or means alone) approach to the formulation of mathematics courses