R E P O R T  R E S U M E S

ED 010 575 56

THE ORGANIZATION OF INTERRELATED INDIVIDUAL PROGRESS AND ABILITY LEVEL COURSES IN MATHEMATICS AT GARBER HIGH SCHOOL--DESCRIPTIVE ANALYSIS.

BY- BRATTEN, JACK E.
SYSTEM DEVELOPMENT CORP., SANTA MONICA, CALIF.

REPORT NUMBER NDEA-VIIA-1130-18 PUB DATE 27 JAN 66
REPORT NUMBER BR-5-0738-18
REPORT NUMBER TM-1493-161-00
GRANT OEG-7-14-9120-217
EDRS PRICE MF-$0.09 HC-$0.80 20P.

DESCRIPTORS- *CURRICULUM DEVELOPMENT, *INSTRUCTIONAL DESIGN, *SYSTEMS ANALYSIS, *MATHEMATICS CURRICULUM, *COURSE ORGANIZATION, INDIVIDUAL INSTRUCTION, STUDENT NEEDS, INSTRUCTIONAL INNOVATION, PROGRAMED INSTRUCTION, SANTA MONICA, CALIFORNIA, ESSEXVILLE, MICHIGAN, CONTINUOUS PROGRESS PLAN SCHOOLS

THE OBJECTIVES, PROCEDURES, AND USE OF RESOURCES THAT CHARACTERIZE THE MATHEMATICS DEPARTMENT AT THE GARBER HIGH SCHOOL AT ESSEXVILLE, MICHIGAN, WERE DESCRIBED IN THE SECOND OF A SERIES OF THREE REPORTS. THE MAJOR OBJECTIVES WERE (1) TO PROVIDE ALTERNATE VERSIONS OF THE FUNDAMENTAL SUBSTANTIVE AREAS TO ACCOMMODATE SEVERAL LEVELS OF STUDENT ABILITY, (2) TO PROVIDE STUDENTS WITH THE MEANS TO PROGRESS THROUGH SUBSTANTIVE MATERIAL AS INDIVIDUALS, INDEPENDENTLY FROM EACH OTHER, AND (3) TO PROVIDE A CURRICULUM FROM MATHEMATICAL CONCEPTS WHOSE RELATIONSHIP WITHIN THE DEPARTMENT AND WITH OTHER DEPARTMENTS IS UNDERSTOOD. THE PROCEDURES EMPLOYED INCLUDED (1) SETTING STUDENT EXPECTANCIES, (2) TEACHING CONCEPT MASTERY, (3) HELPING STUDENTS BY INSTRUCTIONAL ASSISTANCE, (4) USING STUDY GUIDES, (5) GROUPING STUDENTS, AND (6) SWITCHING BETWEEN COURSES. THE FUNCTIONAL SPACE AREAS INCLUDED (1) CLASSROOMS, (2) DEPARTMENT OFFICE AREA, (3) LEARNING RESOURCES AREA, AND (4) TESTING AREA. MEDIA USED IN THE DEPARTMENT AND PERSONNEL ROLES WERE ALSO DESCRIBED. RELATED REPORTS ARE ED 010 574 AND ED 010 576. (RS)

VII A-1130
(6-0738)

The research reported herein was conducted under SDC's independent research program and supported in part by Grant 7-14-9120-217 from the Office of Education, U. S. Department of Health, Education, and Welfare.

TM-1493/161/00

AUTHOR Jack E. Bratten

TECHNICAL

RELEASE Harry F. Silberman

for Jules Schwartz

DATE 1/27/66 PAGE 1 OF 20 PAGES

# TECH MEMO

*a working paper*

System Development Corporation / 2500 Colorado Ave. / Santa Monica, California

## Garber High School: Descriptive Analysis



ABSTRACT

This is the second in a series of documents reporting the work done with Garber High School in connection with the study New Solutions to Implementing Instructional Media Through Analysis and Simulation of School Organizations. This document presents a detailed description of the objectives, procedures and use of resources that characterize the mathematics department at Garber.

* * * * * *

## I. INTRODUCTION

Garber High School, Essexville, Michigan, opened in the fall of 1964 and is presently midway in its second year of providing instruction. During this period, the school has put into effect many procedures aimed at attaining its ultimate goals. Full implementation of the school's plans must wait on developments such as completion of the student body in 1966, and completion of all the materials necessary to support the school's instructional goals. SDC document TM-1493/160/00, dated 4 January 1966, described Garber High School in its over-all aspect as a total organization. The school is taking an approach to meet the individual educational needs of its students that even in its present incomplete form, is outstanding among the nation's high schools. The mathematics program at Garber exemplifies this approach and the plan guiding the development of the program was selected by the authors for detailed study. The present document describes the approaches to instruction that are being taken within the mathematics department.

## II. TECHNICAL DISCUSSION

### A. GENERAL DESCRIPTION

The mathematics program at Garber High School serves all six years of this combined junior-senior high school (Appendix A). Currently, approximately 580 (85 percent of all students) are enrolled in one of the 29 courses offered by the mathematics department. Since the school is just in its second year of operation, the program in mathematics is not fully implemented. One consequence is that some of the courses are not presently used because there are not, as yet, students with the necessary mathematics background to require them. Table 1 lists all of the courses offered in mathematics along with the present enrollment in each course.

Garber requires that all first-, second-, and third-year* students enroll in a mathematics course. In addition, every student must take a general mathematics abilities test during his fifth year in the school. If this test is passed, the student is considered to have met state mathematics requirements for graduation. If the test is failed, the student must take a special course to review his basic arithmetic during his sixth year. This course prepares him for re-examination.

The instructional staff in mathematics consists of the chairman of the department, Mr. Charles Josephson, and four instructors. The staff was selected on the basis of general rather than special mathematics skills so that each instructor can handle courses covering a wide range of subject matter. Typically an instructor will meet with students in groups for about 20 hours each week. The length of time for groups varies from 40 to 100 minutes and the size of groups ranges from about 10 to 40 students.

### B. DIRECTIONS AND PRESENT STATUS OF THE MATHEMATICS PROGRAM

The mathematics program at Garber High School is guided by three major objectives whose collective purpose is to provide sufficient variation in instruction that the needs of each student may be met. One objective is to provide alternate versions of the fundamental substantive areas such as algebra, geometry, etc., so that several levels of student ability can be accommodated in each area. This has been accomplished in several courses (see Appendix A for a description of courses). For example, a version of elementary algebra (Math 300), designed

*Garber does not use conventional grade level terminology because of its ungraded curriculum. Students are identified by the number of years they have done satisfactory work beyond elementary school. Thus a conventional seventh grader is designated at Garber as a first year student; an eighth grader, second year; etc.

Table 1. Courses and Current Enrollment in Mathematics

| Course Name | Description | Year to be Taken | Present Enrollment |
|---|---|---|---|
| Math 100 | Pre-Algebra I | 1 | 81 |
| Math 101 | Pre-Algebra I and II | 1 | 24 |
| Math 102 | Functional Mathematics I | 1 | 16 |
| Math 200 | Pre-Algebra II | 2 | 69 |
| Math 201 | Elementary Algebra | 2 | 28 |
| Math 202 | Functional Mathematics II | 2 | 39 |
| Math 300 | Practical Mathematics | 3, 4, 5, 6 | 31 |
| Math 301 | Elementary Algebra | 3, 4, 5, 6 | 135 |
| Math 302 | Functional Mathematics III | 3, 4, 5, 6 | 0 |
| Math 303 | Selected Concepts of Elementary Algebra | 3, 4, 5, 6 | 68 |
| Math 305 | Independent Study in Mathematics | 3 | 3 |
| Math 306 | Independent Study in Practical Math | 3 | 0 |
| Math 400 | Technical Mathematics I | 3, 4, 5, 6 | 15 |
| Math 401 | Advanced Algebra | 3, 4, 5, 6 | 0 |
| Math 403 | Selected Concepts of Advanced Algebra | 3, 4, 5, 6 | 0 |
| Math 405 | Independent Study in Mathematics | 4 | 1 |
| Math 406 | Independent Study in Practical Math | 4 | 0 |
| Math 500 | Technical Mathematics II | 3, 4, 5, 6 | 16 |
| Math 501 | Plane and Solid Geometry | 3, 4, 5, 6 | 60 |
| Math 503 | Selected Concepts of Geometry | 3, 4, 5, 6 | 0 |
| Math 505 | Independent Study in Mathematics | 5 | 2 |
| Math 506 | Independent Study in Practical Math | 5 | 0 |
| Math 601 | Advanced Mathematics | 5, 6 | 0 |
| Math 602 | Review of Basic Arithmetic Skills | 6 | 0 |
| Math 603 | Continuation of 303, 403 or 503 | 5, 6 | 0 |
| Math 605 | Independent Study in Mathematics | 6 | 0 |
| Math 606 | Independent Study in Practical Math | 6 | 0 |
| Math 701 | Calculus | 5, 6 | 0 |
| Math 705 | Independent Study in Mathematics | 6 | 0 |

as a course for students of lesser ability, differs from one designed for those with greater aptitude in several ways. The "slower" version permits a student to spend more time on specific concepts by breaking them into finer-grained subconcepts. This enables the student to proceed slowly in small steps through materials which a more capable student may grasp in larger portions. Because the faster student can cover more material in the same time, his course contains additional concepts not included in the slower version. Moreover, the methodology and media used for instruction vary according to the level of the course. The faster versions tend to emphasize individual learning from several related textbooks and are more apt to be organized for individual progress (discussed below). Slower versions depend less on the students' ability to acquire information through reading and more on group presentations by instructors. Slower versions also tend to focus on skills rather than concepts and hence emphasize practical experience gained through drill and projects.

A second objective guiding the development of the mathematics program is to provide students with the means to progress through substantive material as individuals, independently from each other. Ideally, such a course organization would permit each student to spend only the time he personally requires to attain mastery of a concept. When he is able to demonstrate mastery of the concept by passing a test, he moves on to the next concept in the course. In practice, Garber was able to implement a modified version of this kind of course during its initial year of operation and has extended the approach to two others during the current year. In these courses, students are permitted some freedom to progress at their own learning rates with the constraint that the same minimum progress goals are established for all students. Course grades depend in part on the ability of the students to meet these common goals. For example, a student whose time in a course exceeds an additional one-third of the minimum goal, fails the course; not meeting the goal, limits his possible grade to a "B." The assumption is made that if a student has great difficulty in meeting these minimum requirements, he is in the wrong version of the course.

Because of this provision for individual progress, some students may complete the prescribed concepts in a course in less than a typical school year while others may take longer. A result of this feature on individual students is that those with superior ability may complete more than the traditional one course per year during their six years at Garber. On the other hand, students with lesser abilities may work continuously in mathematics during their six years in school but only complete four or five courses. Theoretically both kinds of students attain equal mastery when they take the same course; differences in ability are reflected by the amount of time required for attainment. In practice, students are not permitted unlimited time to achieve mastery, hence attainment is not equal for all students in the same course.

A third objective guiding the organization of Garber's mathematics department is to provide a curriculum from mathematical concepts whose relationship within the department and with other departments is explicitly understood. Each mathematics course is viewed as a set of concepts. A particular course is

formed on the basis of communality of subject matter, e.g., pre-algebra, algebra, geometry, etc., and according to a presumed level of student ability for which it is intended. For example, there is a set of concepts that make up a course so that mathematically apt first-year students can cover pre-algebra with about one year's work. By contrast, two consecutive courses covering the same concepts over two years are provided for less able students. The two-year sequence is interlaced with concepts providing a review of arithmetic skills not included in the one-year course.

Not only are parallel courses within the mathematics department related through a common sharing of concepts, as in the above example, but work has been accomplished relating mathematics courses to courses in other departments through correlating concepts. To date, correlations have been made with industrial education, and will be extended to science, business, and homemaking. The product of this effort is a guide for instructors that lists the correlated concepts in industrial education courses for each mathematical concept. Instructors in mathematics are expected to know which of their students are taking the correlated industrial courses and to use individual conferences and special assignments to capitalize on the student's interrelated needs. This is seen as advantageous to a student in two ways. First, he is provided with assistance in developing his mathematical tools for industrial education courses when it is needed; and second, he is provided with meaningful experiences in the exercise of his mathematical skills.

Garber's view of its mathematics curriculum is basically as a complex sequence of interrelated concepts that become grouped into a course because there is a group of students with a common need to attain the same set of concepts who are relatively similar in their ability. A course is therefore an administrative convenience that permits a group of students to be treated alike, i.e., to share the same resources (instructor, media, space, and time).

## C. PROCEDURES

The procedures used by the Garber High School mathematics department are under continuous critical review and revision. As a consequence, the following descriptions of the means employed by the department to achieve its objectives are mainly suggestive.

### 1. Setting Student Expectancies

In order to meet the instructional needs of each student as an individual, the mathematics department holds an annual planning conference with each student. In this conference, a year's study in mathematics is projected for the student. Two factors are considered in making this estimate: one, the particular courses to be taken; and two, the amount of progress (expressed in concepts) that the student can realistically be expected to make during his next year.

The product of this conference is a formal agreement between the department and student that the latter must complete certain specific concepts in order to receive credit for the course. This agreement is signed by the instructor conducting the conference and the student, and kept on file in the department. Figure 1 illustrates the form that is used.

## 2. Concept Mastery Testing

The mathematics department maintains a test bank in a room adjacent to the teachers' general office.* Multiple forms of tests for all concepts are filed in this room. Students who have prepared themselves for tests proceed according to instructions published by the mathematics department and reproduced in this report as Appendix B. Students may take tests at any time they do not have a scheduled class, during established testing hours. Upon completing a test, the student places it in the course instructor's incoming box. Normally the test will be graded and returned to the student on the following day. Usually, students are permitted to take a second test if they are not satisfied with their performance on the first.

## 3. Helping Students

In courses organized for individual progress where students spend the bulk of their time working individually, the mathematics department strives to provide instructional assistance at the time it is needed. Two procedures are available to students: one, applicable when students are in their mathematics class; and the other, when they are in study hall.

Individual progress classes meet regularly in a room accommodating about 30 students. Usually the time a student spends in this class will be devoted to reading and working exercises. An instructor is always present in this room to give assistance to any student who has a need. Occasionally several students with a similar need for help will form a small discussion group with the instructor in one corner of the room. Sometimes an instructor perceives that the whole class has a need for help and will prepare and present a lecture to fill this need.

When students are in study hall and have a need for assistance in mathematics, they may go to the department office area and speak to any instructor who is there. The mathematics instructors are extremely sensitive to students' needs for help and make a point of providing it. The school procedure of issuing



*This is described as the mathematics laboratory in TM-1493/160/00.

STUDENT: _____
(Last name first)

During this school year you will be expected to complete the following concepts in the mathematics courses shown:

| | | | |
|---|---|---|---|
| COURSE(S): | | | |
| CONCEPT NUMBERS: | | | |

If you are able to complete these concepts in a shorter time than is anticipated you will be free to pursue advanced topics ahead of the normal schedule.

"I understand that in order to receive credit for this year of mathematics study it will be necessary to complete the above concepts."

SIGNED: _____

Figure 1. Form Used to Record Student's Expected Performance

maturity passes* to students makes it relatively easy for the student to seek help.

## 4. Use of Study Guides

Study guides have been prepared by the staff of the mathematics department and published for those courses operating on an individual progress basis. The guide tells the student what he must do to prepare himself for each of the concepts mastery tests. The guide is organized according to the concepts included in the course. For each concept there is a list of aims that tells the student in general terms what he is to learn. Next is a "Comments" section that advises the student on varied approaches that might be used to attain the concept. Following this is a detailed program for the student to follow that lists the things he should do (reading assignments, exercises, etc.) and notes the time he should spend in order to accomplish the particular concept. In addition, the guide contains many helpful hints as to what the student might do to get the most from his activities as well as some supplementary instructional materials. The guide may refer the student to any of several media for reading, viewing, listening, or exercising.

## 5. Grouping Students

After initial course assignment, grouping in the mathematics department at Garber is based first on the course a student is taking and second on his progress within a course. As a general rule, students with similar instructional needs are placed together. For example, about 170 students are enrolled in Math 301. This course meets with five instructors in five separate rooms. Students are assigned to a particular instructor on the basis of the particular concept on which they are working. Thus one instructor will have the students who are furthest behind in the sequence of concepts, for instance, concepts 5 and 6; another will have those in the middle range, concepts 6 and 7; and the third will have the students who are in the vanguard.

*Maturity passes are issued to all students. Those with green passes may leave their study halls by merely signing out to go to the learning resources area, library, laboratories, or to the teachers' general office. Yellow passes are issued to first- and second-year students, permitting them limited freedom to move about the school. Red passes are given to those students who have demonstrated an inability to handle freedom; they are not permitted movement without escort.

Students are freely moved from one group to another as their individual relationship to the total group shifts. This procedure is thought to have a motivating effect on students, which it may have. One thing that it does accomplish, however, is to restrict the range of concepts over which an instructor must continually be prepared to teach by providing him with a group with similar instructional needs. There are times when large groups of students may be formed by consolidating all of the sections in one course. This usually occurs during the first several days of the school year and infrequently after that. During the first days there is a need for all students to receive a common orientation to procedures used in the course as well as a general introduction to the subject matter. This is accomplished by lectures prepared for presentation to a total class. There are a few general topics, e.g., use of the slide rule, for which special large groups, such as all students in their third year, have a common instructional need. The department prepares and presents large group instruction for these special groups.

### 6. Switching Between Courses

As described previously, the mathematics department provides parallel courses devoted to the same general content such as pre-algebra, elementary algebra, etc. Each of these parallel versions is designed for a particular level of student ability. Students whose performance in a particular course is deemed inappropriate, may switch to a more appropriate course without completing the original. Thus a student enrolled in Math 301, elementary algebra, may indicate by his performance that he should be switched to Math 303 (essential algebra, a skills-oriented version of elementary algebra). Likewise, a student enrolled in Math 300, practical mathematics, may indicate by superior performance that he can succeed in Math 303 and consequently be shifted to that course.

## D. SPACE

The functional space areas used by the mathematics department are (1) the classrooms, (2) the department office area, (3) the learning resources center, and (4) the testing area.

### 1. Classrooms

The classrooms used by the mathematics department function either as individual study areas or as typical instructor-centered classrooms depending on the particular course using the room. In most cases, classes meet in rooms created by movable partitions from large areas. Garber's space is quite easily arranged into various sized rooms, and the mathematics department uses this flexibility to provide a classroom to fit each of its courses. Occasional needs for large group instruction can be met by combining several smaller rooms into one large area. Classroom furniture can be arranged to suit the particular instructional need of a course. Student desks are easy to move into any desired configuration. Typically, desks are arranged in rows facing the teacher.

## 2. The Department Office Area

Garber maintains a large open area where all teachers have office space (described in greater detail in TM-1493/160/00). The desks of the mathematics department chairman and instructors are clustered rather tightly together in one corner of this area. One feature of the department approach to instruction is that students may come to this area at virtually any time for assistance. It is therefore not unusual for several different activities to be occurring simultaneously in the department office area. For example, one teacher may be correcting examinations, another may be consulting with a student, while a third is monitoring the test activity.

## 3. Learning Resources Area

The learning resources area contains the learning resources center, the library, and space for students to use audiovisual materials, conduct small group discussions or study independently. The mathematics department uses the center to make supplementary learning materials available to students. The student may borrow audio tapes specially prepared to supplement specific concepts, programmed texts, etc., as needed.

## 4. Testing Area

In individual progress courses testing is an important activity that requires time, materials, and space in fairly sizeable amounts. For example, the individual progress version of Math 301 has 11 concepts and is given to about 125 students. In the first place, since each student may take two tests at the conclusion of each concept, it is necessary to prepare and store 22 different tests. Allowing each student the freedom to schedule a test when he is ready for it may result in as many as 22 times 100, or 2,750 different test administrations during a normal school year in just one course.

As a solution to this problem, the department has established a test area and procedures governing its use. The procedures were described previously in Section II, C. The test area is in a room adjacent to the teachers' office area. The room contains a large file where various test forms are stored and where completed tests may be deposited. It also contains four large work tables where students may sit while writing their examinations. Facilities are available for the simultaneous testing of 25 students. If more than this number sign up for a test on a particular day, the test is scheduled into a larger room.

## E. MEDIA USED IN THE MATHEMATICS DEPARTMENT

The mathematics department at Garber High School employs a wide range of media in achieving its instructional objectives. The particular concepts being learned, the needs of students for assistance and the particular course organization are major determinants of the medium employed. For example, first- and second-year courses are taught mainly by text and related group lecture. Thus the typical accoutrements, such as overhead projectors, filmstrips, etc., are available and may be used. By contrast, most third-year courses are organized for individual progress and hence employ study guides, textbooks, supplementary materials, and personal consultation with instructors as primary media.

The importance of the study guide as used at Garber in its relationship to media and to courses organized for individual progress cannot be overemphasized. The guide, while in itself not strictly a medium of instruction, is the medium for organizing a course for students. The guide provides a program for the student that directs him to various instructional media. He may, for example, be directed to read a specific section in one text, work through a section in a programmed text, view a filmstrip, listen to an audio tape, work a set of exercises from a workbook and finally subject himself to an oral quiz from the instructor all in connection with a particular concept. Use of a study guide provides an instructor with a capability for employing a wide range of media that are tailored to particular concepts and to the various levels of student ability.

## F. PERSONNEL ROLES

The organizational structure of the mathematics department at Garber High School as it relates to personnel is made up of two positions, that of department chairman and instructor. Student teacher assistants are planned at Garber and as the student body in this new school matures, the mathematics department will use several to aid with some of the nonprofessional administrative tasks.

The chairman is the department's point of contact with other organizational elements of the school. He is a member, along with chairmen from the science, industrial education, business, homemaking, and physical education departments, of Team B. A function of this group is to interrelate the curricula from the separate departments by first, identifying common substantive concepts across departments, and second, creating learning situations that will capitalize on the overlapping needs of students. The chairman of the mathematics department is also responsible for implementing the school's instructional policies within the department. It is his responsibility to provide the means so that the mathematics department can attain the school's educational objectives related to the individualizing of instruction.* In addition, the chairman is an instructor and as such, has duties and responsibilities similar to other instructors.

*See TM-1493/160/00 for a discussion of Garber's instructional objectives.

The role of the instructor in mathematics at Garber may be viewed in connection with the functions of administration, diagnosis, explanation, and organization. The following list presents examples of some of the tasks performed under each of these functions.

1. Administrative Tasks

   a. Check student attendance and maintain record.

   b. Collect and record daily work output of student. Maintain check list of progress.

   c. Assign concept grades, quarter grades, and final grades.

   d. Administer testing procedures.

2. Diagnostic Tasks

   a. Review aptitude and performance and assign student to group that most nearly fits his instructional needs.

   b. Consult with students to help them define possible courses of action in solving their learning problems.

3. Explanatory Tasks

In general, an instructor is not viewed as the primary source for presenting substantive materials--this is the function of textbooks, audio tapes, filmstrips, etc. It is the instructor's job to do whatever he can to enhance the effectiveness of primary source materials by providing explanation and reteaching where needed. The instructor may do the following in this connection:

   a. Prepare additional problem sets or explanatory materials for individual use.

   b. Convene a small group whose members have similar needs for explanation and provide the necessary supplementary instruction.

   c. Prepare and present lectures to the whole class when it is deemed necessary.

4. Organizational Tasks

All instructors share in the tasks involved in organizing instruction. Involved is the preparation of the procedures and materials that make the instructional process function. Examples of tasks are:

a. Preparation of procedures.

b. Preparation of tests and their revision.

c. Preparation of study guides.

# APPENDIX A

## Description of Mathematics Curriculum

The mathematics curriculum is designed to provide for the diversified requirements and abilities of those needing mathematics for everyday use, for broad cultural purposes, and for advanced study.

Each mathematics course includes a prescribed number of concepts to be completed by students in order to receive credit for the course. It is assumed that some students will complete the prescribed number of concepts in less than the 9 1/2 months' school calendar year and will, therefore, receive credit earlier in the year. Likewise, students who work at a slower pace may need more than the 9 1/2 months' school calendar year to complete the prescribed concepts for course credit.

In order to help each student plan what he might realistically expect to accomplish each year in mathematics, a year's study will be projected at the beginning of each school year. In other words, if the student can realistically be expected to complete only one-half of a course in a given year, this will be indicated. The content of the year's study will be based upon four things: (1) recommendation of previous instructors as approved by the mathematics department; (2) rate of progress in previous mathematics classes; (3) present level of achievement; and (4) acceptance by the student.

The following list will serve to establish the amount and kinds of credit that are available in mathematics. Notice that courses with even numbers are application-oriented, while odd-numbered courses emphasize theoretical content.

Math 100 is Pre-Algebra I and is a review of the fundamentals of arithmetic and an introduction to concepts designed to prepare the student for advanced study in secondary school mathematics.

Math 101 is Pre-Algebra I and II and combines the content of Mathematics 100 and 200. Students who complete Math 101 successfully will be enrolled in Mathematics 201.

Math 102 is functional Mathematics I designed for students who have a history of slow achievement in arithmetic and/or reading.

Math 200 provides Pre-Algebra II which is designed to maintain and develop arithmetic skills and to present concepts of geometry, probability, applications, and problem solving for the student who will be enrolled in Mathematics 300, 301, or 303 during his third year.

Math 201 is an elementary algebra course and covers the same concepts as Mathematics 301.

Math 202 is functional Mathematics II and provides a continuation of Mathematics 102. Attempt is made, on an individual basis, to provide assistance in areas where competence in arithmetic skills is low.

Math 300 is practical mathematics and is planned for students whose records indicate slow achievement in the past, and likely lack of success in Mathematics 301. Students may enter from Math 200, 202, or 302.

Math 301 is elementary algebra and includes the development of skills of elementary algebra, to and including graphing, solution of simultaneous linear equations in two variables and the solution of quadratic equations. Capable students, or students who have completed Mathematics 200 ahead of schedule, should be able to complete Math 301 by the end of their third year; others may require an additional one-half year to complete this course.

Math 302, a continuation of Mathematics 202, is functional Mathematics III. Although concept content is similar to Mathematics 300, students are evaluated primarily on the basis of effort, rather than achievement.

Math 303 includes selected concepts of elementary algebra and is for students who are able to complete most of the concepts of Mathematics 301 but in a less rigorous approach. The particular concepts are chosen in consultation with the instructor upon entrance into the course. Entrance to Math 303 may be from Math 200, 300, or 301; students who complete Math 303 may elect to enroll in Math 400, 403, or 503.

Math 400, technical Mathematics I, is designed for students who have completed the basic content of pre-algebra at a high level, possess fair arithmetic skills, but indicate a need for a more concrete approach to mathematics than is offered by the odd-numbered courses. Students may enter Math 400 from Math 201, 300, or 303.

Math 401, which is advanced algebra, is a continuation and review of Math 301, developing the concept of function, extensions of number systems, exponential, logarithmic and trigonometric functions and an introduction to infinite sequences and series.

Math 403 includes selected concepts of advanced algebra and is for students who are able to complete some, but not all, of the concepts of Math 401. See Math 303. Entrance may be from Math 301, 303 (in special circumstances), 500, or 401.

Math 500, technical Mathematics II, is similar to Math 400 and is open to students who have completed Math 403 or 503 and (in special cases) 201 or 301. It is designed to provide a "break" in the odd-numbered sequence of mathematics courses for the student who needs to explore some practical application of the theoretical mathematics that he has learned.

Math 501, which is plane and solid geometry, is a rigorous development of Euclidean geometry, including some plane analytic geometry, the concepts of area and volume, and the concepts of congruence and similarity. Open to students from Math 301, 401, and (in special cases) 500 and 503.

Math 503, selected concepts of geometry, is for students who are able to complete some, but not all, of the concepts of Math 501. Open to students from Math 301, 303, 400, 403, 500, and 501.

Math 601, concepts of advanced mathematics, is for students who have successfully completed the "01" sequence of mathematics courses or who have completed the necessary work in Math 603 to qualify for Math 601. There are three different sequences of concepts that comprise Math 601: (1) pre-calculus mathematics, (2) abstract (linear and matrix algebra), (3) probability and statistics. Which of these sequences is appropriate for the individual student should be determined by a conference with [the student,] the instructor and counselor, since it may be determined by the student's future goals.

Math 602 is a review of arithmetic skills and is designed to help any students who have not been able to pass the basic arithmetic skills examination which is administered during the fifth year. Math 602 does not fulfill the mathematics requirement for graduation.

Math 603, selected concepts of algebra and geometry, is designed for students who have completed some, but not all, of the concepts of Math 301, 401, and 501, and who desire to pursue the remaining concepts that are within reach. The amount of course credit and course content for individual students will be arranged.

Math 701, which is calculus, is for the superior student who wishes to work toward advanced placement credit in mathematics at the college level. Students should be aware, however, that advanced placement credit is awarded by colleges, not by secondary schools, and is usually based upon outstanding performance on competitive examinations administered during the sixth year.

Math 305, 405, 505, 605, 705 is independent study in mathematics and may be elected by any student who has demonstrated the ability and initiative to establish his own goals, his own methods of achieving those goals, and has obtained the approval of the mathematics department for a tentative program of study. Credits will generally be offered in 1/2 units to cover a half-year's work.

Math 306, 406, 506, 606 is independent study in practical mathematics. Similar to the "05" sequence, this sequence is designed to accommodate any student in the even-numbered sequence of courses who is able to proceed on an independent study approach.

# APPENDIX B

## Mathematics Department Test Administration

[The materials presented below are the instructions to the student for taking tests:]

All Concept Final Examinations for mathematics classes, Levels 300, 400, and 500, will be given in accordance with these instructions, unless directions to the contrary are given by individual teachers. In addition, all retests (regardless of class level) will be administered as indicated here. To take a concept final examination, or a retest, do this:

(1) Obtain a "CONCEPT FINAL REQUEST FORM" from the instructor or from the Mathematics Test Bank (adjoining the teacher's room.)

(2) Fill out the form completely, including the concept number of the final and the time at which you would like to have the test administered. Give the form to your teacher for approval, and verification that you are ready for the concept final.

(3) Go to the test bank at the time you have requested. Bring with you pencil, scratch paper and any tools you may need. If you are coming from a check-out area, you are responsible for reporting to that area first. At the test bank a teacher will administer the examination that has been requested. IF FOR SOME REASON YOU ARE UNABLE TO KEEP YOUR TESTING APPOINTMENT, SIMPLY REPEAT THE ABOVE PROCEDURE.

(4) Concept Finals and retests will be administered only at the times listed as TEST BANK HOURS. Requests for test administration through the test bank at any other times cannot be honored since there are no instructors available to administer the tests.

(5) Papers will be graded by your instructor and then returned directly to your file in the mathematics department area of the teacher's room. Every effort will be made to have tests graded on the day following administration.

(6) Tests must be completed in one sitting, so be sure you have sufficient time (45 to 60 minutes) remaining when you begin writing.

TEST BANK HOURS

(COMPARE THESE HOURS WITH YOUR CLASS SCHEDULE TO SEE WHEN YOU ARE FREE FOR MATHEMATICS TEST ADMINISTRATION: THEN REQUEST YOUR EXAMINATIONS ACCORDINGLY.)

MONDAY: From 9:15 until 11:30, and from 12:15 until 1:30.

TUESDAY: From 10:45 until 11:30, and from 1:00 until 2:15.

WEDNESDAY: From 11:00 until 11:45 and from 12:30 until 3:30.

THURSDAY: From 9:15 until 10:15 and from 11:30 until 12:15; also, from 1:15 until 3:30.

FRIDAY: From 9:15 until 10:00; from 11:15 until 12:00 and from 1:15 until 3:00.