# MATHEMATICS

# IN IOWA

# HIGH SCHOOLS

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1959-1960

# INTRODUCTION

Since the announcement of Sputnik being put into orbit, a wave of examination of the mathematics program in the United States has passed over us. In support of the importance of mathematics courses to our total educational program, the national government has passed the National Defense Education Act.

In order to review the status of instruction in mathematics in the 614 approved four-year public high school districts of Iowa, an attempt has been made in this booklet to give as complete a picture as the data available in the State Department will allow. Most of these data were obtained from a compilation of answers to a mathematics questionnaire sent to every public high school in Iowa.

In order to make the information more meaningful the terms used in this book are defined as follows:

(1) Teacher of mathematics: any person who taught one or more classes in mathematics in grades 9 through 12.
(2) Unit: the amount of credit gained by a pupil who successfully completes a thirty-six weeks course for the required number of minutes per week as specified by the State Board of Public Instruction.
(3) Advanced algebra: the algebra course that follows two semesters of freshman or beginning algebra.
(4) Fifth semester algebra: the algebra course following two semesters of advanced algebra (sometimes referred to as "college algebra").
(5) Basic mathematics courses: general mathematics, freshman algebra, plane geometry, advanced algebra, trigonometry, solid geometry, analytic geometry and fifth semester algebra. All other courses in mathematics other than these eight shall be referred to throughout this study as "Other Mathematics Courses".

# HOW MANY UNITS OF MATHEMATICS WERE OFFERED AND/OR REQUIRED ?

UNITS OF MATHEMATICS OFFERED:

An increased demand for qualified mathematicians has placed a strain on high school mathematics programs. Many schools are adding new courses each year to meet the challenge. One hundred eighty-two schools indicated that they had added courses in mathematics in 1959-1960 as compared with the previous year (not including alternate-year subjects).

Forty-two schools had discontinued teaching certain mathematics courses. Solid geometry was fused with plane geometry or other advanced courses. Trigonometry was also fused with advanced algebra to form a senior mathematics course.

The majority of the districts (88.8 per cent) offered from two to five units in mathematics, while 57.8 per cent offered from three to four units. It is interesting that seven schools offered one unit or less, and an equal number offered seven or more units. The mean of all schools was 3.6 units.

Table I below shows the high school districts according to the number of units of mathematics offered for the 1959-1960 school year. Table II shows the number of units of mathematics required for graduation according to the number of schools making such requirements. Most of the schools (597 out of 614) require one or two units; eight schools require three units and one school required no units at all.

## TABLE I

### MATHEMATICS OFFERINGS

| High School Enrollment | Number of Districts | Number of High School Districts Offering | | | | Average Math. Units Offered |
|---|---|---|---|---|---|---|
| | | 4 or More Units of Math. | 3 Units of Math. | 2 Units of Math. | 1 Unit of Math. | |
| 0- 24 | 2 | 0 | 0 | 2 | 0 | 2.0 |
| 25- 49 | 64 | 4 | 25 | 33 | 2 | 2.5 |
| 50- 74 | 86 | 16 | 45 | 23 | 2 | 2.9 |
| 75  99 | 88 | 28 | 43 | 16 | 1 | 3.1 |
| 100-149 | 135 | 74 | 50 | 10 | 1 | 3.6 |
| 150-199 | 72 | 53 | 17 | 1 | 1 | 4.1 |
| 200-299 | 76 | 61 | 15 | 0 | 0 | 4.2 |
| 300-399 | 32 | 27 | 4 | 1 | 0 | 4.5 |
| 400-499 | 19 | 19 | 0 | 0 | 0 | 4.9 |
| 500-599 | 13 | 13 | 0 | 0 | 0 | 5.4 |
| 600-above | 27 | 25 | 2 | 0 | 0 | 4.7 |
| Totals or Averages | 614 | 320 | 201 | 86 | 7 | 3.6 |

The average number units of high school mathematics offered ranged from 1.0 in the smaller high school districts to approximately 5 units in the larger high school districts with an average of 3.6 units for all public four-year high school districts in the state.

## TABLE II

UNITS OF MATHEMATICS REQUIRED FOR GRADUATION IN IOWA'S APPROVED FOUR-YEAR PUBLIC HIGH SCHOOL DISTRICTS FOR SCHOOL YEAR 1959-1960

| Number of Schools | Number of Units Required | |
|---|---|---|
| 1 | 0 | |
| 0 | ½ | |
| 290 | 1 | |
| 7 | 1½ | Mean 1.52 Units |
| 307 | 2 | |
| 1 | 2½ | Mode 2 Units |
| 8 | 3 | |

# WHAT MATHEMATICS COURSES WERE OFFERED ?

MATHEMATICS OFFERINGS FOR 1959-1960:

The mathematics courses offered in 1959-1960 school year by Iowa's four-year public high schools are given in the two figures which follow.  Figure 1 shows the percentage of schools which offered the "basic mathematics" courses, while Figure 2 pictures the myriad of "other mathematics" courses offered, grouped in six catagories according to type of course.

As would naturally be expected, the greatest percentage of schools offered freshman algebra (99.3 per cent); plane geometry was offered by 88.9 per cent; general mathematics by 56.0 per cent and advanced algebra by 66.2 per cent.

It should be realized that "arithmetic courses" in Figure 2 included many different courses identified by an equally great number of names, but basically they were all arithmetic courses and the number of schools offering such courses were nearly equal to those offering trigonometry, solid geometry, analytic geometry and fifth semester algebra.
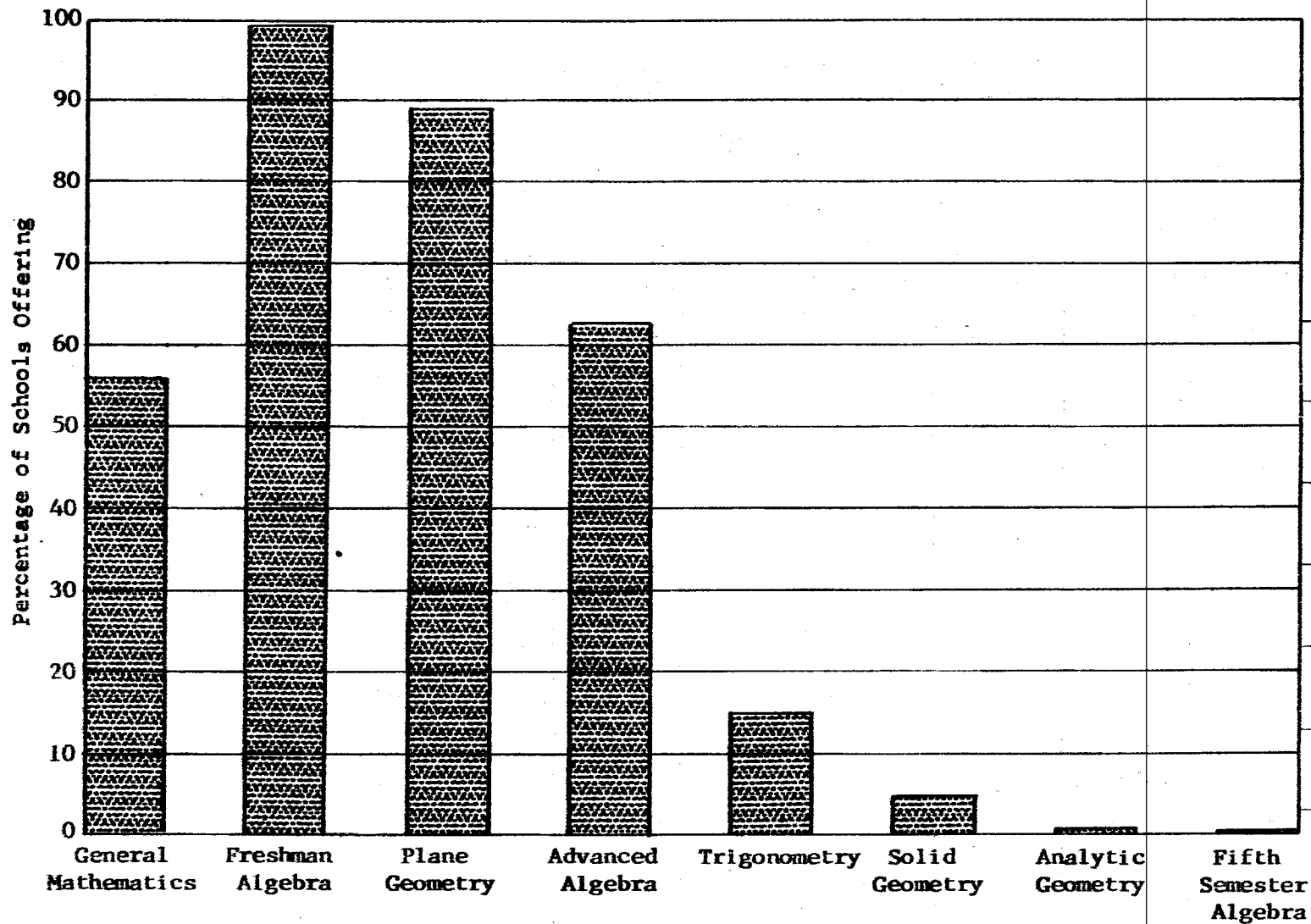
FIGURE 1

PERCENTAGE OF IOWA HIGH SCHOOLS
OFFERING "BASIC MATHEMATICS" COURSES
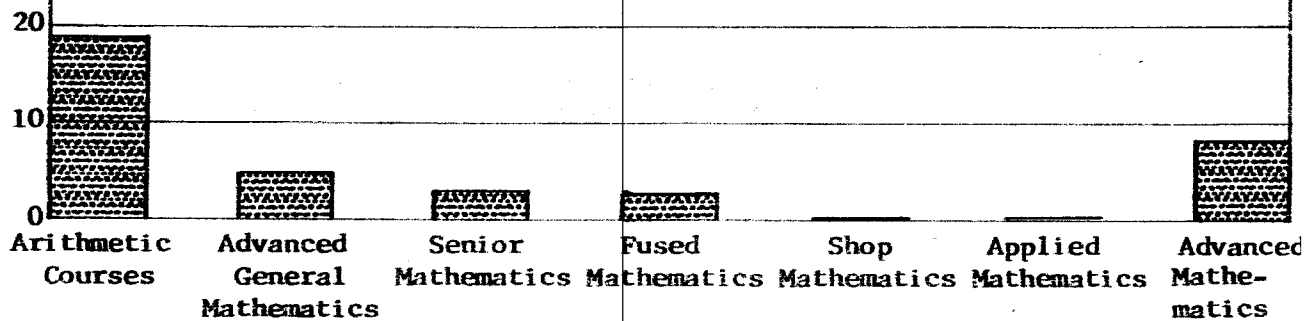FOR THE SCHOOL YEAR 1959-1960



FIGURE 2

PERCENTAGE OF IOWA HIGH SCHOOLS OFFERING "OTHER MATHEMATICS" COURSES FOR THE SCHOOL YEAR 1959-1960

Freshman algebra was required in 85.6 per cent of Iowa public high school districts; general mathematics was required in nearly three times as many schools as plane geometry; and very few (3) schools required any of the advanced mathematics courses. Forty-nine schools required one of the courses classified as "other mathematics".

Of the elective courses, plane geometry and advanced algebra were the most popular. About half as many offered trigonometry as an elective. The rest of the electives were spread fairly evenly over the entire range of courses. The different courses and whether or not they were required or elective in the public high schools of Iowa are recorded in Figure 3.
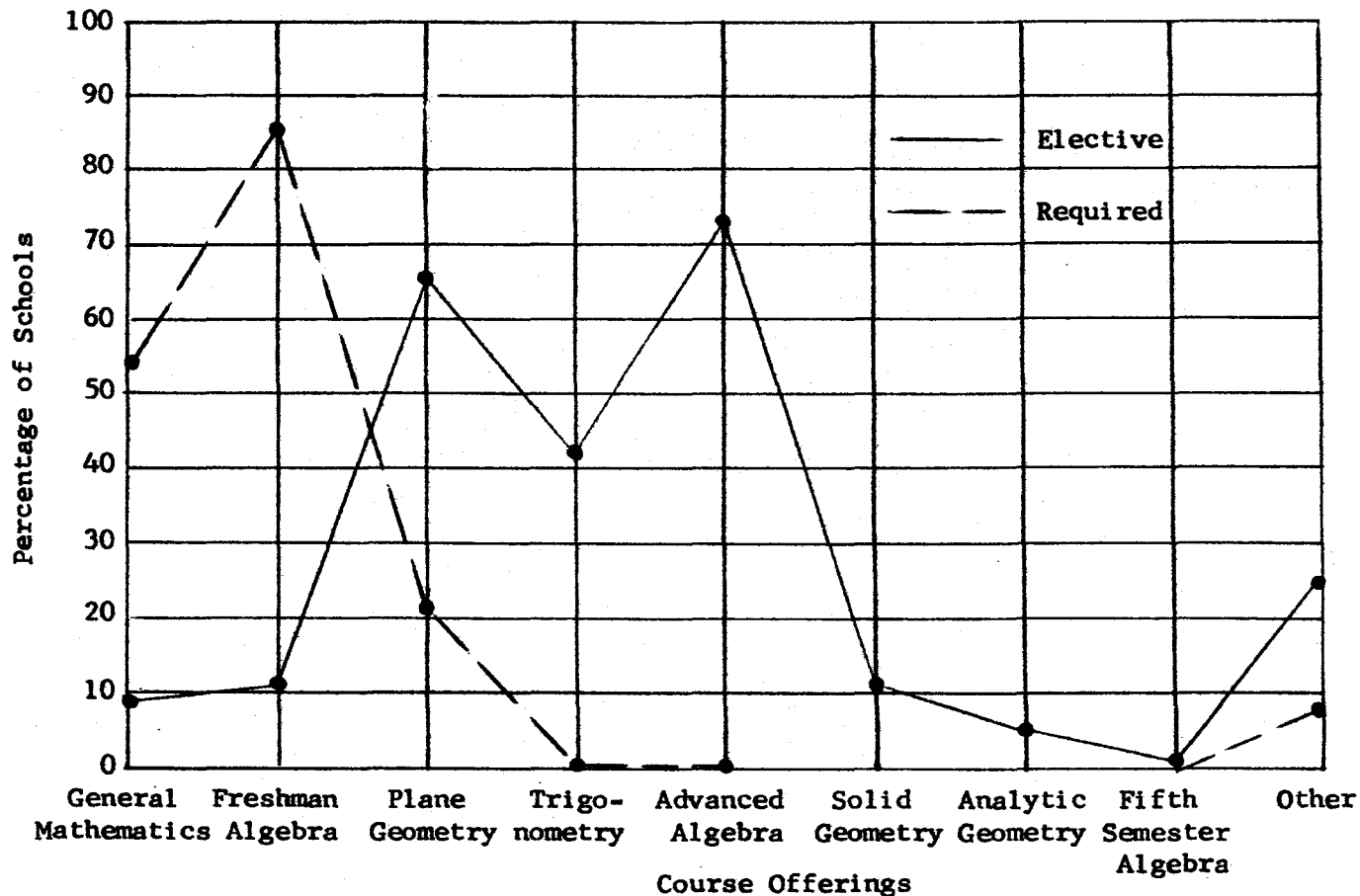


FIGURE 3

ELECTIVE AND REQUIRED MATHEMATICS COURSES IN THE 614 APPROVED FOUR-YEAR PUBLIC HIGH SCHOOLS OF IOWA FOR THE SCHOOL YEAR 1959-1960

AT WHICH GRADE LEVEL

WERE DIFFERENT COURSES IN MATHEMATICS OFFERED ?

MATHEMATICS COURSE OFFERINGS BY GRADES:   •

The distribution of the course offerings in mathematics by grade levels is given in Figure 4.  It is interesting that 91.6 per cent of the schools offered freshman algebra in the ninth grade and 59.6 offered general mathematics.  This may indicate the trend toward a two-track program in mathematics starting at the ninth grade level.  Not many courses other than these two were offered to freshman pupils.

The offerings at the tenth grade level followed the traditional plane geometry with 77.8 per cent, but it is significant that over 40 per cent of the school districts offered general mathematics or freshman algebra at the tenth grade level, too.  This may have been done to allow pupils who enrolled in general mathematics as a freshman to take freshman algebra as a sophomore course, and then proceed to the more advanced mathematics in his eleventh and twelfth year.  In order to allow for individual differences and to challenge the brilliant pupil, a few schools offered trigonometry, advanced algebra and solid geometry to tenth grade pupils.  It is becoming more popular to offer advanced algebra immediately after freshman algebra.

The mathematics offerings in the eleventh grade ran the entire gamut.  The highest percentage, of course, was in advanced algebra with 60.0 per cent of the districts offering that course, while only half as many (36.4 per cent) offered plane geometry and only about one-third (19.2 per cent) offered trigonometry.  Several of the schools continued to offer general mathematics and freshman algebra--apparently for those pupils who decided rather late to pursue a mathematics course, or for repeat or remedial pupils.

The offerings in the twelfth grade followed nearly the same course as the eleventh except that plane geometry and trigonometry switched places in popularity and the more advanced courses were offered by a greater percentage of schools.

It should be noted that the percentage of schools offering no mathematics at the different grade levels progresses rapidly from the ninth grade through the twelfth, nearly doubling itself at each grade level.
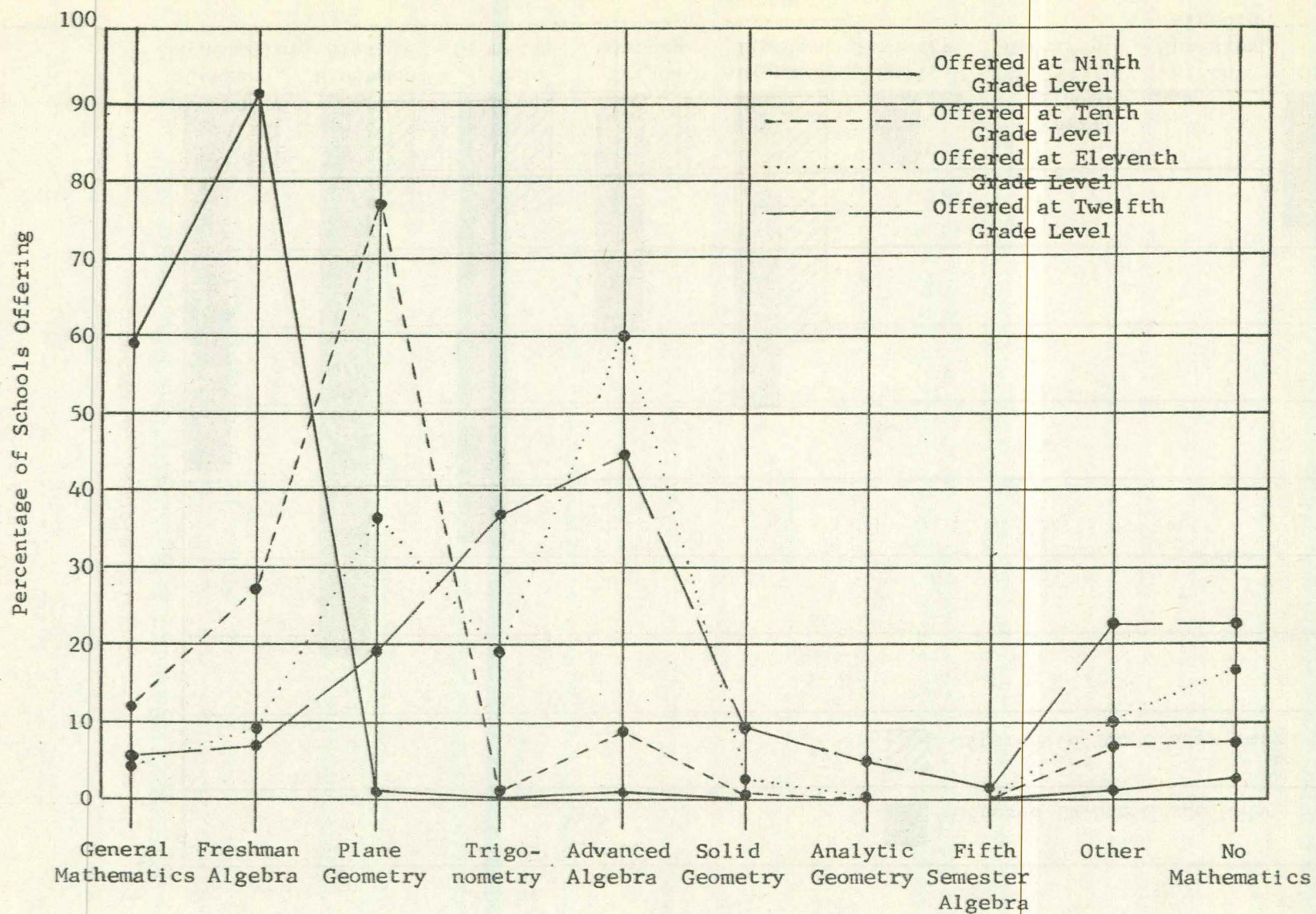
FIGURE 4

MATHEMATICS COURSE OFFERINGS BY GRADE LEVEL IN 614 APPROVED FOUR-YEAR PUBLIC HIGH SCHOOL
DISTRICTS IN IOWA

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Some mathematics courses were offered in only one grade (represented by the solid black bars) and some were offered in two different grades (represented by the diagonal lined bars) as illustrated in Figure 5 below. Freshman algebra was a one-grade offering in more instances than any other course, with plane geometry following closely behind. More schools offered advanced algebra to combined-grades than any other mathematics subject.
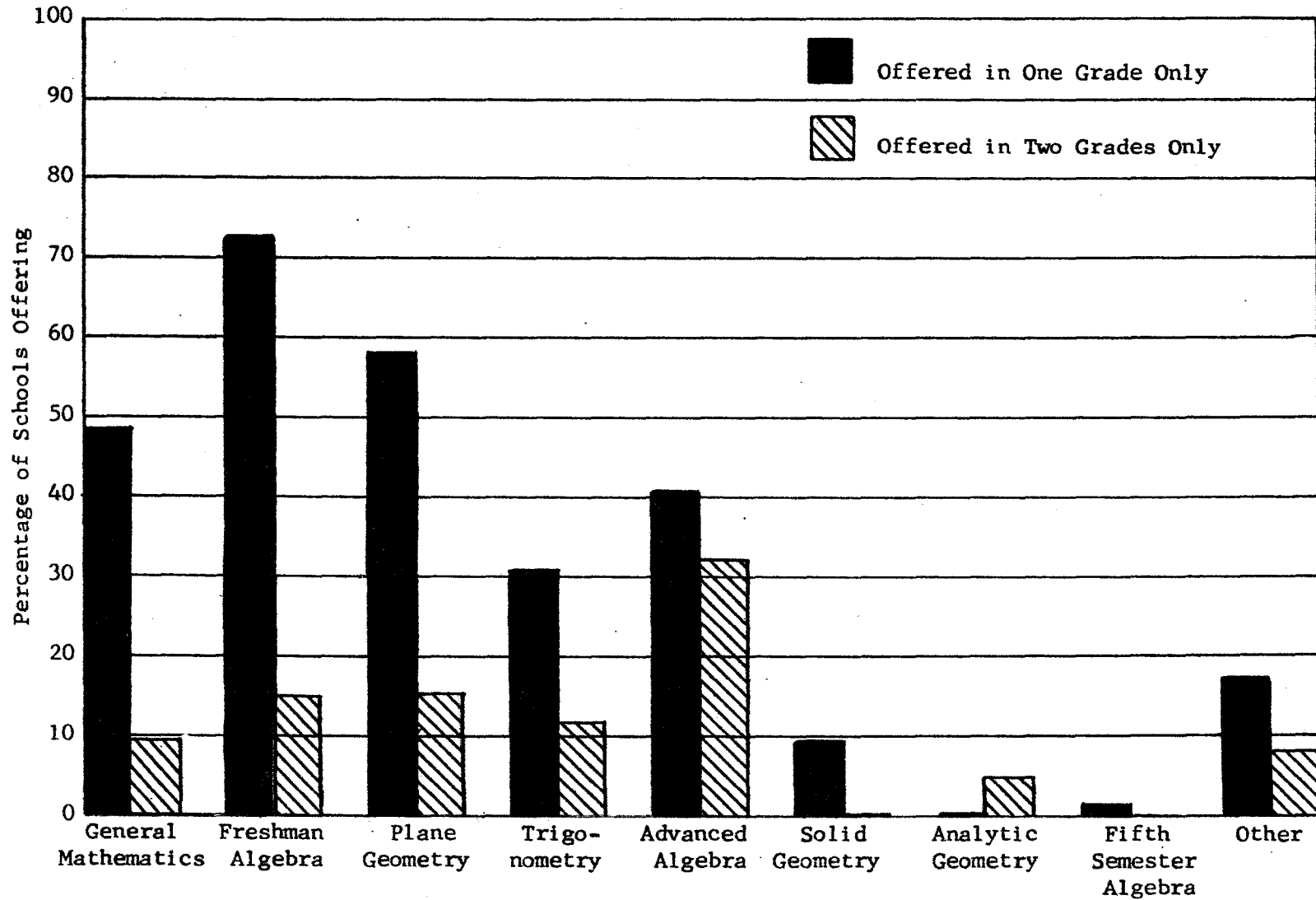


FIGURE 5

MATHEMATICS COURSES OFFERED TO ONE GRADE ONLY OR TO A COMBINATION OF TWO GRADES
IN IOWA PUBLIC HIGH SCHOOLS DURING THE 1959-1960 SCHOOL YEAR

# WHAT IS A TYPICAL

# MATHEMATICS PROGRAM

# IN IOWA HIGH SCHOOLS ?

## TOTAL MATHEMATICS PROGRAMS:

Most of the mathematics programs in Iowa public high schools centered around the four courses of general mathematics, freshman algebra, plane geometry and trigonometry. Different combinations of these four courses with advanced algebra, solid geometry and analytic geometry and fifth semester algebra, along with the other mathematics courses listed below were used to make up the programs for each high school in Iowa as shown in Chart 1 below. For example, in program number 10 these four courses were offered in combination with advanced algebra, solid geometry and one "other" course by 3.4 per cent of the public high schools of Iowa.

A few schools offered only one course in mathematics; one school provided no mathematics courses for the year.

The subjects listed as "other" on the chart included advanced arithmetic, advanced basic mathematics, advanced mathematics, analytic mathematics, applied mathematics, arithmetic, basic arithmetic, business arithmetic, business mathematics, consumer mathematics, consumer arithmetic, functional arithmetic, mathematics V, refresher arithmetic, remedial arithmetic, senior mathematics, shop mathematics, trigonometry and calculus, vocational arithmetic and other fused mathematics.

Percentage of
Schools With
This Program

| Program Number | | Percentage |
|---|---|---|
| 1 | | 13.1 |
| 2 | | 13.1 |
| 3 | | 9.0 |
| 4 | | 8.7 |
| 5 | | 7.7 |
| 6 | | 7.7 |
| 7 | | 7.7 |
| 8 | | 6.8 |
| 9 | | 5.1 |
| 10 | | 3.4 |
| 11 | | 2.9 |
| 12 | | 2.7 |
| 13 | | 2.2 |
| 14 | | 2.0 |
| 15 | | 1.5 |
| 16 | | 1.4 |
| 17 | | 1.4 |
| 18 | | .7 |
| 19 | | .5 |
| 20 | | .3 |
| 21 | | .3 |
| 22 | | .3 |
| 23 | | .3 |
| 24 | | .2 |
| 25 | | .2 |
| 26 | | .2 |
| 27 | | .2 |
| 28 | | .2 |
| 29 | | .2 |

General Mathematics | Freshman Algebra | Plane Geometry | Trigo-nometry | Advanced Algebra | Solid Geometry | Analytic Geometry | Fifth Semester Algebra | Other

Course Offerings

CHART 1

COMBINATIONS OF COURSES MAKING UP THE TOTAL MATHEMATICS PROGRAM IN HIGH SCHOOLS, BY THE NUMBER
OF SCHOOLS OFFERING SUCH COMBINATIONS FOR THE SCHOOL YEAR 1959-1960

# HOW MANY PUPILS ENROLLED IN MATHEMATICS ?

# AND IN WHICH COURSES DID THEY ENROLL ?

For the 1959-1960 school year the total enrollment in the approved four-year public high school was 137,131. Fifty-seven per cent of these pupils were enrolled in mathematics courses of some kind. The figure below shows the percentage of those enrolled by grade level of courses. For example, 42.9 per cent of the total number of pupils enrolled in mathematics were taking ninth grade mathematics courses.
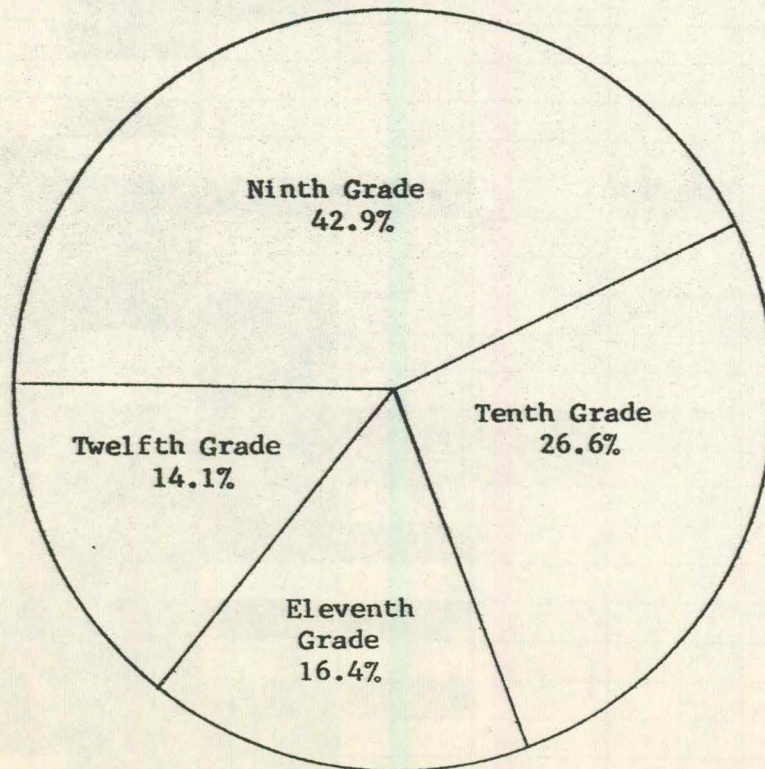


FIGURE 6

PERCENTAGE OF HIGH SCHOOL PUPILS ENROLLED IN MATHEMATICS BY GRADE LEVEL OF THE COURSES
IN WHICH THEY WERE ENROLLED IN 1959-1960 SCHOOL YEAR

## ENROLLMENTS BY GRADES:

Twice as many ninth grade pupils (enrolled in mathematics courses) chose freshman algebra than chose general mathematics. In the tenth grade nearly three-fourths of the pupils taking mathematics enrolled in plane geometry. Nearly half of the eleventh grade pupils took advanced algebra, while the twelfth grade pupils were distributed fairly evenly among trigonometry, general algebra and other mathematics courses.
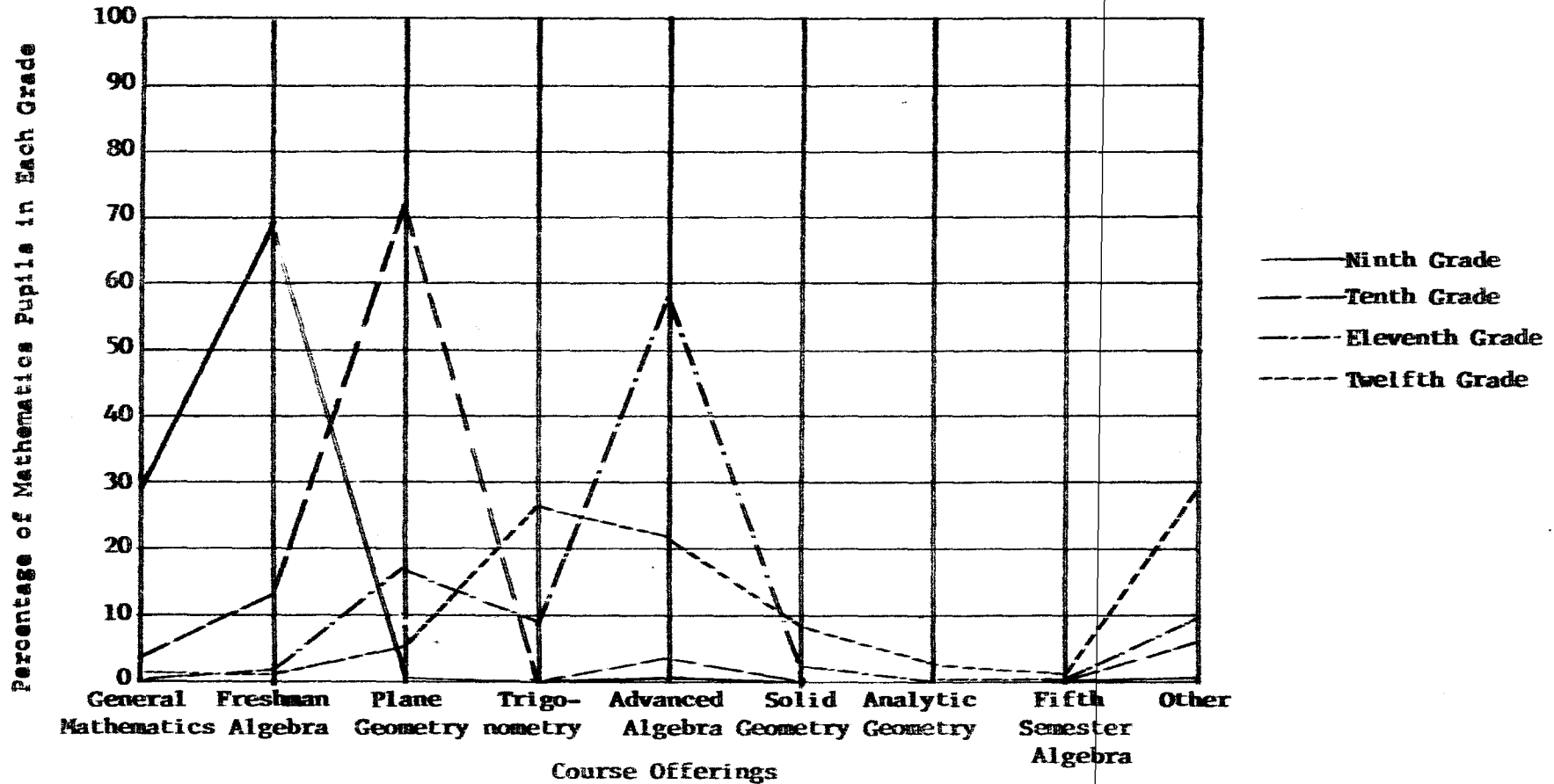


FIGURE 7

PERCENTAGE OF MATHEMATICS PUPILS IN EACH GRADE ENROLLED IN SPECIFIC COURSES

## TABLE 3

PERCENTAGE OF ENROLLEES IN MATHEMATICS COURSES FURNISHED BY EACH GRADE LEVEL

| Grade Level | Subject | Percentage of total Enrollment furnished by Different Grades in Different Courses |
|---|---|---|
| Ninth Grade | General Mathematics | 90.0 |
| | Freshman Algebra | 88.0 |
| | Plane Geometry | 1.6 |
| | Advanced Algebra | .6 |
| Tenth Grade | General Mathematics | 7.7 |
| | Freshman Algebra | 10.7 |
| | Plane Geometry | 82.8 |
| | Trigonometry | .9 |
| | Advanced Algebra | 7.3 |
| | Solid Geometry | 3.1 |
| Eleventh Grade | General Mathematics | .8 |
| | Freshman Algebra | .8 |
| | Plane Geometry | 12.2 |
| | Trigonometry | 28.9 |
| | Advanced Algebra | 69.3 |
| | Solid Geometry | 30.9 |
| | Analytic Geometry | 3.9 |
| | Fifth Semester Geometry | 16.8 |
| Twelfth Grade | General Mathematics | 1.5 |
| | Freshman Algebra | .5 |
| | Plane Geometry | 3.4 |
| | Trigonometry | 70.2 |
| | Advanced Algebra | 22.8 |
| | Solid Geometry | 66.0 |
| | Analytic Geometry | 96.1 |
| | Fifth Semester Algebra | 83.2 |

Note: For example (on the first line) of all pupils taking general mathematics, 90.0 Per cent came from the ninth grade; for freshman algebra, 88.0 per cent of the pupils enrolled in this course came from the ninth grade; etc.

# WHAT WERE THE QUALIFICATIONS

# OF TEACHERS OF MATHEMATICS ?
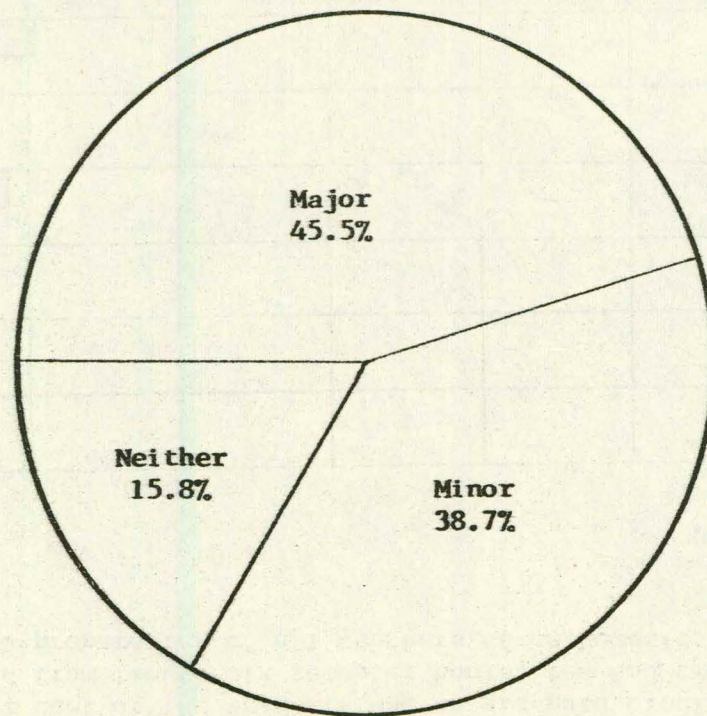
# AND WHAT WERE THEIR TEACHING LOADS ?



**FIGURE 8**

PERCENTAGE OF IOWA TEACHERS OF MATHEMATICS FOR SCHOOL YEAR 1959-1960 WITH MAJORS, MINORS, OR NEITHER MAJORS OR MINORS IN MATHEMATICS

Eighty-four per cent of all teachers of secondary mathematics in the 514 approved four-year public high schools in Iowa had at least a minor in mathematics.

Only about one in every sixty teachers of mathematics in Iowa had five semester hours or less of undergraduate work in mathematics and only one in six had less than a minor (fifteen hours) in mathematics. The mean semester of undergraduate work was 21.3.

With the help of National Science Foundation and institutes financed by commercial interests, many teachers had taken advantage of the opportunity to gain graduate credit in mathematics. But in spite of this, 64 per cent of the teachers had no graduate credit in mathematics. Of the remaining 36 per cent, many had from two to six semester hours; few had credits comparable to a Master's Degree. The mean for graduate preparation of all teachers of mathematics was 3.9 semester hours.
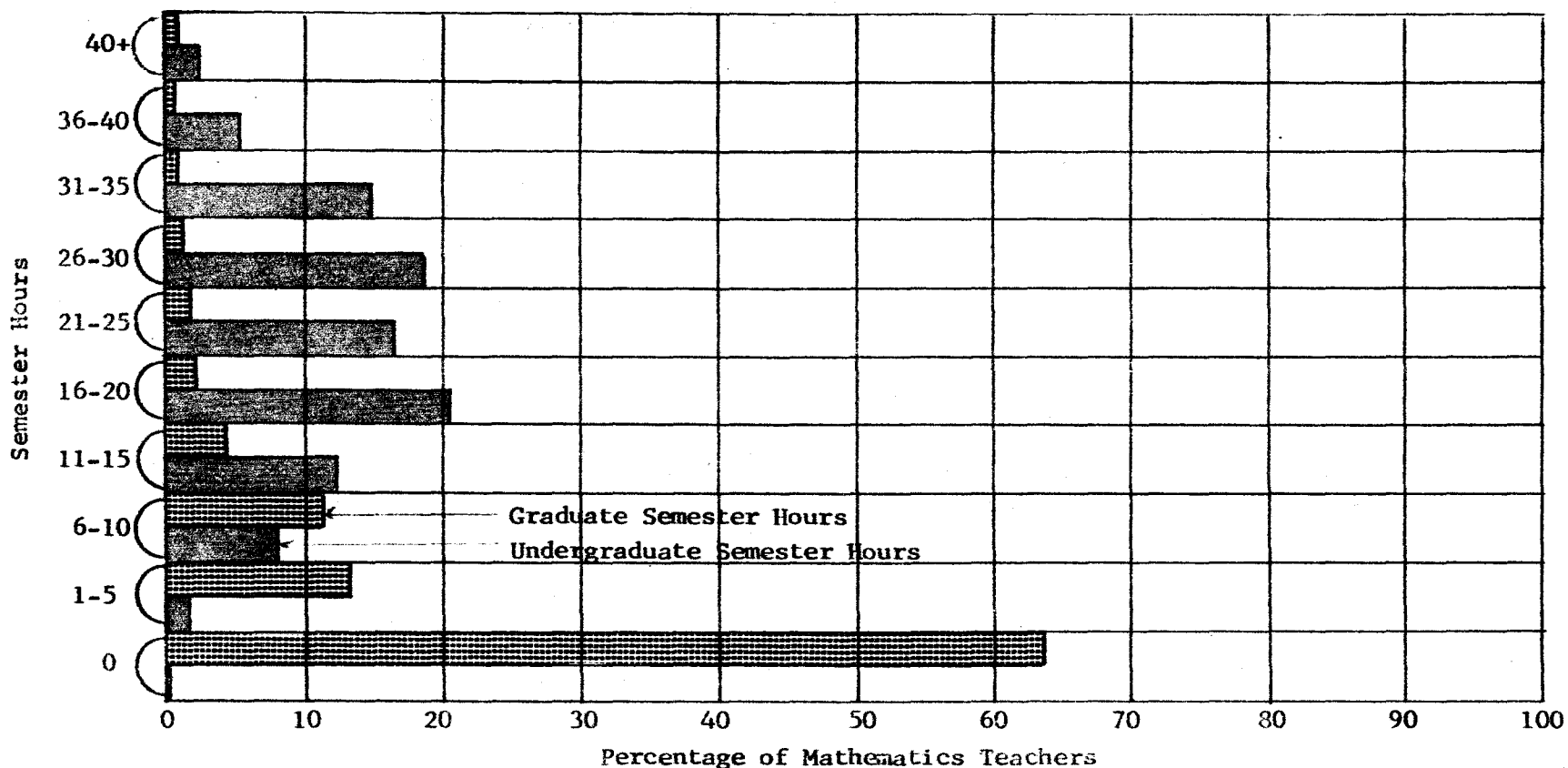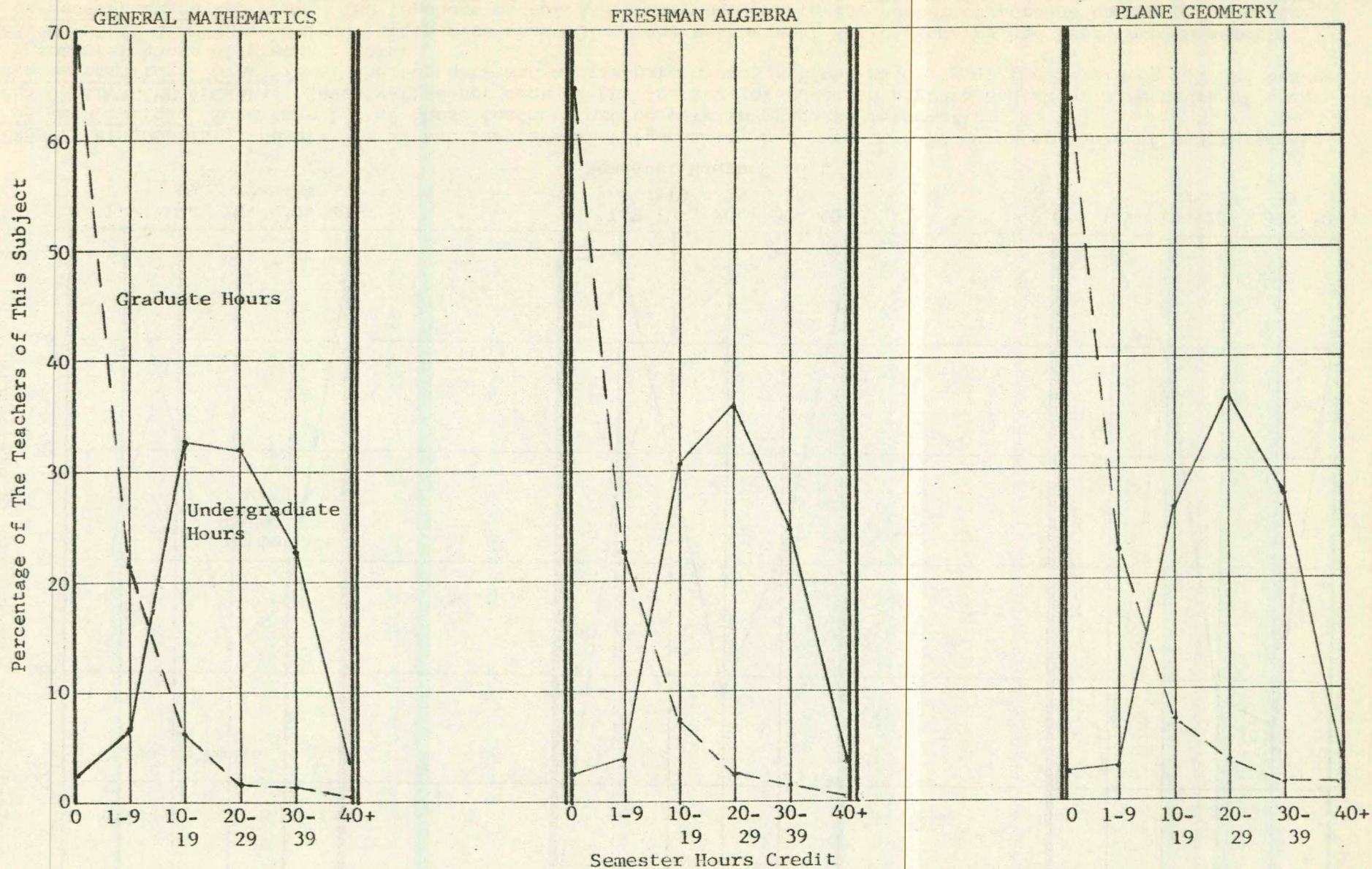


FIGURE 9

PROFESSIONAL PREPARATION OF APPROVED HIGH SCHOOL TEACHERS OF MATHEMATICS IN 1959-1960 SCHOOL YEAR

TEACHERS OF GENERAL MATHEMATICS:  Only 9% of the teachers of general mathematics had less than 10 semester hours of under-graduate mathematics; 68.9% had no graduate credits.  Very few teachers with 30 semester hours or more of graduate training were teaching general mathematics.

TEACHERS OF FRESHMAN ALGEBRA:  The majority of the teachers of freshman algebra had between 10 and 39 hours of under-graduate work but over half of them had no graduate work.

TEACHERS OF PLANE GEOMETRY:  Nearly 1/3 of the teachers of plane geometry had 30 hours or more of undergraduate work; another 1/3 had between 20 and 29 hours, and the rest had less than 19 hours.  Two-thirds of the teachers had no graduate hours, and about 23% had less than 10 hours of graduate work.  (Continued on next page)

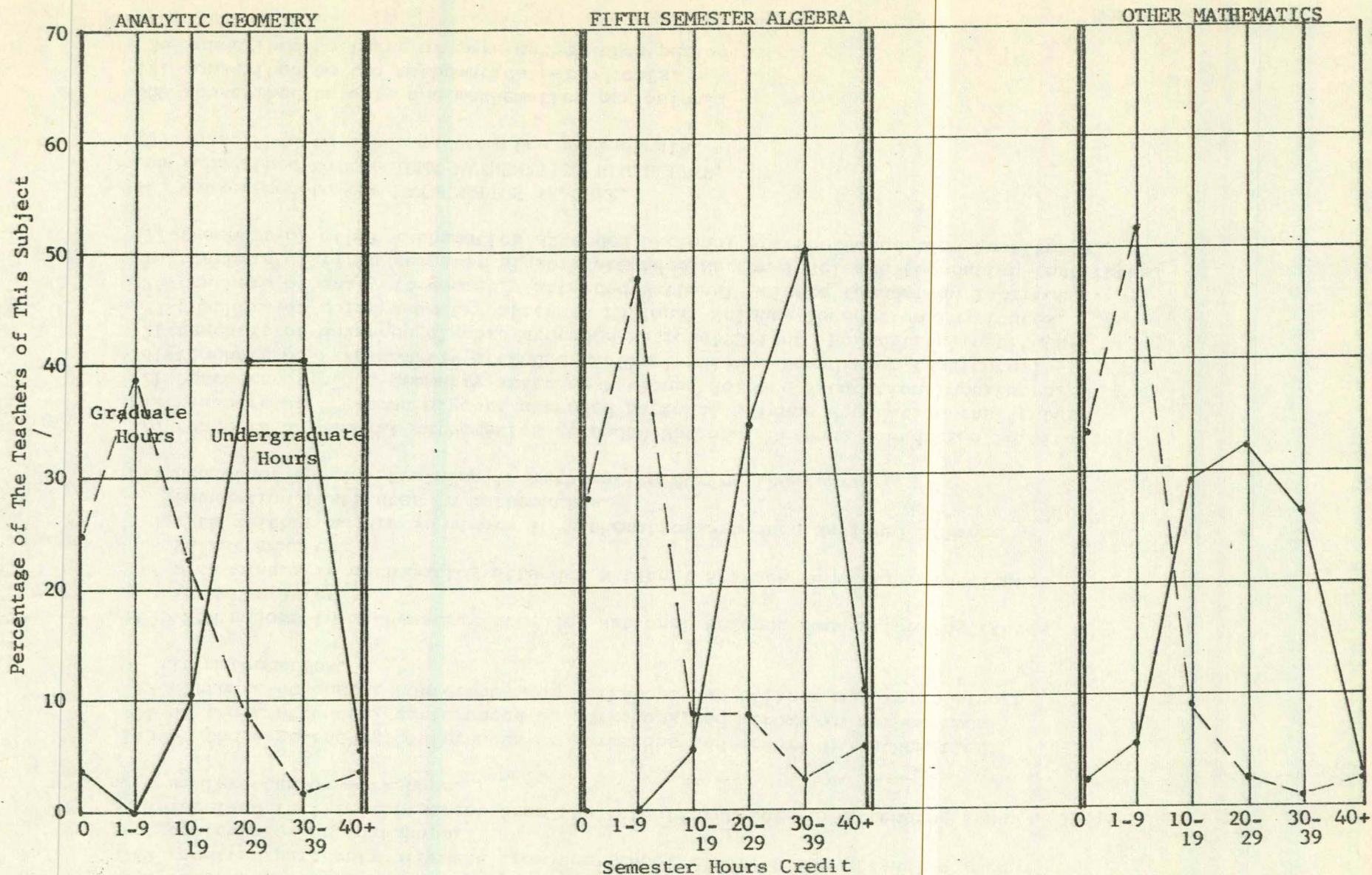# EDUCATIONAL PREPARATION IN MATHEMATICS FOR TEACHERS OF DIFFERENT COURSES OF MATHEMATICS: (Continued)
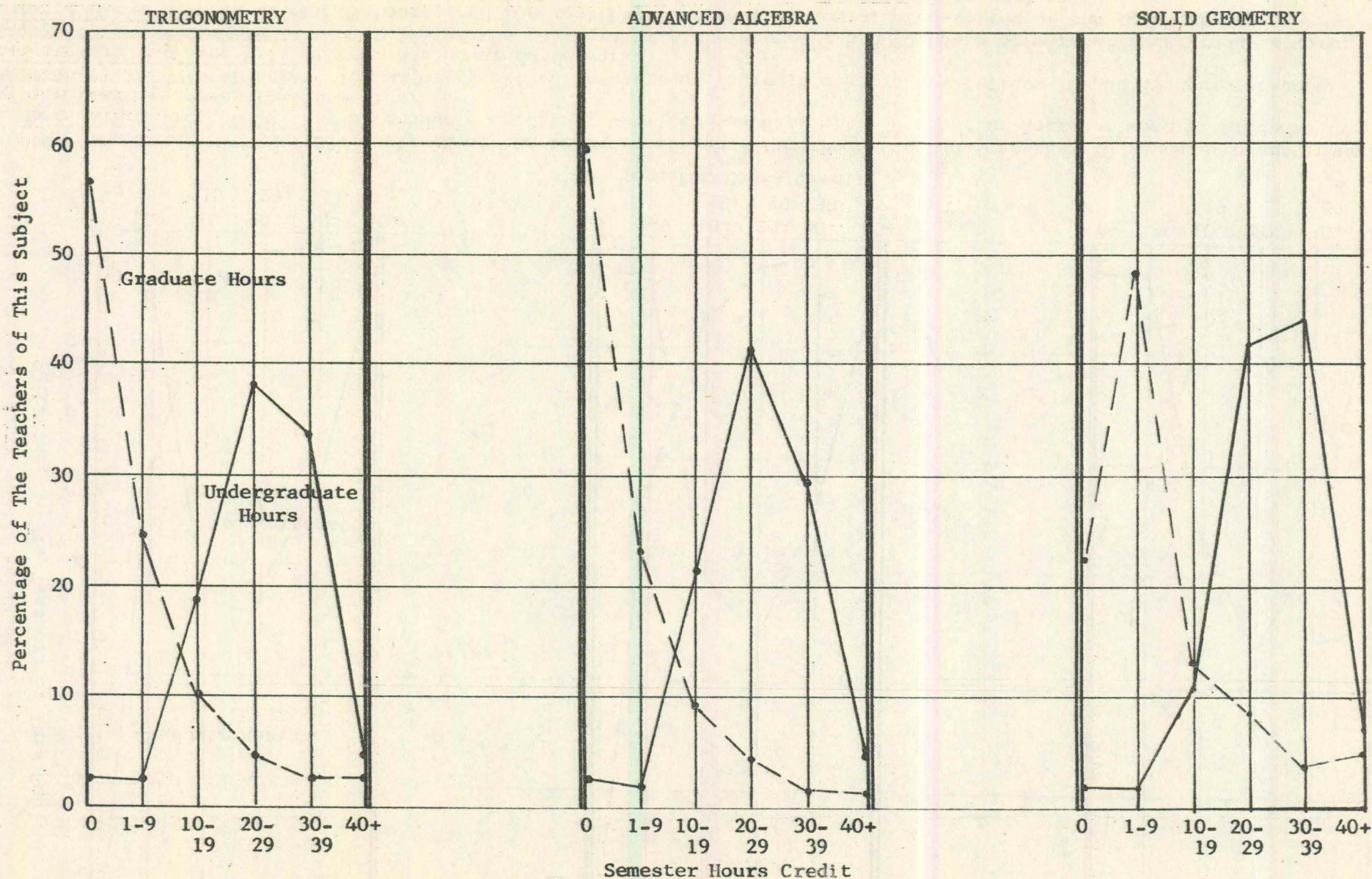


TEACHERS OF TRIGONOMETRY:  Nearly 3/4 of the teachers of trigonometry had more than 20 semester hours of undergraduate hours of mathematics.  More than 1/2 of these teachers had no work in graduate mathematics.

TEACHERS OF ADVANCED ALGEBRA:  Seventy-five per cent of the teachers of advanced algebra had 20 or more hours of undergraduate mathematics.  Over 1/2 of the teachers had no graduate hours, and the majority of the remaining 1/2 had between 1 and 9 semester hours of graduate work.

TEACHERS OF SOLID GEOMETRY:  Only a little more than 10% of the teachers of solid geometry had less than 20 semester hours of undergraduate training.  The teachers of solid geometry had the fewest number of persons having no graduate semester hours--a little over 22%.  Nearly 1/2 of them had from 1 to 9 semester hours of graduate work and 1 in every 20 had more than 40 hours of graduate work.  (Continued on next page)

TEACHERS OF ANALYTIC GEOMETRY: Fourteen per cent of analytic geometry teachers had less than 20 semester hours of under-graduate preparation. Eight out of every 10 had between 20 to 39 semester hours of undergraduate work. Only 1/4 of these teachers had no graduate work; 1/3 had from 1 to 9 hours and 1/4 had 10 to 19 hours of graduate work.

TEACHERS OF FIFTH SEMESTER ALGEBRA: Fifth semester algebra teachers were the best qualified so far as preparation is concerned. Over 60% of them had 30 or more semester hours of undergraduate work and not one had less than 10 hours. A little over 1/4 of them had gained graduate credits but nearly 1/2 of them had between 1 and 9 hours in the graduate field.

TEACHERS OF OTHER MATHEMATICS SUBJECTS: Most of the teachers of other mathematics subjects had between 10 and 39 semester hours of undergraduate credits. Nearly 1/3 had no graduate credit; and over 1/2 had between 1 and 9 hours in graduate school.

Of 1165 teachers of mathematics in approved four-year public high schools reporting:

224 attended mathematics workshops or conferences during 1959-1960 school year.
229 received part reimbursement from the school district for attending such conferences or workshops.
 13 received full reimbursement from the school district for attending such conferences or workshops.

145 of those attending conferences or workshops had majors in mathematics.
 74 of those attending conferences or workshops had minors in mathematics.
 12 of those attending conferences or workshops had neither majors or minors in mathematics.

145 with majors in mathematics attended National Science Foundation Institutes in mathematics.
 77 with minors in mathematics attended National Science Foundation Institutes in mathematics.
 20 with neither majors or minors in mathematics attended National Science Foundation Institutes in mathematics.
143 had other special training in mathematics during the year.

 74 teachers of general mathematics attended National Science Foundation Institutes.
142 teachers of freshman algebra attended National Science Foundation Institutes.
121 teachers of plane geometry attended National Science Foundation Institutes.
 81 teachers of trigonometry attended National Science Foundation Institutes.
121 teachers of advanced algebra attended National Science Foundation Institutes.
 37 teachers of solid geometry attended National Science Foundation Institutes.
 24 teachers of analytic geometry attended National Science Foundation Institutes.
 14 teachers of fifth semester algebra attended National Science Foundation Institutes.
 77 teachers of other mathematics attended National Science Foundation Institutes.

345 subscribed to the MATHEMATICS TEACHER.
166 subscribed to the IOWA MATHEMATICS NEWSLETTER.
103 subscribed to other mathematics periodicals.

360 subscribed to only one mathematics periodical.
121 subscribed to two mathematics periodicals.
 36 subscribed to three or more mathematics periodicals.
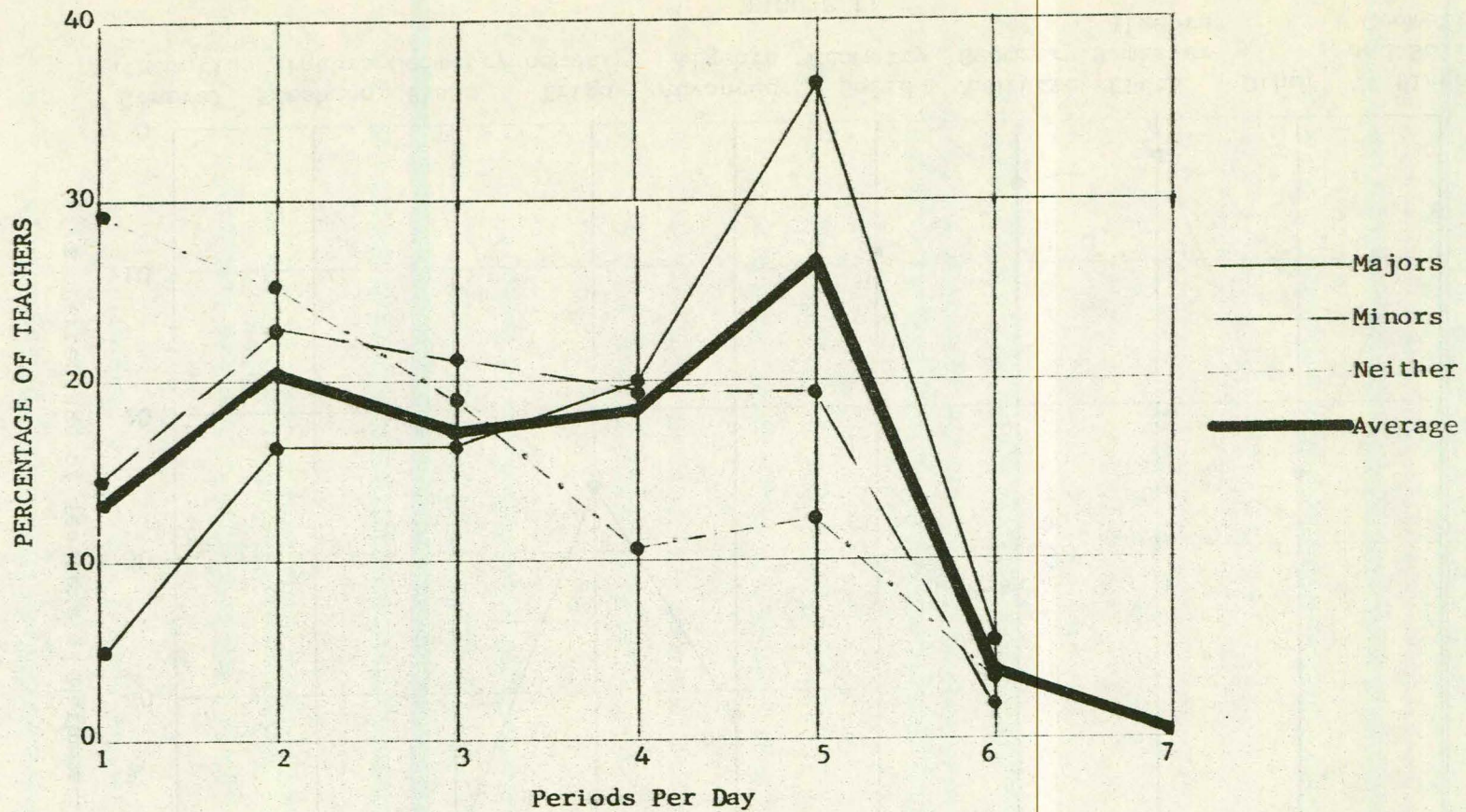
Periods Per Day

FIGURE 10

PERIODS PER DAY OF MATHEMATICS TAUGHT BY TEACHERS WITH MAJORS, MINORS, OR NEITHER A MAJOR OR
MINOR IN MATHEMATICS AND THE AVERAGE NUMBER OF PERIODS PER DAY FOR ALL HIGH SCHOOL TEACHERS
OF MATHEMATICS FOR THE 1959-1960 SCHOOL YEAR

The percentage of teachers of mathematics who were engaged in teaching particular subjects is illustrated in Figure 11 below. More teachers were engaged in teaching freshman algebra than any other course but this is understandable since this course (followed closely by geometry and general mathematics) had higher enrollments than all the other courses.
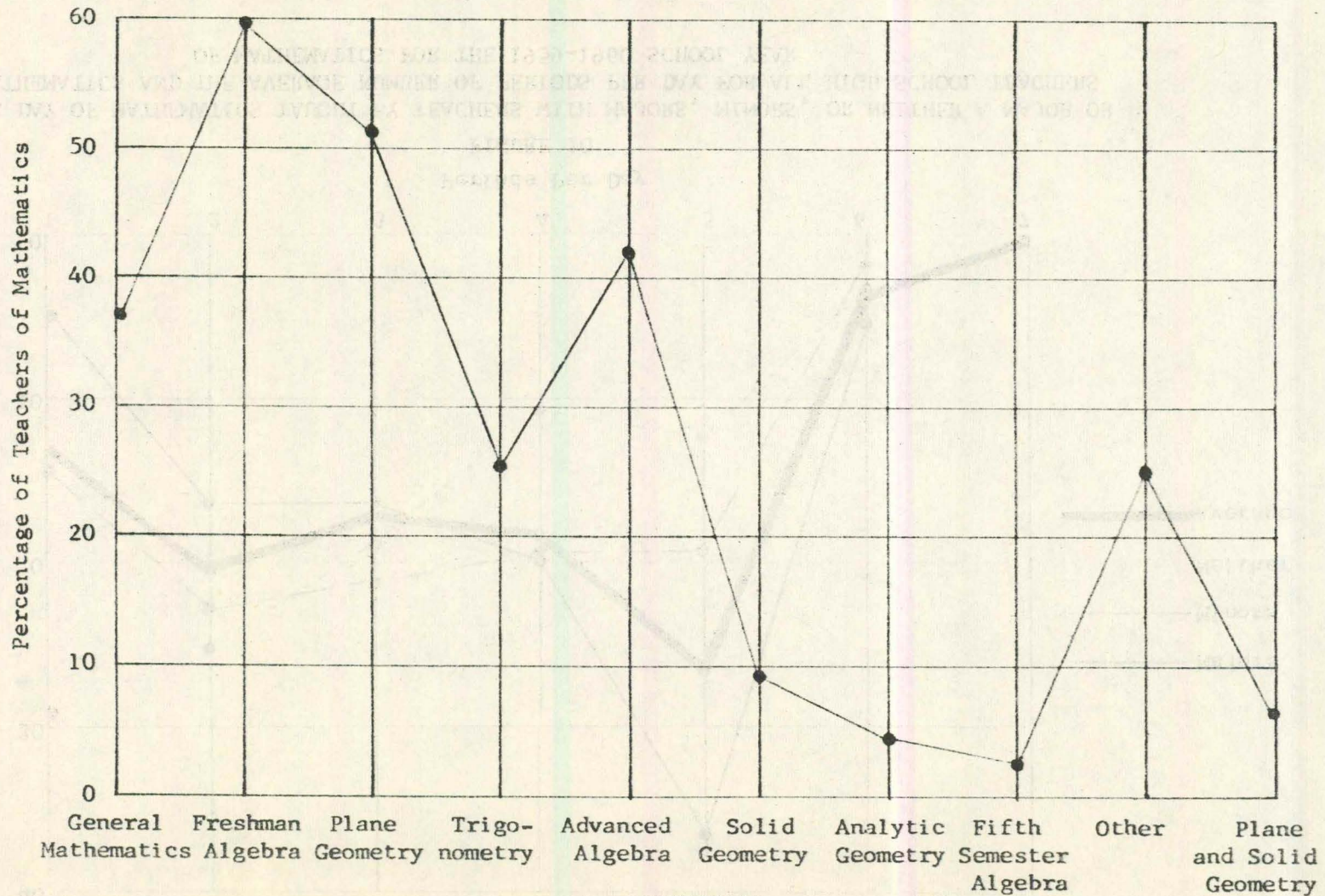


FIGURE 11

COURSE ASSIGNMENTS FOR TEACHERS OF MATHEMATICS IN IOWA'S APPROVED FOUR-YEAR PUBLIC HIGH SCHOOLS FOR THE 1959-1960 SCHOOL YEAR

A little more than one-fourth of the teachers of mathematics in Iowa public high schools taught more than three different mathematics courses. One and one tenth per cent of them taught seven different mathematics courses; 28.2 per cent of them made only two different mathematics preparations per day; and 23.0 per cent taught only one mathematics course. Figure 12 gives the percentage of teachers by the number of courses of mathematics taught.
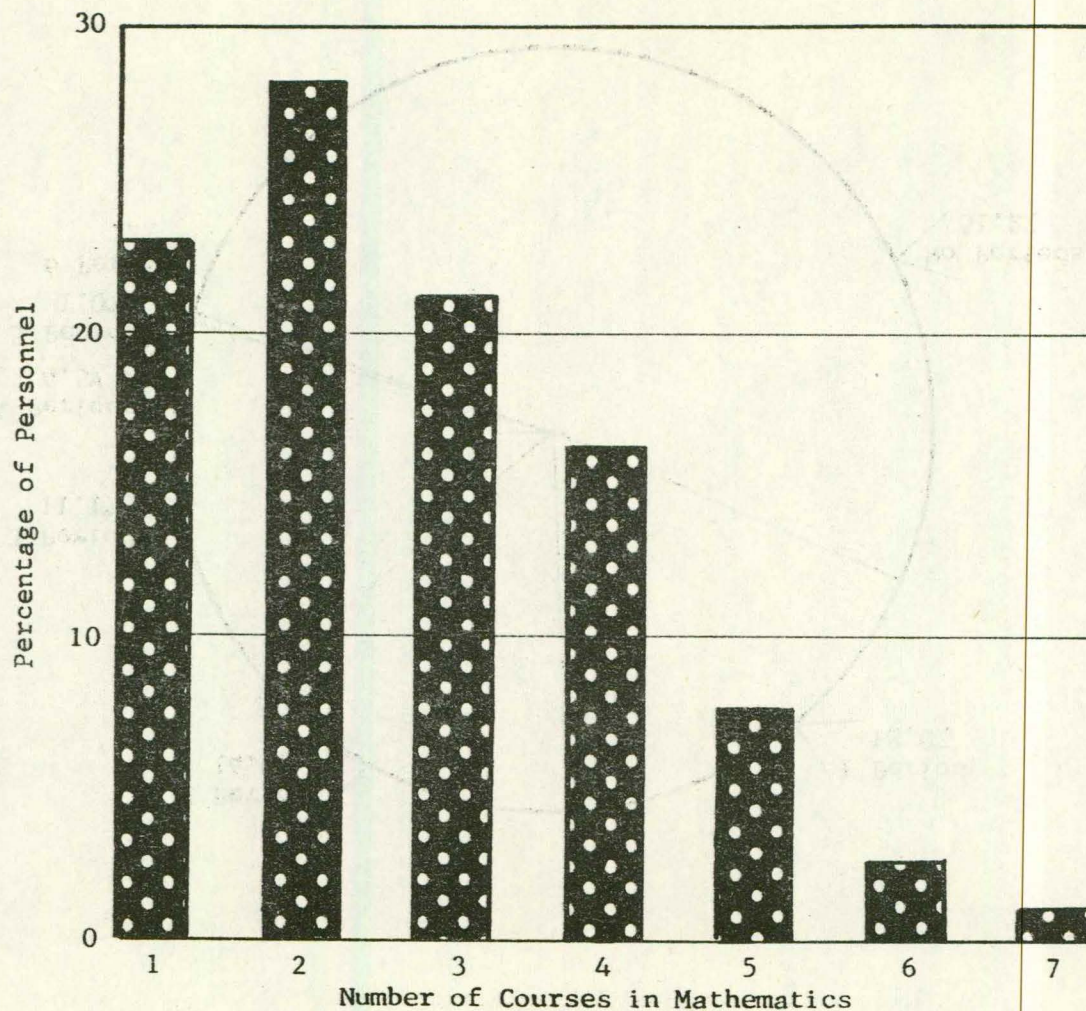


FIGURE 12

NUMBER OF COURSES OF MATHEMATICS TAUGHT BY IOWA PUBLIC HIGH SCHOOL TEACHERS
FOR SCHOOL YEAR 1959-1960

This survey indicates that 51.2 per cent of the teachers of mathematics devoted their full-time to mathematics. Nearly half (48.8 per cent), however, did devote some time to teaching other subjects; some of them spent as much as five or six periods per day in other areas as shown in Figure 13 below.
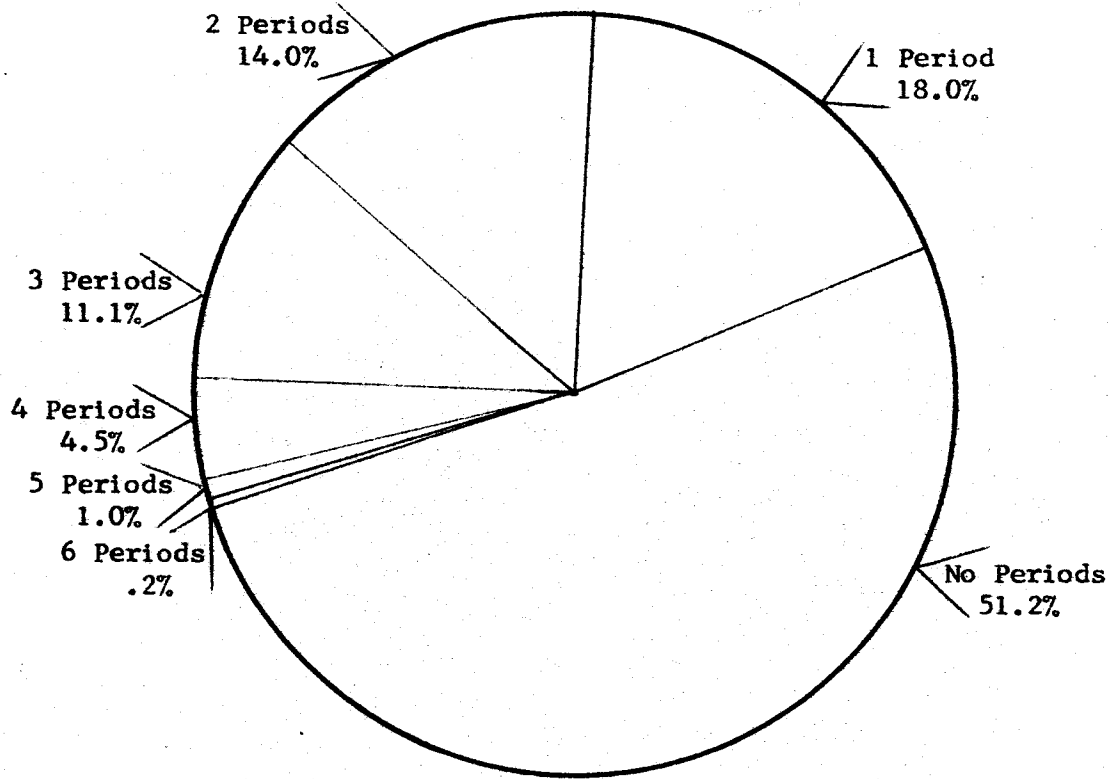


FIGURE 13

NUMBER OF PERIODS TEACHERS OF MATHEMATICS DEVOTED TO SUBJECTS OTHER THAN MATHEMATICS IN THE 614 APPROVED PUBLIC HIGH SCHOOLS FOR THE 1959-1960 SCHOOL YEAR

Each instructor of mathematics in Iowa public high schools spent one or more periods per day teaching, on the average, 68 pupils in mathematics classes. As shown by the chart below the pupil-teacher ratio in the beginning mathematics (general mathematics, freshman algebra, plane geometry) is between 25 and 40 with freshman algebra leading with 38 pupils per class. All of the advanced mathematics courses tended to be smaller since they were more highly selective in the persons enrolled.
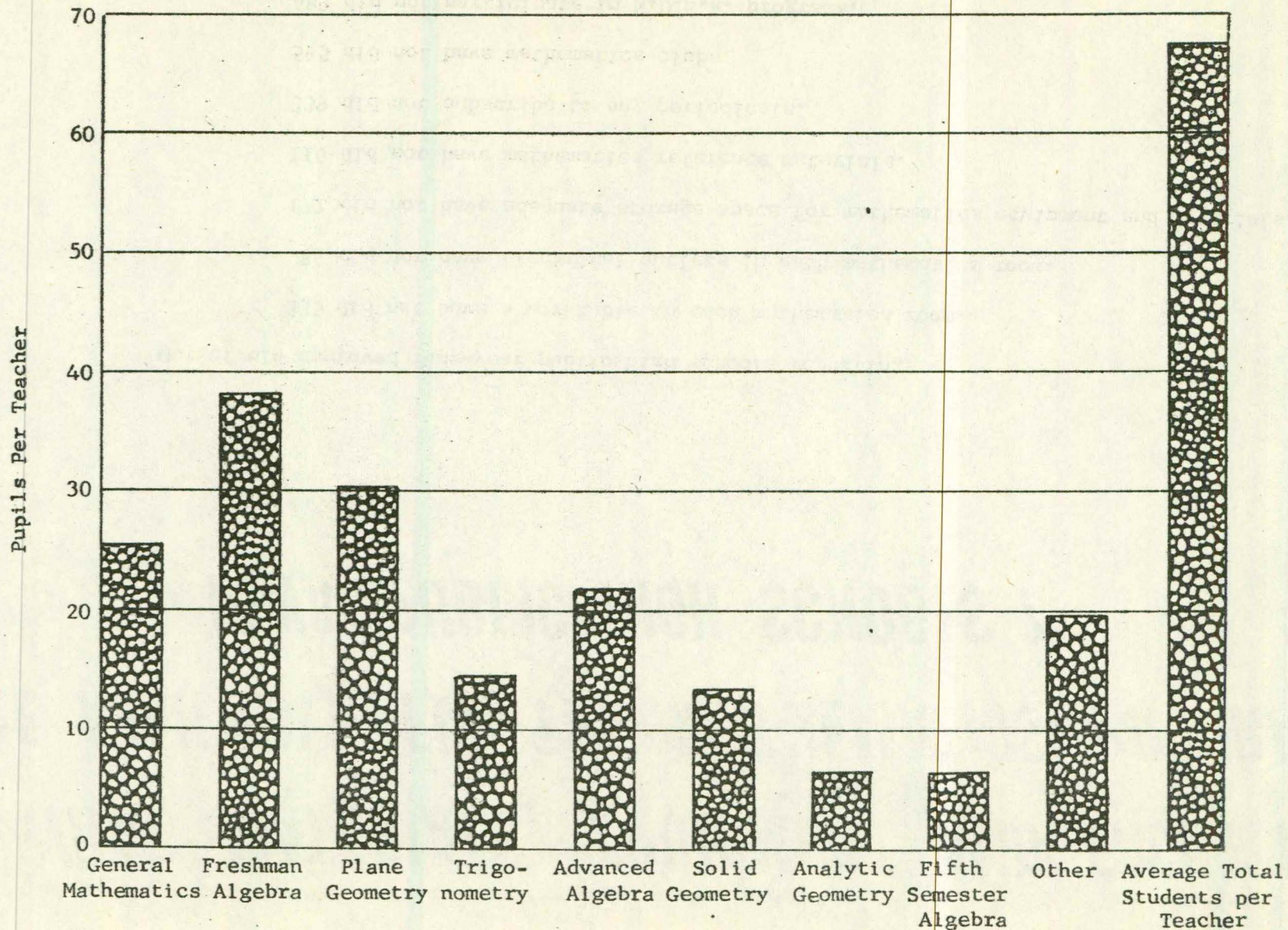


FIGURE 14

PUPIL-TEACHER RATIO FOR MATHEMATICS COURSES IN IOWA PUBLIC HIGH SCHOOLS FOR SCHOOL YEAR 1959-1960

# WHAT MATERIALS, EQUIPMENT AND FACILITIES WERE AVAILABLE FOR THE MATHEMATICS PROGRAM IN IOWA PUBLIC HIGH SCHOOLS ?

Out of 614 approved four-year public high schools reporting:

335 did not have a worktable in each mathematics room.

86 did not have electrical outlets in each mathematics room.

177 did not have adequate storage space for mathematics equipment and materials.

116 did not have mathematics reference materials.

339 did not subscribe to any periodicals.

595 did not have mathematics clubs.

489 did not participate in N.D.E.A. programs.