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ABSTRACT

GRADES OR AGES: Grades 9-12. SUBJECT MATTER: Basic mathematics. ORGANIZATION AND PHYSICAL APPEARANCE: The guide has three main sections--general mathematics, applied mathematics, and senior mathematics. The material in each section is set out in four columns--major areas, significant anticipated outcomes, observations and suggestions, and references and films. The guide is mimeographed and spiral bound with a soft cover. OBJECTIVES AND ACTIVITIES: Objectives are listed at the beginning of each section. The content of the major areas is described but activities are not specified in detail. INSTRUCTIONAL MATERIALS: Texts, films, and filmstrips are listed for the major areas, and a bibliography and list of film distributors is given at the end of each section. STUDENT ASSESSMENT: A multiple choice test is included for use in evaluating basic concepts of mathematics studied in each of the three sections. (MBM)

MATHEMATICS CURRICULUM GUIDE

BASIC MATHEMATICS 9 - 12

SCHOOL CITY OF GARY
Gary, Indiana
1968

Participants in the Preparation of this Supplement

Mathematics Department Representative Committee

1966-67

Ernest Bennett
Paul Bohney
Doris Boose
Lillian Bradley
Robert Crowe
Joseph Dolak
George Dunleavy
Wilma Flewelling
Charles Hubbard
Harold Jones
Wayne Morgan
John Pitts
Maurice Smolinske
Thomas Uecker

1967-68

Ernest Bennett
Paul Bohney
Doris Boose
Joseph Dolak
George Dunleavy
Charles Hubbard
Elwood Lumpkin
Wayne Morgan
John Pitts
Maurice Smolinske
Thomas Uecker
Ann Van Beek

Basic Mathematics Curriculum Committee

James Conlon
Floyd Moore
George Orlich

Secretarial Personnel

Sharon Marley

Procedure

The Department Representative Committee, working in their sessions, review the mathematics program and recommend specific improvements needed to strengthen instruction. Some of the recommendations require the service of special committees.

This supplement was proposed to update the basic mathematics curriculum by the Department Representative Committee. The writing of the first draft took place during the summer of 1966. The first draft was submitted to the entire mathematics faculty for suggestions for incorporation in this edition.

All materials were reviewed and edited by the Mathematics Consultant.

BASIC MATHEMATICS

T A B L E O F C O N T E N T S

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F O R E W O R D

If citizens are to be employed, to fulfill job responsibilities adequately, and to make intelligent choices in consumer matters, they must have skill and understanding in basic mathematics.

Basic mathematics is not only vital to the solution of consumer problems but also to preparing individuals for the acquiring of further knowledge as our society and technology continually become more complex. It is essential also to citizens as they participate in decision making processes in our community and nation.

The value of basic mathematics instruction in schools is being underscored at this time, since major emphasis in mathematics curriculum development during the past ten years has been given to the preparation of potential mathematicians and scientists. The need for all citizens to share in these past developments through greater understanding of mathematics provides an opportunity for mathematics teachers to render valuable and worthy service to our pupils.

Varying levels of ability and achievement in mathematics require that teachers be acutely aware of student needs. These include assessing gaps in achievement, clearly defining teaching goals based on these needs, analyzing and remedying learning difficulties when they occur, creative and interesting presentations, and seeing that all is done to reach teaching goals through giving continual encouragement to students.

This guide represents another step in the on-going process of developing a strong mathematics curriculum in the Gary Public Schools. We express appreciation to each individual, to the committee and supervisory personnel who have contributed to its development. We hope mathematics teachers will use it diligently, evaluate its effectiveness, and share in identifying further revisions that will keep the program moving forward.

CLARENCE E. SWINGLEY
Acting Superintendent of Schools

HARON J. BATTLE
Assistant Superintendent-Instruction

I N T R O D U C T I O N

This curriculum guide is an effort to place emphasis on a meaningful approach to the study of basic mathematics. The concern in developing this guide was for a sequence and approach designed to meet the needs of students whose formal education will probably lessen on completion of high school. Primary interest is to equip students with basic fundamentals for learning mathematics during high school and beyond in the world of work and not specifically for college study for a baccalaureate degree.

It is well-known that the success one may expect in teaching these courses will depend upon the personality and skill of the teacher in presentation of topics. The teacher will be a student often reflecting on the conditions of learning necessary for students to be successful. Among the virtues necessary will be the acceptance of responsibility to identify and understand weak spots in not only students' mathematical development, but also attitude. The teacher who is successful might consider as reasons for success: (1) enthusiasm; (2) the building of a pleasant attitude toward mathematics by providing many opportunities for students to be successful in performing tasks; (3) the use of concrete examples within students' experiences; (4) the use of students' attraction for novelty; (5) the very sympathetic understanding of students' difficulties and proving it by patient reteaching; (6) the judicious use of praise and encouragement; (7) having students compete against themselves rather than against other students; and (8) by continued effort to improve teaching competencies by setting well-defined teaching goals, thoroughly analyzing learning situations, and constant self-study of one's teaching procedures and students' achievement.

This guide is an attempt to clarify and organize curriculum materials in such a way that concepts are thoroughly outlined and also that outcomes are stated in behavioral terms, i.e., what a student does. writes, or says so one can infer that learning has taken place. It is the product of many discussions of

I N T R O D U C T I O N
(Continued)

curriculum committee members and helpful suggestions of mathematics teachers. As a guide, its purpose is to clarify the basic mathematics curriculum in high school, formulate attainable objectives, and provide helpful teaching suggestions.

In using the guide, teachers will find major areas for each course in sequences which follow, in general, the development of mathematical ideas. Within some major areas, the sequence given is essential to learning while in others it is not. It is recommended, however, that the sequence developed for each course in the guide be followed to ease problems of transfers of students or changes in scheduling of students.

The outcomes stated in the guide are by no means all-inclusive, but they do define purposes for daily lessons and criteria for determining whether or not students have learned. The view taken is that students may be slow or fast in achievement in mathematics, but it is more meaningful in considering teaching strategies to be specific about exactly what students' difficulties or successes may be.

There is sufficient space available in the guide to include special notes concerning the teaching of topics or for identifying additional instructional materials. Numerals listed in the reference column refer to texts listed in the bibliography for each course.

A multiple choice test is included in the appendix for use in evaluating basic concepts of mathematics studied in each of the three courses.

Suggestions for improving this guide as a means of improving students' mathematics education are welcome. Teachers can make suggestions to their mathematics department chairmen or to the mathematics consultant.

Appreciation is expressed to the curriculum committee, the department chairmen, and to teachers who have made valuable suggestions, incorporated in this guide.

Paul J. Bohney

PAUL J. BOHNEY
Mathematics Consultant

OBJECTIVES FOR GENERAL MATHEMATICS

Before setting down our objectives for the course, it might be well to consider the student for whom this course is designed. First of all, while the material in the course is not generally considered "college bound" mathematics, it cannot be assumed that no student taking General Mathematics will ever go on to college. The value of the course lies in its potential for developing facility with arithmetic necessary for entry positions in the world of work whose technology continually requires better prepared beginning employees. This course can be one of the avenues to successful careers in education, business, industry and responsible citizenship. It is important for students studying the course, and that importance in contributing to effective citizenship cannot be minimized.

In spite of attempts at homogeneous grouping, it must be recognized that a wide range of abilities, interests, and attitudes will be exhibited by students in almost any General Mathematics class.

1. At one end of the spectrum, we see the student who has not mastered the skills and concepts of junior high school mathematics. Such a student has probably been assigned to the ninth grade on the basis of factors other than academic achievement. His lack of success in mathematics in the past has led to a distaste for the subject with resulting lack of effort and poor study habits. This in turn leads to further failure and frustration. It would seem that breaking this vicious cycle would, in itself, be a worthy goal for such a student.

2. We can also expect to see in the class the student who has mastered the topics of junior high mathematics, but who, because of borderline ability or lack of motivation, has been considered incapable of success in Algebra I.

3. Finally, we can expect to see the student who has mastered the basic topics of junior high school mathematics, is capable of success in Algebra I, but fails to see the need of Algebra I. To meet the needs of such a wide variety of students, the following guide must, of necessity, cover a wide range of topics. Surely no teacher should expect that ALL STUDENTS master all topics of this guide. Classes composed of primarily slow learners, for example, might do well to concentrate on Major Areas I, II, III, V, VII, VIII, IX and whatever other areas a teacher may choose depending on time available, class interest, etc. For better classes the other additional major areas such as X, XI, parts of XIV, XVI might be studied.

A major area on Algebra is included in the guide. It closely parallels, some, but does not cover all material covered by a basic algebra text. Examinations of some general mathematics texts reveal treatments of algebra which would nearly duplicate that taught to low-achieving algebra classes. The question might be asked, "If a student can master this much algebra as <u>part</u> of a general mathematics course, why wasn't he placed in Algebra I?" Therefore, it would seem that only the most exceptional classes should attempt to cover Major Area XIII. While a certain portion of our students do take general mathematics as a pre-algebra course, it does not necessarily follow that the student should study Algebra per se. It should be pointed out that even if Major Area XIII is omitted from their course, a great deal of excellent pre-algebra mathematics remains.

GENERAL MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
I. Sets and Sets of Numbers A. Sets 1. Definition and examples 2. Notation 3. Finite sets, infinite sets, and null sets B. Sets of Numbers 1. The Natural Numbers, Whole Numbers & the Number Line 2. Prime Numbers a. The Sieve of Eratosthenes b. Prime Factorization c. Greatest Common Factor d. Least Common Multiple	1. List the elements of a set described by a given rule. 2. Describe by a rule a set given in roster form. 3. Classify a set as finite, infinite, or null. 4. Distinguish between the null set and the set $\{0\}$ 5. State the successor of a given natural number or of a given whole number. 6. Name the coordinates of designated points on the number line. 7. Identify a point on the line when given its coordinate. 8. Construct the Sieve or Eratosthenes for the natural numbers 1 to 100. 9. Write a given number in prime factored form. 10. Find the greatest common factor for two or three given whole numbers using prime factorization. 11. Find the least common multiple using prime factorization for two or three given whole numbers. 12. Determine whether two given sets can be placed in one to one correspondence.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
I. Sets and Sets of Numbers The concept of sets should be carefully introduced. Use numerous examples of sets from everyday life. A set of tires, a set of dishes, a croquet set, etc. as well as numerous examples of sets of numbers such as the set of even numbers, the set of odd numbers, the set of multiples of 5 etc. should be used. Simple notations such as use of capital letters to represent sets; use of braces to enclose the elements of the set; use of $\emptyset$ or $\{\}$ to represent the null set should be presented. Students should be made aware of the distinction between the set $\emptyset$ which contains no elements and the set $\{0\}$ which contains one element, namely 0. When constructing number lines, point out that the coordinates 0 and 1 may be chosen arbitrarily. But having chosen these two points, the coordinates of all other points become fixed. Students should see that for every whole number we have a corresponding point on the number line, but there are points on the number line which have no corresponding whole number. The sections of Prime Numbers & Factoring might be introduced by listing the factors of certain numbers. The class should be led to observe that some numbers have only 2 factors, namely 1 and the number itself. This leads naturally to the definition of prime numbers. All students should construct the Sieve of Eratosthenes for numbers one to 100. It is a common misconception that the prime numbers from 100 to 200 are merely the prime numbers from 1 to 100 plus 100. Constructing the Sieve of Eratosthenes from 100 to 200 will shock some students out of this idea. By constructing the Sieve from 100 to 200 we can also show more clearly a few helpful short cuts, i.e. writing down only the 1's, 3's, 7's, and 9's columns since all numbers in the other columns will be eliminated when dividing by 2 or 5.	I. 8 Chapter 1 * 1 Chapter 2, 3 2 Chapter 1, 7, 16 7 Chapter 3 9 Chapter 1 Audio-Visual Materials: Films: How Do You Count 12 min. (color) (1FB) Filmstrips: Introduction to Sets 45 fr. (color)(MH Intersection of Sets 45 fr. (color)(MH Early Counting 39 fr. (color) (FH) *The first reference listed is the currently adopted text.

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOME
II. Numbers, Numerals and Numeration Systems A. Ancient Numeration Systems 1. digits 2. positional notation B. Non-decimal Numeration Systems 1. base five 2. base two 3. base twelve 4. other bases	1. Write various other numerals for a given number. 2. Distinguish between a numeral and a number. 3. Express numerals written in base 5, base 2, base 12 (and other bases*) as base 10 numerals. 4. Express base ten numerals as base 5, base 2, base 12 (or other bases) numerals. 5. State the value of a given digit written in various positions in base 5, 2, 12, and 10.

* See OBSERVATIONS AND SUGGESTIONS

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
II. Numbers & Numerals Two objectives of Major Area II that should be kept in mind are: 1. Understanding the difference between number and numeral and 2. Appreciation of our decimal number system A study of other numeration systems should not be carried to the point that manipulation of these other systems become more important than the two objectives above. There seems to be little point in memorizing ancient numeration symbols. Open book quizes might be in order for this section. * While Reference 1 considers numeration systems for base 2 through 10 and base 12, the necessity of studying all of these might be questioned. Surely for the slower classes consideration of base 5, base 2 and possibly base 12 would seem to be sufficient. The interest of students in classes will help determine this.	II. 8 Chapter 2 1 Chapter 2 2 Chapters 2, 3, 4 3 Chapter 2 4 Chapter 2 6 Chapter 1 7 Chapter 1, 2 9 Chapter 1 Audio-Visual Materials: Films: ABACUS 12 min. (color) (AVIS) The Earliest Numbers: Understanding Numbers 30 min. (black & white) (Ind. U.) Understanding Numbers: Base and Place 30 min. (black & white) (Ind. U.)

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOME
III. The Set of Whole Numbers A. Properties of Whole Numbers 1. Closure Properties for addition and multiplication 2. Commutative Properties for addition and multiplication 3. Associative Properties for addition and multiplication 4. Distributive Property 5. Identity Elements for addition and multiplication	1. Recognize (but not necessarily name) the property of the whole numbers which verifies the equality of two given expressions. 2. Use the properties of whole numbers to compute and to simplify computation.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
III. The Set of Whole Numbers As was pointed out in the introduction, a great deal of excellent pre-algebra mathematics is covered in this guide. This major area is an example. The properties of the whole numbers provide the foundation on which much of the study of algebra rests. The student who completes a course in general mathematics with a thorough understanding of these properties, will have an excellent start on the study of algebra However, the importance of these properties for the non-algebra bound student should not be overlooked. Many of the operations of arithmetic have these properties as their base. For example: the use of the identity element for multiplication in changing fractions to higher terms. The resourceful teacher will find many occasions when manipulations which have been taught on a "tell and do" can be presented in a logical and meaningful manner if they are shown to be logical consequences of these fundamental properties. How well the student should know these properties would depend on the ability of the class. For the slowest student merely recognizing for example that "some" property tells us that (6+3)+4=6+(3+4) is a true statement might be considered sufficient even though he cannot name the property. For such a student a simple true and false test might be used to test his achievement. For slightly better students a matching test where the properties of the whole numbers appear in a list which he matches with statements such as the one above. The very best student may be capable of handling a "Property or False" test where he must actually name the property which verifies the equality between two expressions or write the word false if the two expressions are not equal. When three addends are used many students will fail to see the difference between (3+2)+4=3+(2+4) and (3+2)+4=(2+3)+4. This seems to be a distinction worth pointing out.	III. 8 Chapter 3 1 Chapter 2 2 Chapters 5, 6 3 Chapter 3 7 Chapter 4 9 Chapters 2, 3, 4, 5 Films: Natural Numbers, Integers, and Rational Numbers 29 min. (black & white) (MLA) The Number System and Its Structure 11 min. (color) (CORONET)

GENERAL MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
IV. Modular Arithmetic	1. Construct addition tables and multiplication tables for mod 12, mod 5, mod 7. 2. State the properties of whole numbers which apply to various modular systems. 3. Add, subtract, multiply and divide whole numbers.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
IV. Modular Arithmetic Just as other numeration systems were introduced to give an appreciation of our own base ten system, various modular arithmetics are introduced so that a student might contrast their properties with the properties of the whole number system and thereby gain greater appreciation of the properties of the whole numbers. Do not let modular arithmetic be confused with various base numeration systems. In base 5 we use only five digits 0, 1, 2, 3, 4 to represent an infinite set of numbers, (0, 1, 2, 3, 4, 10, 11, 12, 13, 14, 20, 21....); whereas in mod 5 we use the same 5 digits, but we have a finite set of elements in our set. For better students, it could be pointed out that because a modular system is a finite system, we can look at the entire addition table. In contrast, we could never write out the entire addition table for the set of whole numbers. Relation of modular systems to days of the week and hours on the clock can be used to easily familiarize students with this idea. Modular arithmetic illustrates the closure property. It provides practice in division of whole numbers. It also illustrates periodic phenomena. Good judgement should be used to determine if or to what extent students can profit from its extended study.	IV. 8 Chapter 3 2 Chapter 3 9 Chapter 3

GENERAL MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
V. Operations with Whole Numbers A. Addition B. Subtraction C. Multiplication D. Division	V. 1. Mastery of the basic facts of addition exhibited by answering oral and written questions within a ten second time span. 2. Mastery of the basic facts of multiplication exhibited by answering oral or written questions within a ten second time span. 3. Solve verbal problems using whole numbers and the four fundamental operations. 4. Explain multiplication characteristics of multiplying by 9. 5. Check multiplication problems by "casting out nines". 6. Increase speed of computation.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
V. Operations with Whole Numbers It is to be hoped but not presumed that most general mathematics students have mastered the contents of this major area. Hence, a short review of these topics is all that may be necessary. For slower classes, however, more opportunity for understanding and drill is absolutely necessary. In today's world every student must have competency and confidence in using the basic facts in the four fundamental operations. The "function machine" approach found in Modern General Mathematics by Eicholz et.al. (Chapter 2) may be novel and useful in remedying a serious shortcoming in multiplication of some students.	V. 8 Chapter 3 1 Chapter 3 3 Chapters 3, 4, 5 4 Chapter 2 6 Chapters 2, 3, 4, 5 7 Chapter 4 9 Chapters 2, 3, 4, 5

GENERAL MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
VI. Number Sentences (open sentences) A. Equation and their solution sets B. Inequalities and their solution sets	1. Determine whether a given open sentence is true or false. 2. Use basic facts of arithmetic to state or write the solution sets of simple equations over a given domain. 3. Use knowledge of arithmetic to state or write the solution sets of simple inequalities over a given domain.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
VI. Number Sentences No attempt should be made at this point to solve equations or inequalities by use of the properties of equality or order. The symbols $>$, $=$ and $<$ are introduced. All open sentences at this point should be solved using basic facts of arithmetic. Emphasize to students that they realize a given open sentence there is a set of numbers which makes it false, and a set of numbers which makes it true. This latter set we call the truth set or solution set. While some of the references do not introduce the concept of variable, domain of variable , or graphing solution sets on the number line, these could be brought in at this point. We do have here an opportunity to teach some excellent pre-algebra mathematics.	VI. 8 Chapter 4 1 Chapter 7 2 Chapter 16 3 Chapter 2 4 Chapter 9 9 Chapter 6 Films: Algebra A Way of Thinking About Numbers 11 min. (Color) (Coronet) Language of Mathematics 11 min. (black & white) (MH)

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
VII. Positive Rational Numbers A. Meaning of Fractions B. Order for the set of positive rational numbers C. Computing with fractions	1. Determine whether or not two fractions represent equal rational numbers. 2. Change fractions to higher terms using the multiplication property of 1 as well as LCM. 3. Change fractions to lowest terms using multiplication property of 1 as well as GCF. 4. Change improper fractions to mixed numerals. 5. Change mixed numerals to improper fractions. 6. Determine whether $>$, $<$ or $=$ relationship holds between two given fractions. 7. Add subtract, multiply and divide whole numbers. 8. Find a fractional part of a number. 9. Find what fractional part one number is of another. 10. Find a number when a fractional part is known. 11. Solve verbal problems requiring the use of fractions.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
VII. Common Fractions For many, review and reinforcement may always be necessary. Reference #2 provides additional exercises if those in the text are insufficient. The multiplicative property of one (the identity element for addition) along with our rules for multiplication of fractions should be used to give greater understanding to reducing fractions to lowest terms and to change fractions to higher terms. It may be helpful to establish that in general $\frac{a}{b} \times \frac{c}{d} = \frac{axc}{bxc}$ $\frac{a}{b} + \frac{c}{d} \neq \frac{a+c}{b+d}$ $\frac{a}{b} = \frac{a+a}{b+b} = \frac{a+a+a}{b+b+b}$ using numerical examples. It is generally believed that outcomes 8, 9, and 10, should not be taught only as three separate types of problems, but also as an application of open sentence problems covered in the previous major area. Some call this the factor x factor = product idea. The proportion method may also be used. The necessity of good understanding of topic for application to decimals and percents is obvious. For the better classes much of this unit will be a review of material mastered in junior high mathematics.	VII. 8 Chapter 5 1 Chapter 3 2 Chapters 8, 9, 11 3 Chapters 8, 11 4 Chapter 4 6 Chapters 6, 7 7 Chapter 5 9 Chapter 6 Films: Ratio and Proportion in Mathematics 11 min. (black & white) (Coronet)

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
VIII. Decimal Fractions A. Meaning of decimal fractions B. Operations C. Problem solving	1. State the denominator of various decimal fractions. 2. Change common fractions to decimal fractions. 3. Change decimal fractions to common fractions. 4. Read and write decimal fractions. 5. Round decimals to a given place. 6. Write in order a given set of decimals. 7. Add, subtract, multiply and divide decimal fractions. 8. Find a decimal part of a number. 9. Find what decimal part one number is of another. 10. Find a number when a given decimal part is known.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
VIII. Decimal Fractions It should be made clear to students that decimal fractions are merely a special type of common fraction, that is, a fraction with denominators of 10, 100, 1000, etc. The denominator is not written but is indicated by the number of decimal places. This concept is the basis for much of our work with decimal fractions. For example, we do not actually "move the decimal point" when dividing, but write the indicated division as a common fraction and change to higher terms. Example: $2.0 \div .5 = \frac{2.0}{.5} \times \frac{10}{10} = \frac{20}{5} = 4$ Once again the problems at the end of this major area are probably best taught not as <u>three separate types of problems but as applications of open sentences or as ratio problems</u>. Using all three ways of teaching this may be better than just one.	VIII. 8 Chapter 6 1 Chapter 4 2 Chapter 12 3 Chapter 12 4 Chapter 4 6 Chapters 8, 9 7 Chapter 5 9 Chapter 6

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
IX. Per Cent A. Meaning of Per Cent B. Computations with per cent	1. Change common fractions to per cents. 2. Change a percent to a given fraction. 3. Change a decimal fraction to a percent. 4. Change a per cent to a decimal fraction. 5. Find a per cent of a number; find what per cent one number is of another; and find a number when a per cent is known using simple equations or using proportions. 6. State the decimal and percent equivalents for: $\frac{1}{2}, \frac{1}{3}, \frac{2}{3}, \frac{1}{4}, \frac{3}{4}, \frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}, \frac{1}{6}, \frac{5}{6}, \frac{1}{8}, \frac{3}{8}, \frac{5}{8}$ and $\frac{7}{8}$. EXAMPLE: $\frac{1}{2} = .50 = 50\%$

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
IX. Per Cent The first four outcomes for this major area involve meaning of percent and conversions from common fractions and decimal fractions to per cents and vice versa. The final outcome involves the three types of percentage problems. Numerous exercises of each of these separate types are available in the references. A teacher prepared exercise of a random mixture of the three types of problems would be helpful and possibly a necessity to impress students of their understanding or lack of it. A thorough study and mastery of the topics at the end of Major areas VII and VIII should make these problems a simple extension of three types of fractional parts problems, and the 3 types of decimal parts problems.	IX. 8 Chapter 7 1 Chapter 5 2 Chapter 4 3 Chapter 13 4 Chapter 5 6 Chapter 10 7 Chapter 6 9 Chapter 6 Filmstrips: Meaning and Understanding of Percent 45 fr. (color) (SVE)

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
X. Square Root A. Uses B. Methods of finding C. Application to real problems	1. State the square roots of given perfect squares. 2. Use a table to state the square roots of numbers. 3. Find the square roots of numbers by estimation, division and averaging.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
X. Square Root Three methods of finding square roots are considered (1) intuitive, such as, 9, 16, 25 etc. (2) Using a table and (3) using estimation, division and averaging. While this latter method may be somewhat different from the method taught for many years in 8th grade it has two advantages: 1. Many of the people who will have any need to calculate square roots in later life will have at their disposal a desk calculator which shortens the operations of dividing and averaging. 2. For many cases in applications an approximation to the first decimal will suffice.	X. 8 Chapter 8 1 Chapter 8 2 Chapter 14 6 Chapter 28 7 Chapter 7 9 Chapter 7

GENERAL MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
I. Measurement A. Types of measurement B. Units of measurement C. Precision of measurement D. Computations E. Verbal problems	1. Convert from one denomination to another, measurements of length, capacity, weight, time, area, volume, (and arcs and angles). 2. Convert from one denomination to another, metric units of measurement. 3. Convert (with the use of conversion tables) from metric to English and English to metric units of measurement. 4. State the precision, greatest possible error, relative error and accuracy of a given measurement. 5. State the number of significant digits in a given number. 6. Compute using approximate numbers.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS

XI. Measurement

The amount of time devoted to this area will vary greatly depending on the variables of students' abilities, students' future needs, time available, etc.

Use of conversion tables should take priority over memorization of conversion tables. This is especially true of the Metric-English conversion. The major justification of problems involving conversion from metric to English would seem to be the appreciation of the size of metric units. For most students this topic will be meaningless unless they have direct experience with a meter stick and its divisions. Provide sufficient time for this.

Since $\frac{1}{1000}$ km = $\frac{1}{100}$ hm = $\frac{1}{10}$ dkm = m =

10 dm = 100 cm = 1000 mm,

we can develop an aid for metric conversions. The following helpful table for metric conversions might be used:

km-hm-dkm-m-dm-cm-mm

To convert from one unit to another, count the steps to the right or left required and move the decimal that number of places to the right or left e.g.

1) 5km = ___?___ m

To get from km to m we must move 3 steps to the right. Hence we move the decimal point three places to the right 5km=5000m

2) .7 mm ___?___ cm

To get from mm to cm on our table we must move one step to the left. Hence we move the decimal point one place to the left.

.7mm = .07cm

XI. 8 Chapter 9
1 Chapter 3
2 Chapter 22
3 All Chapters
4 Chapter 5
6 Chapters 21, 22, 28, 29
7 Chapter 10
9 Chapter 9

Films:

Measurement
10 min. (black & white) (MLA)

Story of Weights and Measures
11 min. (black & white) (CORONET)

Indirect Measurement
10 min. (black & white) (KB)

The Metric System
10 min. (black & white) (MLA)

Errors in Measurement
28 min. (black & white) (MLA)

Weights and Measures
14 min. (black & white) (EBF)

GENERAL MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XII. Sets A. Subsets B. Set operations C. Venn diagrams	1. State whether one set is or is not a subset of another. 2. Perform simple operations with sets (namely union of two sets and intersection of two sets). 3. State whether a given property such as commutativity, associativity, etc, holds for a given operation on a set. 4. Draw Venn diagrams to represent union and intersection of sets.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
XII. Sets This major area extends and reinforces the concepts presented in Major Area I. If more work on Venn Diagrams is desired teacher prepared excercises are necessary. This area is best suited only for higher achieving classes.	XII. 8 Chapter 10 4 Chapter 1

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XIII. Algebra A. The language of algebra; symbols. B. Integers 1. Integers on the number line; opposites 2. Properties of integers C. Polynomials over the integers D. The Rational Numbers	1. Write a given verbal phrase as an algebraic phrase. 2. Write a given verbal sentence as an algebraic sentence. 3. Represent the set of integers on the number line. 4. Name the coordinate of a point on the number line. 5. State the opposite or additive inverse of a given number. Determine whether $>$, $<$, or $=$ relationship holds for two given integers. 6. Recognize the property of the integers which verifies the equality of two given phrases. 7. Use the properties of the integers to determine the rules for computing with the integers. 8. Add, subtract, multiply and divide integers. 9. Evaluate an algebraic expression which is a polynomial. 10. Indicate whether or not a given expression is a polynomial. 11. Indicate whether or not a given polynomial is a monomial. 12. Add, subtract and multiply polynomials over the integers. 13. Determine whether the relationship $<$, $>$ or $=$ holds for two given rational expressions. 14. Write a given indicated multiplication as an indicated division. 15. Write a given indicated division as an indicated multiplication. 16. Recognize (but not necessarily name) the properties of the rational numbers. 17. Use the properties of rational numbers to add, subtract, multiply and divide rational numbers. 18. Use the addition and multiplication properties of equality to solve linear equations in one unknown, (including simple proportions). 19. Use the addition and multiplication properties of order to solve simple inequalities.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
XIII. Algebra As stated in the introduction, the inclusion of this major area is open to question. If it is covered, it should probably be done only after all other major areas have been studied. What is done in this major area should be covered thoroughly.	XIII. 8 Chapter 11 1 Chapter 7 2 Chapter 18, 20 4 Chapter 9 6 Chapters 26, 27 7 Chapter 14 9 Chapter 6 Films: Axioms in Algebra 13 min. (color) (IFB) A Positive Look at Negative Numbers 10 min. (color) (SEF)

GENERAL MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XIV. Graphs and Statistics A. Bar, Line, and Circle Graphs B. Mean, Mode and Medians C. Permutations D. Combinations E. Probability	1. Interpret and construct bar, line, and circle graphs. 2. Compute mean, mode and median. 3. Find the number of permutations that can be formed from n things taken m at a time. 4. Find the number of combinations that can be formed from n things taken m at a time. 5. Find the probability of a simple event.
XV. Logic--Compound Sentences	1. State whether "and" and "or" sentences are true or false.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
XIV. Graphs and Statistics The use sigma notation may be too difficult for some students to grasp and may be omitted. The problems on permutations and combinations should be kept within students ability to solve.	XIV. 8 Chapter 12 1 Chapter 6 3 Chapter 15 4 Chapter 12 5 Chapters 3, 6 6 Chapter 24 7 Chapter 15 9 Chapter 11 Films: The Language of Graphs 13½ min. (black & white) (COR) How's Chances 30 min. (black & white) (MH)
XV. Logic and Compound Sentences Exercises on determing whether "and" and "or" sentences are true or false would constitute a minimum requirement.	XV. 5 Chapter 13

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XVI. Informal Geometry A. Points, lines, planes B. Angles C. Plane figures D. Space figures	1. Name points, lines, and planes using accepted notation. 2. Name angles; distinguish different types of angles (e.g. rt. angle, acute angle, obtuse angle, etc.) 3. Use a protractor to measure and draw angles. 4. Define simple plane figures. 5. Identify simple plane and solid figures. 6. Make simple geometric constructions using compasses and straightedge. 7. Find the measure of the third angle of a triangle when the measure of the other two are given. 8. Identify complementary angles, supplementary angles, adjacent angles and vertical angles. 9. Determine whether given pairs of triangles are similar and/or congruent. 10. Use the Pythagorean formula to solve simple right triangle problems. 11. Use similar triangles to solve indirect measurement problems. 12. Find the perimeter, circumference, area and volume of simple geometric figures.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
XVI. Informal Geometry For the very best general mathematics students, i.e. for those who may go on to algebra and geometry, this major area provides important introductory background concepts. For those who take general mathematics as a terminal course this will be their last opportunity to learn some of the fundamental concepts of geometry. The novelty the material will tend to interest and motivate. The amount of time devoted to this topic and its priority with respect to the Unit on Algebra depends on the ability of the class, and time available which must be determined by the teacher. There is no question about the fact that the information learned in this unit has value in many occupations.	XVI. 8 Chapter 14 1 Chapter 1 2 Chapters 21, 23, 24 3 Chapter 6 4 Chapters 3, 10 6 Chapters 23, 25 7 Chapter 10 9 Chapter 8 Films: What's The Angle? 30 min. (black & white) (AFI) Areas 10 min. (black & white) (KB) Surface Area of Solids I & II 15 min. (color) (CEN) Volume and Its Measurement 11 min. (color) (CORONET) Volumes of Cubes, Prisms, and Cylinders 30 min. (color) (CEN) Volumes of Pyramids, Cones, and Spheres 15 min. (color) (CEN)

MAJORS AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XVII. Mathematical Activities	1. Make necessary calculations to solve consumer mathematics problems dealing with: a. income b. income and social security taxes c. buying food d. household and living expenses e. automobile expenses f. installment buying g. insurance h. taxes i. simple interest, compound interest, bank discount promissory notes j. commission k. profit and loss l. payrolls m. invoices n. inventories o. making change and writing checks p. stocks and bonds 2. Make necessary calculations to solve "on the job" problems dealing with: a. measurement b. simple machines c. temperature d. electricity

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
XVII. Mathematical Activities This unit deals with those topics usually classified as "social mathematics" or "Consumer mathematics." As previously been pointed out, this guide for many class outlines more than might be studied in one year's work. For some classes this unit might be included in the year's work in preference to the Units on Algebra and Informal Geometry. For some students, especially potential drop outs, this will be the last opportunity to prepare them for the world they are about to face. For others the senior mathematics course might be a more auspicious time to present these topics. In discussing auto expenses have students find distances on road maps. Problems involving gasoline usage are of interest also. Writing checks correctly needs to be emphasized.	XVII. 8 Chapter 15 1 Chapters 10, 11, 12 4 Chapters 6, 7, 8 6 Chapters 12 - 20 9 Chapter 10 Films: Latitude, Longitude and Time Zones 13½ min. (color) (CORONET)

GENERAL MATHEMATICS

B-I-B-L-I-O-G-R-A-P-H-Y

1. Brown, Kenneth, Daniel W. Snader, and Leonard Simon. General Mathematics - Book One. River Forest, Illinois: Laidlaw Brothers, 1964.

2. Brumfiel, Charles F., Robert E. Eicholz, Merrill E. Shanks, Introduction to Mathematics. Reading, Massachusetts: Addison-Wesley Publishing Company, Inc., 1961.

3. Eicholz, Robert E., O'Daffer, et. al. Modern General Mathematics. Palo Alto, California: Addison-Wesley Publishing Company, Inc., 1965.

4. Joseph, Margaret and Mildred Keiffer. Basic General Mathematics - 2nd Edition. Englewood Cliffs, New Jersey: Prentice Hall, 1965.

5. Kinney, Lucian B., Vincent Ruble, M. Russell Blythe. Holt General Mathematics. New York: Henry Holt and Company, 1960.

6. Lankford Jr., Francis G., James F. Ulrich, and John R. Clark. Essential Mathematics. New York: Harcourt, Brace and World, Inc., 1961.

7. Nichols, Eugene, Pre-Algebra Mathematics. New York: Holt, Rinehart and Winston, Inc., 1965.

8. Stein, Edwin I. Fundamentals of Mathematics. Rockleigh, New Jersey: Allyn and Bacon, Inc., 1964.

9. Wiebe, Arthur J. Foundations of Mathematics. New York: Holt, Rinehart and Winston, Inc., 1962.

SPECIAL REFERENCES:

Sobel, Max A., Teaching General Mathematics Englewood Cliffs, New Jersey: Prentice Hall Inc., 1967.

Herrick, Marian, Jane Zartman, Thomas R. Conrow Jr. Modern Mathematics for Achievement I & II Boston: Haughton Wifflin Company, 1966.

National Council of Teachers of Mathematics: Experiences in Mathematical Discovery 1201 Sixteenth Street N.W., Washington, D.C. 20036

GENERAL MATHEMATICS

LIST OF FILM AND FILMSTRIP DISTRIBUTORS

AV Avis Films, Inc., P.O. Box 643, Burbank, California 91503

CEN Cenco Educational Films, 1800 Foster Avenue, Chicago, Illinois 60640

COR Coronet Films, 65 E. South Water Street, Chicago, Illinois 60601

EBF Encyclopedia Brittanica Films, Inc., 425 N. Michigan Avenue, Chicago, Ill. 60611

FH Filmstrip House, Inc., 432 Park Avenue, New York, New York 10016

IU Indiana University Audio-Visual Center, Bloomington, Indiana

IF International Film Bureau, Inc., 332 S. Michigan Avenue, Chicago, Ill. 60604

KB Knowledge Builders, Visual Education Center, Floral Park, New York 11001

MH McGraw-Hill Text-Films, 330 W. 42nd Street, New York, N.Y. 10036

MLA Modern Learning Aids, 3 E. 54th Street, New York, N.Y. 10022

SEF Sigma Educational Films, 11717 Ventura Boulevard, Studio City, California 91604

SVE Society for Visual Education, Inc., 1345 Diversey Parkway, Chicago, Ill. 60614

All movie films in this guide are available from the Audio Visual Department of the School Service Center.

Filmstrips are available from secondary school libraries.

GENERAL OBJECTIVES FOR APPLIED MATHEMATICS

1. To reteach basic mathematics concepts necessary for better understanding and facility with the four fundamental operations using whole numbers, fractions, decimals, and percents.

2. To provide opportunities for mathematical skill development necessary to solve consumer, business, and technical problems of the kind that will confront students.

3. To extend applications of mathematics in the home, personal life, and occupation, through study of installment buying, budgets, taxes, measurement, and estimation.

4. To bring about student awareness of the importance of mathematics in careful planning, critical thinking, wise buying, and judicious saving.

5. To let students experience some success each school day to assure proper motivation through solving problems geared to student reading levels as well as mathematical maturity.

6. To provide opportunities for students to expand their creativity, imagination, curiosity, and visualization necessary for improved mathematical reasoning.

7. To develop a realization of the beauty of mathematics as a logical structure, as well as a social tool for solving problems of every day living.

APPLIED MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
I. Sets in the Study of Mathematics	I. 1. List the elements of a set from a given rule.
A. Notation	2. Establish a rule to describe a given set.
B. Equivalent and Equal Sets	3. Identify elements that belong to a solution set of a particular set operation.
C. Subsets	4. Distinguish between examples of finite and infinite sets.
D. Union and Intersection	5. Identify a null set or a universal set.
E. Universal and Null Sets	6. Distinguish between equal sets and equivalent sets.
F. Finite and Infinite Sets	
II. Numeration Systems	II. 1. Describe the difference between a number and numeral.
A. Counting Numbers (Natural Numbers) 1. Cardinal use 2. Ordinal use	2. Write Babylonian, Egyptian, and Roman Numerals.
B. Systems from Other Cultures 1. Egyptian 2. Babylonian 3. Roman 4. Hindu-Arabic	3. Describe the significance of numeral position in the above.
C. Decimal and Non-Decimal Numeration 1. Bases, exponents, scientific notations 2. Bases other than 10	4. State whether numbers are used in the ordinal or cardinal.
	5. Explain similarities and differences between decimal and non-decimal numeration systems.
	6. Write numerals and identify numerals in polynomial form or expanded notation in various number bases.
	7. Write numerals in scientific notation.
III. Whole Numbers	III. 1. Designate positions of whole numbers on a number line.
A. Operations	2. Perform the fundamental operations using a number line.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
I. It has been often stated that the fundamental notions of sets can aid understanding of most, if not all, concepts of mathematics. This major topic is suggested as an avenue to clear thinking, and stress should be placed upon the topic only to the degree that it aids students in understanding the mathematics presented in this guide. It would be hoped that once these notions are presented, that the terminology would be used wherever it would help students understanding, or aid them in expressing ideas.	I. Textbooks: 11 Chapter 1 12 Chapter 3 10 Chapter 1 Filmstrips are available from your school library.
II. The use of films, overhead projectors with appropriate transparencies, and filmstrips are important adjuncts to teaching this and other major areas found in this guide. The films suggested can be motivators of interest in appreciating different number systems. The outcomes listed do not exhaust the limits to which this topic could be pursued. One would hope students would have a deeper appreciation of the benefits of the Hindu-Arabic numeration system from this topic. Some students have difficulty distinguishing between exponents and bases. Some multiply exponents times bases. If students understand what a factor is, their confusion could be remedied by explaining that the exponent determines the number of times the base is used as a factor. In discussing number bases, it might also be helpful to consider bases as related to the grouping of objects, i.e., base 5 represents a grouping of objects by five. Picturing objects and actually grouping them by five can be enlightening.	II. Textbooks: 11 Chapter 2 12 Chapter 1 10 Section 1-1 Films: 2 3

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
III. Whole Numbers (cont)	III. 3. Identify properties and relations of whole numbers.
B. Properties 1. Closure 2. Commutative 3. Associative 4. Distributive 5. Property of 1 6. Property of 0	4. Solve verbal problems requiring whole numbers and the four fundamental operations.
C. Order Relations 1. Less than 2. Greater than 3. Equality	
D. Verbal Problems Involving the Use of the Four Basic Operations	
IV. Number Theory	IV. 1. Distinguish between odd and even numbers.
A. Odd Numbers	2. Write six multiples of whole numbers.
B. Even Numbers	3. Use rules of divisibility to determine if numbers are divisible by a given number.
C. Multiples	4. State or write factors of a whole number.
D. Factors and Rules for Divisibility Using 0,1,2,3,4,5, 6,7.8,9,10.	5. Determine if a number is prime or not.
E. Prime and Composite Numbers	6. Find the greatest common factor of two or three numbers.
F. Greatest Common Factor	7. Find the least common multiple of two or three numbers.
G. Least Common Multiple	
V. Non-Negative Rational Numbers	V. 1. State the difference between a rational number and a fraction.
A. Meaning	2. Designate the position of a rational number on a number line.
B. Equivalent Fractions	3. State whether one rational number written as a fraction is greater than, less than or equal to another rational number.
C. Order Relations (Related to Number Line) 1. Equality $\frac{a}{b} = \frac{c}{d}$ iff ad = bc	

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
III. Wide variation is usually found in applied mathematics classes in students' ability to compute with whole numbers. It cannot be too strongly emphasized that every effort must be made to increase students computational ability. This requires an attitude of understanding, patience, and encouragement. It is not the view of this guide that properties of whole numbers, commutative, associative, distributive, and identity should be considered as names to be memorized without understanding of their meaning and value through use. Drawing diagrams, giving instances where they do not hold, and using them in decreasing difficulties of computation justify their inclusion in this guide.	III. Textbooks 6 pp. 236-237 11 pp. 135-136 12 pp. 9- 43 Film 16
IV. The greatest common factor and the least common multiple seem difficult for some students to find. Students must know what factors are, what common factors would be of two numbers. Obviously, they must be able to factor numbers into prime factors. Above all they must be impressed why this is all important in working with fractions. Many examples patiently shown by the teacher can bring understanding where it has never existed for some students. To understand what the least common multiple of two numbers is, students must know what a multiple of a number is and be able to write multiples of numbers. Example: What are multiples of 2 and 5? Multiples of 2 are 2,4,6,8,10,12... Multiples of 5 are 5, 10, 15, 20, 25. Common multiples of 2 and 5 are 10, 20, 30, 40 ... The least common multiple of 2 and 5 then is 10, the smallest of the multiples.	IV. Textbooks 6 Chapter 1 11 Chapter 1 7 Chapter 2 5 Chapters 3 and 4 Consult libraries for filmstrips available.

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
V. C. 2. Inequality $\frac{a}{b} > \frac{c}{d}$ iff $ad > bc$ D. Proper and Improper $\frac{a}{b} \geq 1$ E. Operations using Fractions 1. Addition $\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$ 2. Subtraction 3. Multiplication $\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$ 4. Division $\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc}$ F. Verbal Problems Using Fractions G. Decimal Fractions 1. Relation to common fractions 2. Terminating and repeating 3. Order 4. Operations using decimals 5. Verbal problems using decimals H. Percents 1. Relation to fractions and decimals 2. Operations	V. 4. Write equivalent fractions for a given fraction. 5. Perform fundamental operations with fractions, decimals, and percents. 6. Convert fractions to decimals and/or percent equivalents and vice versa. 7. Write equations representing verbal statements about rational numbers, using fractions, decimals and percents. 8. Solve verbal problems using fractions, decimals and percents. 9. Distinguish between percent, rate, base and percentage. 10. Apply percent to the solution of problems involving increase, decrease, interest, budgets, taxation, depreciation, mortgages, payroll deductions, and graphing, estimation and measurement.
VI. Real Numbers A. Rational Numbers B. Irrational Numbers 1. Square root 2. Cube root 3. Approximation of square roots of irrational numbers.	V. 1. State some of the properties of real numbers. 2. Write approximations of irrational numbers. 3. Use symbols for principal roots of numbers. 4. Compute square roots of numbers using the familiar algorithm or the iterative method.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
V. For many students, a great stumbling block in their achievement, has been a combination of two things, one is disappointment in their inability to master the multiplication facts, the other is their inability to comprehend operations with fractions. Students who have these difficulties must approach the study of fractions with grave reservations about their potential for being successful. If this is the case, the teacher's presentation might best help meet the objectives of this major area, if considered as a first introduction to the study of rational numbers. Understanding of this topic is essential for training in many occupations. Applications from drafting classes, home economics classes, machine shops, science classes, or simply, working with a ruler, can give evidence of the importance of this topic. Have your students bring to class problems requiring the use of fractions for solution. It is further suggested that in presenting this topic, that physical models, drawings, and number lines be used. In using the number line, students can readily see that whole numbers are subsets of the rational numbers. The view considered in organizing this guide was that fractions, decimal fractions, and percents were so closely related they should be considered as one major area. It was also the view that the student who has learned how to work with fractions well can easily understand how to work with decimal fractions and percents. As long as requirements for acceptability of applicants for certain job training include tests which include heavy empnasis on verbal problems involving fractions, decimals, and percents, the importance of this major	V. Textbooks: 6 Chapters 2 and 3 11 Chapters 5 and 6 12 Chapters 6 and 7 7 Chapters 3 and 4 5 Chapters 6 and 7

OBSERVATIONS AND SUGGESTIONS (Cont.)
V. area can not be minimized. A large number of verbal problems should be studied in conjunction with this major area. Undoubtedly, this will include instruction in reading, including looking for clue words, and interpreting what has been read. Extreneous information, insufficient information, and translation of words into mathematic statements, are matters deserving of attention.

APPLIED MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
VI. Real Numbers (Cont.)	VI. 5. Apply square root computations to solving right triangles using the pythagorean theorem.
	6. Describe the decimal representation of the square root of an irrational number.
VII. Equations and Inequations	VII. 1. Distinguish between an equation and an expression.
A. Statements and Open Sentences	2. Distinguish between a statement and an open sentence.
B. Variables and Replacement Sets	3. Find solution sets satisfying verbal sentences as well as symbolic equations.
C. Equivalent Equations and Transformations	
VIII. Ratio and Proportion	VIII. 1. Explain a ratio as a comparison of numbers by the operation of division.
A. Definitions	
B. Solution of Proportions	2. Explain a proportion as a statement that two ratios are equal.
C. Verbal Problems Involving Proportions (Examples)	3. Write proportions when given a ratio.
1. Scale drawings 2. Mixtures 3. Recipes 4. Shrinkage 5. Ratio of threads per inch to distance screw travels in one revolution 6. Ratio of quantity of paint to area covered 7. Ratio of pounds of fertilizer to square feet of lawn covered 8. Ratio of diameter to circumference of circle 9. Ratio of distance traveled to circumference of a wheel 10. Ratio of speed to stopping distance	4. Identify the means and extremes of a proportion. 5. Solve proportions. 6. Use proportions to solve verbal problems in the examples listed. 7. Solve problems involving percents.

MAJOR AREAS (Continued)	
VIII. C.	11. Ratio of distance traveled per second to miles per hour 12. Percent as a ratio

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
VI. Emphasis in this major area should be on computations with sqaure root. It is by no means anticipated that this area would be given the same emphasis as that given in algebra classes. The use of a square root table would be a valuable experience for most students along with computation of square roots.	VI. Textbooks: 11 pp. 210-223 10 pp. 42 and 375
VII. In this major area, emphasis must be on how the four fundamental operations are used to solve equations. This is necessary to understand the next major area.	VII. Textbooks: 6 Chapter 17 11 pp. 207, 236-280 12 Chapter 10 10 Chapter 2 2 pp. 358-384 3 pp. 34- 36
VIII. The ratio 2:15 or 2/15 can represent the rate at which two oranges are selling, that is 2 for 15¢. One might want to know how many oranges could be bought for 60¢ when selling at the same rate. If n stands for the number we can buy, then the rate at which n oranges are selling for 60¢ is expressed as the ratio, n:60 or n/60. Since the oranges are selling at the same rate, the ratios must be equal, so we can write 2/15 = n/60. Two methods for finding n can be made available to the student. One would be to write equivalent fractions for 2/15 by multiplying by equivalent forms of one such as 2/2, 3/3, or 4/4. Another method comes from the equality of rational numbers, that is: if a/b = c/d, then it follows that ad = bc. Some refer to this as the cross-products method. If percents have been considered by students as ratios, they can readily translate, for example: 25% to 25/100. If 240 students of a high school can swim 50 yards and this represents 25% of the student body, the size of the student body can be found using ratios: 25/100 = 240/n. The concept of ratio obviously is a powerful one for solving problems. It has innumerable applications in elementary mathematics.	VIII. Textbooks: 6 pp. 90-95 12 pp. 234-237 7 Chapter 7 1 pp. 146-152 Film: 10

APPLIED MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
IX. Graphical Representations A. Bar Graph B. Circle Graph C. Pictograph D. Line Graph	IX. 1. Determine the number units needed to represent given data. 2. Determine representative units for graphing. 3. Draw bar graphs and pictographs from given data of immediate interest to students. 4. Draw line graphs and circle graphs. 5. Explain the best uses of the types of graphs. 6. Interpret graphs of current interest based upon student surveys, newspaper or magazine articles.
X. Denominate Numbers and Measurement A. Units of Measurement B. Conversions from One Unit to Another 1. Linear(English and Metric) 2. Liquid(English and Metric) 3. Weight(Avoirdupois and Metric) 4. Time 5. Dry 6. Temperature F. and C. 7. Angle	X. 1. Measure lines with arbitrary and standard units of measure. 2. Measure angles with arbitrary and standard units of measure. 3. Measure capacity of a bottle with an arbitrary unit. 4. Estimate weights. 5. Convert measurements from higher to lower denominations such as pounds to ounces and vice versa. 6. Use the fundamental operations with denominate numbers. 7. Use various measuring instruments with accuracy to the nearest half unit. 8. Find averages of measurements made by students.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
IX. The problem most difficult for graphing is determining a unit which can be used to represent data. Time can be valuably spent in helping students make these decisions. Making a graph provides a firm basis for learning to interpret a graph. A meaningful assignment in this unit is to have students find graphs and interpret them to the class. The films listed should aid in a better understanding of this unit.	IX. Textbooks: 1 Chapter 5 2 Chapter 12 3 pp. 350-357 5 pp. 39-67 6 Chapter 26 7 Chapter 24 Films: 4 5
X. 1. A basic consideration in teaching this topic is that measurement is never exact. 2. To be able to compute with denominate numbers is an important skill. It is necessary to give students experiences in measuring to develop a feeling of the meaning of standard measures and some reasonable skill in using measuring instruments. 3. This topic lends itself to the possibility of working with teachers in other departments such as, home economics, science, and industrial arts, to develop skills required to perform tasks in these applications. 4. The metric system is becoming increasingly important in our technology. Well-written articles are available regarding this trend. 5. It does not seem wise to have students be required to memorize tables of measurement; however, they could be encouraged to develop their memories by trying it!	X. Textbooks: 2 Chapter 4 3 Chapter 15 8 Chapter 7 Films: 7 13

APPLIED MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XI. Consumer Mathematics A. Budgeting B. Savings and Income 1. Reasons 2. Types a. hiding places b. checking accounts c. savings accounts d. stocks and bonds e. life insurance f. property ownership g. borrowing 3. Interest - Simple and Compound 4. Pay Check C. Spending 1. Reasons 2. Usual credit purchases a. housing b. automobile c. appliances and furniture d. entertainment e. travel expenditures 3. Usual cash a. food and rent b. clothing c. automobile expenses d. household utilities e. taxes 1. sales and excise 2. income 3. real estate 4. personal property f. entertainment g. charity D. Depreciation and Appreciation 1. Straight line 2. Declining balance E. Discount 1. Computation of single and successive discounts 2. Finding list price when the rate and net amount are given 3. Finding the rate of discount	XI. 1. Prepare a household budget based upon a specific income. 2. Identify principle, rate, time and interest in verbal problems. 3. Solve verbal problems involving simple interest. 4. Use a table to compute compound interest when given a specified principle, rate, time, and conversion period. 5. Write checks according to accepted procedure. 6. Reconcile a bank statement. 7. Explain details of a local bank's saving account. 8. Explain the meaning of a listing in a stock market quotation. 9. Explain financial details of a United States Savings Bond. 10. Compute simple and compound interest. 11. From a table, determine the cash value of a life insurance policy when given necessary information. 12. Calculate pay check with necessary information such as: hourly rate, hours worked, or commission. 13. Explain how property ownership can be a form of saving. 14. Compute total cost of credit purchases specified. 15. Determine food expenditures for the students family for a period of time.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
XI. Making a household budget that is realistic in terms of expenses and income can be a valuable experience. A study of students' budgets in terms of amounts allocated for various expenses can develop some insight into wise money management. It might also be a profitable experience in actually stretching the student's family budget. By no means should the privacy of families be invaded, however, in studying this topic. The study of rates of interest, in borrowing, can be an eye-opening experience for students. It would be hoped that they would have many opportunities to profit from such study. It is somewhat unbelievable that there are so many people in the general population unable to correctly write a check. Business firms can readily attest to this. Good citizenship could be fostered from a discussion of the responsibility involved in keeping a checking account. The importance of careful computation in reconciling bank statements can help students prevent financial difficulties. The outline for this unit took into consideration the listing of topics in an order based on the proportion of income used for various needs. There are many different interesting possibilities in presenting this topic and emphasis must be on mathematical reasoning and computations.	XI. Textbooks: 6 Chapters 9, 10, 11 11 Pages 366-414 2 Chapters 10, 11 5 Chapters 13-20 9 Units 1-10 Film: 12
OBSERVATIONS AND SUGGESTIONS (Continued)	
XI. This topic provides opportunity to invite resource persons from other disciplines and the community to discuss consumer problems, and encourage speakers to discuss mathematics problem solving in their presentations. Possible speakers could include a banker, credit union representative, small loan office representative, life insurance representative, stock broker, realtor, tax specialist, automobile salesman, social security representative, and teachers of home economics, economics, and general business. Coordination with the principal is necessary in inviting speakers.	

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XI. F. Financial Security through Insurance 1. Life insurance 2. Automobile insurance 3. Homeowners insurance 4. Health insurance 5. Social security and Medicare 6. Pensions and annuities	XI. 16. Determine automobile expenses for a specified period of time per mile. 17. Compute sales taxes on various prices. 18. Compute federal and state income taxes. 19. Compute real estate and personal property taxes given a valuation and tax rate. 20. Compute depreciation by two methods. 21. Solve problems dealing with discounts. 22. Distinguish between a life insurance policy, premium, and other terms related to life insurance. 23. Explain differences between term and permanent life insurance. 24. Compute the premium of life insurance when given pertinent information. 25. Compute the daily and weekly rate of life insurance when given a semi-annual rate. 26. List three settlement options of life insurance policies. 27. List three coverages included in a homeowners insurance policy. 28. Compute the cost of a premium for a homeowners policy when given pertinent information. 29. Compare the costs of premiums for two different health insurance plans.

SIGNIFICANT ANTICIPATED OUTCOMES (continued)
XI. 30. Compute social security taxes on a given salary. 31. Explain at least three benefits of social security. 32. Explain how an annuity is a form of insurance.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
XI. Some say like housing and food, a basic need in every family is some semblance of financial security. Life insurance can contribute to that security. The non-forfeiture options of extended term insurance, cash, and paid-up insurance are not too generally known by policy holders. Many assume that life insurance benefits are paid solely upon the death of the insured. The merits of various policies should be discussed since decisions have to be made that are economically sound based upon income. An actual insurance policy could be used to show settlement options and cash surrender values. Students could compute cash values based upon various years of insurance in force and face values of policies. An insurance agent is a good resource person for this topic. Co-ordination with the principal, regarding inviting a speaker, is necessary and helpful.	XI. *Textbooks:* 6 Chapter 8 4 Chapter 6

APPLIED MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XII. Geometry in Applied Mathematics A. Undefined Terms 1. Point 2. Line 3. Plane B. Geometric Figures C. Linear Measurement D. Areas of Polygons E. Volumes of Solids F. Applications	XII. 1. Measure lines with rulers with accuracy to the nearest given unit. 2. Find areas of geometric figures. 3. Find circumferences of circles of given radius or diameter. 4. Find the radius or diameter of a circle of given circumference. 5. Find volumes of rectangular solids. 6. Find volumes of cylinders. 7. Solve problems requiring the use of linear measures in various applications.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
XII. It would seem that this unit would have most meaning when students become convinced of geometry ideas in solving problems of living. People still paint rooms in their homes. They still put in lawns and fertilize them. They are concerned about the cost of carpeting. If they are considering building a home, they might need to know the amount of fill necessary to bring a lot up to grade. Are these things worth knowing about? Ask your students. It has been long known that the best motivation for the study of any topic is the conviction of the student himself of the worthwhileness of what he is studying. This topic can be quite controversial if one were to poll people in various disciplines about what a student should be able to do as a result of this learning experience. Some would say he should be able to use a vernier calipre, some would say he should be able to use a micrometer, some would say he should be able to determine rim speeds or surface speeds of pulleys, while others might be concerned about the students ability to figure board feet. It is obvious that the list of things various people would like students to be able to do as a result of this study would be beyond the memorization ability of the students enrolled in this course. Having a wide variety of materials for independent study related to various types of trades and occupations might be a possible solution. Students could be	XII. Textbooks: 6 Chapters 12, 13, 14, 15 11 Chapter 14 12 Chapter 13 10 Chapter 3 2 Chapter 5 3 Chapter 13 Films: 1 6 8 9 11 14 15 17 18

OBSERVATIONS AND SUGGESTIONS (Continued)
XII. assigned projects in using geometry related to their current occupational interests. Other faculty members might be of assistance in identifying possible materials for such self-study. Students do like the opportunity to present the results of their study to the class. This might possibly provide motivation for applications of geometry to areas of student interest.

APPLIED MATHEMATICS

B-I-B-L-I-O-G-R-A-P-H-Y

1. Brown, Gordey, Sward, and Mayor. Mathematics Second Course. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1960.

2. Brown, Simon and Snader. General Mathematics-Book Two. Dallas, Texas: Laidlaw Brothers Publishers, 1963.

3. Brumfield, Eicholz, Shanks, and O'Daffer. Arithmetic Concepts and Skills. Reading, Massachusetts, Palo Alto, London: Addison-Wesley Publishing Company, Inc., 1963.

4. Hindle, John and Harold Feldman. Mathematics in Business. Chicago, Illinois: Allyn and Bacon, Inc., 1963.

5. Lankford, Ulrich, and Clark. Essential Mathematics. Chicago, Illinois: Harcourt, Brace & World, Inc., 1961.

6. Lasley, S., M. Mudd, and P. Rogler. The New Applied Mathematics. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1964.

7. McNally, Adams, and Olson. Business and Consumer Arithmetic. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1964.

8. School Mathematics Study Group. Mathematics for Junior High School, Volume I. New Haven, Connecticut: Yale University Press, 1961.

9. Piper, E. and J. Gruber. Applied Business Mathematics. Chicago, Illinois: South-Western Publishing Company, 1965.

10. Skeen, K. and E. Whitmore. Modern Basic Mathematics-Book II. Chicago, Illinois: The L.W. Singer Company, 1965.

11. Stein, Cowin I. Fundamentals of Mathematics. Chicago, Illinois: Allyn and Bacon, Inc., 1964.

12. Wilcox, M. and J. Yarnelle. Mathematics-A Modern Approach. Reading, Massachusetts, Palo Alto, London: Addison-Wesley Publishing Company, Inc., 1963.

APPLIED MATHEMATICS
F-I-L-M-S

1. Donald in Mathemagic Land
   30", color, Walt Disney, Junior and Senior High
   (Interesting, good for background, entertaining for students)

2. Earliest Numbers
   30", black and white, Indiana University, Junior and Senior High
   (Good for introducing the set of the first numbers and numerals -- but needs support.)

3. Language of Mathematics
   11", black and white, Junior and Senior High
   (Good for introducing mathematics)

4. Language of Graphs
   13 ½", black and white, Cornet, Junior High
   (Good for introducing graphs and showing the use of graphs in specific cases.)

5. Mathematician and the River
   19", color, Senior High
   (A very good film on the application of mathematics in controlling and predicting the flood stages of a river.)

6. Meaning of Pi
   10", black and white, Cornet, Junior High
   (Good - explains Pi as a ratio)

7. Metric System
   11", black and white, Cornet, Junior and Senior High

8. Parallel Lines (Geometry)
   11", black and white, Johnson Hunt, Junior High
   (Good - Practical application)

9. Polygons (Geometry)
   10", black and white, Senior High

10. Ratio and Proportion in Mathematics
    11", black and white, Junior High

11. Solids in the World Around Us
    15", color, Delta (Cenco), Junior High
    (Good for introduction - helps students visualize the shapes of figures)

12. Story of Our Money System
    11", black and white, Junior and Senior High
    (A good film for the introduction of business and consumer arithmetic)

13. Story of Weights and Measures
    11", black and white, Cornet, Junior High
    (Good for historical background)

14. Surface area of Solids, Part I
    15", color, Delta (Cenco), Junior and Senior High
    (Very good for Simple plane figures)

APPLIED MATHEMATICS
F-I-L-M-S

15. Surface Area of Solids, Part II
    15", color, Delta (Cenco), Junior and Senior High

16. Understanding Numbers, Base and Place
    30", black and white, Indiana University, Junior and Senior High
    (Introduces binary system while studying about different bases)

17. Volumes of Cubes, Prisms, and Cylinders
    30", color, Senior High

18. Volumes of Pyramids, Cones, and Spheres
    15", color, Senior High

OBJECTIVES FOR SENIOR MATHEMATICS

1. To be able to use and understand the four fundamental operations on whole numbers and fractions.

2. To be able to use and understand the use of percentage problems.

3. To be able to solve verbal problems that involve everyday living in the use of basic arithmetic.

4. To establish and gain self-confidence in his ability, at the same time acquire respect for himself as well as for others.

5. To see the real need for mathematics in consumer buying and the ability to earn a decent living with mathematics as a tool.

6. To encourage students to try the seemingly difficult before they give up, to have them experience success, and thereby, assure them what once looked difficult can be understood when problems are taken a step at a time with concentration and effort.

7. To help students be wise consumers.

8. To equip students with enough mathematics to be able to compete for satisfying jobs that they can perform to their employer's satisfaction.

9. To gain enough interest and motivation so as to see the possibilities of furthering education after graduation.

THE NATURE OF THE STUDENT IN SENIOR MATHEMATICS

In most cases the student did not achieve a satisfactory score on mathematics tests given to juniors. The tests are designed to measure computational skills as well as reasoning in basic arithmetic.(The four fundamental operations of addition, subtraction, multiplication, and division using whole numbers, common fractions, and decimal fractions; the use of percentages, denominate, and verbal problems.) The student is likely to have ranked in the lower 50% of a general mathematics class, and in some cases repeated general mathematics. This student is most likely a person who lacks self-confidence, respect, proper study habits, joy of completing an assignment, and doesn't see the need of mathematics. He may have a strong dislike of mathematics or even a mental block for this subject. His intelligence could range from below 70 IQ. to above 100 IQ. The student often comes to class without proper materials and ill prepared. He does not see many relationships in mathematics, nor is he likely to see the real need of mathematics in order to function as a consumer as well as a worker. His attendance in school is probably sporadic, and when attending school, his attention span is short. With all of these shortcomings, this student can prove to be a real challenge to the best of teachers. It is the thinking of administration and mathematics teachers that this student needs to be given a remedial mathematics course in the senior year when he is at a more mature level, and at a point of termination of his formal education, when the effect of the subject should be most meaningful. It would be an error to have high school graduates take their place in the community who are ill-prepared to meet the needs and demands of society; so as a real social and individual need this course was instituted.

POINTS TO CONSIDER IN TEACHING SENIOR MATHEMATICS

1. Work assignments should be short and if possible done in class where the student can obtain supervision and assistance. (It is possible to leave the student with the impression that taking work home is a privilege when he feels the need to complete his assignment.)

2. Expect mastery of mathematics terminology where its purpose would be to stimulate, create understanding, and show relationships.

3. Have spare equipment in the classroom, such as extra pencils and books for the student who forgets his materials.

4. Encourage students to ask as many questions as necessary for understanding, and insist that the student seek help at the first encounter of not knowing. Often a student's problem can be cleared by correcting a small procedure in a problem; thereby, making the problem seem easy.

5. Treat the student with understanding, and respect his problems. Use his ideas.

6. Give as much varied approach to problems as possible in order to create interest and motivation. Use many open end questions to involve students in learning.

7. Frequent tests should be given to measure the progress of the student. This is valuable to the teacher and also encourages the student, because he can see progress when the results take an upward swing.

8. Some topics of recreational mathematics can be used.

9. It is possible for the majority of the class to receive grades that are average or above.

10. Students' work should be corrected immediately to remedy habits that may become set.

11. Positive statements and encouragement by the teacher are very important aspects of this course.

12. Resource people can be of assistance in reinforcing ideas considered and bringing new ideas to your class.

13. There is no pressure on the amount of subject matter that must be completed in a year; therefore, a reasonable and relaxed pace is always possible.

14. The student can work and think at a rate at which he can assimilate the material.

15. Much time can be devoted to class discussion, not only on mathematics per se, but on the importance of improving one's self.

16. In this twelfth-grade course, the student should be given frequent opportunities to review and strengthen the skills of arithmetic--meaningful drill is not outdated.

17. Excellent diagnostic and drill practice can be found in the booklet, "Diagnostic and Practice Exercises", Mathematics Department, Gary Public Schools, 1961, provided by the Secondary Education Office.

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
I. Symbols, Sets, and Sets of Numbers	I-1. Distinguish between symbols and the ideas they represent.
A. Symbols	2. List several examples of symbols, and name the ideas they represent.
B. Sets	3. Solve problems using symbols of inclusion (order of operation).
1. Set notation	4. Recognize in mathematics there exists symbols for numbers, operations, and order.
2. Set membership	5. State the use of braces.
3. Null set, finite set, and infinite set.	6. Identify the members or element of a given set.
C. Sets of numbers	7. Classify a given set as finite, infinite, or null set.
1. Natural numbers	8. Describe by rule a set given in roster form.
2. Whole numbers	9. Write a set in roster form, given a rule.
a. Properties	10. Describe the relationship a capital letter has with a set
(1) Closure property for addition and multiplication	11. Identify and state the set of natural number and the set of whole numbers.
(2) Commutative property for addition and multiplication	12. State and identify the properties of whole numbers which verify the equality of two given expressions.
(3) Associative properties for addition and multiplication	13. Use properties of whole numbers to compute and simplify.
(4) Distributive property	14. Describe the difference between a number and a numeral--a cardinal number and an ordinal number.
(5) Property of numbers one and zero	15. Write numerals for a given number in several ways.
b. Number and numerals	16. Name the ordinal number and cardinal number given a number by the use of a number line and sets of objects.
(1) Counting	17. Count by use of objects and number line to any given number using one-to-one correspondence, counting by two, etc.
(2) Cardinal number and ordinal number	18. State which number is less than, greater than, or equal to another number.
(3) Order	19. State and show that the positional value system we use is based on ten.
(4) Positional value	20. State that each period has three places and each place names ones, tens, and hundreds in a given period and each place has a unique value based on tens.
(5) Reading, writing, and meaning	21. Read and write given numerals.
3. Number line	22. State the meaning of each numeral in a given place.
4. Prime numbers	23. Name the coordinate of a point on a number line.
	24. Name a point on a number line given its coordinate.
	25. Identify prime numbers.
	26. Write prime numbers from 2 to a given number.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
I- 1. The teacher can find excellent material on Sets and Sets of Numbers which can be duplicated in the workbook The Modern Math Series (8) by Deans, Kane, McMeen, & Oesterle --Pp. 1-39. 2. The student should be acquainted with the properties of whole numbers, because throughout the course referral will be made to these properties. 3. Mastery of this unit is not necessary, but the student should become acquainted and have a good background in this area. 4. Use the number line whenever possible in working with whole numbers. 5. Discuss and demonstrate the use of the abacus (It might be possible to assign as a project the making of an abacus.) 6. If time permits and the class shows interest teach a unit on the history of numerals.	I. Textbooks 2 Chapters 1, 12 3 Chapters 1,3,5,6,7,10,16 4 Chapters 1, 8 6 Chapters 2, 3 7 Chapter 1 9 Chapter 1 11 Chapters 1, 2, 3, 4, 7 12 Chapter 19 13 Chapters 1, 2, 4, 10 14 Chapters 6, 7 15 Chapter 1 16 Chapters 1, 5, 6 17 Chapters 1, 2, 11 Audio-Visual Materials: Films: The Earliest Numbers: Understanding Numbers 30 min. (black & white) Language of Mathematics 11 min. (black & white) The Meaning of Pi 10 min. (black & white) Understanding Numbers: Base and Place 30 min. (black & white) Filmstrips: Intersection of Sets 45 fr. (color) (MH) Introduction to Sets 45 fr. (color) (MH) Early Counting 39 fr. (color) (FH)

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
II. Operations With Whole Numbers	II-1. Write the answers to the 390 basic facts of addition, subtraction, multiplication, and division with speed and accuracy. (Possible goal - 10 minutes, 95% accuracy)..
A. Basic facts for addition, subtraction, multiplication, and division.	2. Compute with accuracy addition, subtraction, multiplication, and division using the properties of whole numbers.
B. Computations with respect to	3. Give estimates to given problems. (Whole number operations)
1. Addition	4. Give oral answers to given problems. (Whole number operations)
2. Subtraction	5. Use the number line to round off whole numbers to a given place.
3. Multiplication	6. Round off whole numbers to a given place without the use of number line.
4. Division	7. Solve verbal problems using whole numbers.
C. Rounding off whole numbers	8. Identify the units of measure in length, liquid measure, dry measure, weight, and time. (Basic measurements)
D. Computations with denominate numbers with respect to	9. Solve problems changing from a smaller unit of measure to a larger unit of measure and vice versa.
1. Addition	10. Solve problems using denominate numbers and give the answers in simplest forms for addition, subtraction, multiplication and division.
2. Subtraction	
3. Multiplication	
4. Division	

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS

II-1. The basic facts are important to the student, because it is at this phase where most mistakes are made in basic computations.

2. Not all students will completely master the basic facts but every student should make an honest attempt to obtain accuracy and speed. Much drill is needed in this area and it should be varied.

3. Bridging of tens can be helpful in basic addition facts-

$$\begin{array}{r} 8 \\ +7 \\ \hline 15 \end{array}$$ think 8 and 2 are 10 and 5 more equals 15

4. On subtraction facts the following can be helpful:

$$\begin{array}{r} 11 \\ -7 \\ \hline 4 \end{array}$$ think 7 from 10 is 3 and 1 makes 4

5. Use the number line to teach rounding off whole numbers.

6. It is important that the student learns to estimate problems in order to make a quick check.

7. The idea of place value and the property of whole numbers is important in the operations of whole numbers.

8. Have the student solve problems by the method that shows place value.

$18 = 20+8$, $+31 = 30+1$, $59 = 50+9$

$258 = 200+50+8$, $-136 = 100+30+6$, $122 = 100+20+2$

$4\overline{)92} = 4\overline{)90+2}$, $23 = 20+3$

$34 = 30+4$, $\times 2 = \times 2$, $68 = 60+8$

8, 12, 12

80, $10+2$, $10+2$

9. In the unit on Whole Numbers, the student is to undertake and receive a thorough review in the fundamental processes involving whole numbers. This competency is necessary for continuing course units in sequence.

10. Use the idea of regrouping for the operation of whole numbers.

11. The idea of inverse operations can be helpful.

12. Most errors are made when working with denominate numbers by students who think in terms of base ten rather than their equivalent measurements.

II. Textbooks

1 Chapters 1, 2, 3, 4, 5
2 Chapters 1, 3, 12
3 Chapters 6, 9, 10
4 Chapter 2
5 Chapter 1
6 Chapters 3, 7, 8
7 Chapters 2, 3, 4, 5
8 Chapters 1, 5
10 Chapters 2, 6
11 Chapter 4
12 Chapter 18
13 Chapters 3, 9
14 Chapter 2
15 Chapters 1, 3, 11
16 Chapters 6, 7
17 Chapter 3

Audio-Visual Materials:

Films:

Story of Weights and Measures
11 min. (black & white)

Weights and Measures
14 min. (black & white)

SENIOR MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
III. Operations With Common Fractions	III-1. Name, identify, and define the terms of a fraction.
A. Definition of fractions	2. State the various meanings of fractions.
1. Part of a whole	3. Recognize and identify proper fractions, improper fractions, and mixed numbers.
2. Part of a group	4. Write in order a given set of fractions largest to smallest and vice versa.
3. Ratio	5. Use the number line to round off common fractions to nearest whole number.
4. Division problem	6. Round off common fractions to a whole number without the use of the number line.
B. Order of fractions	7. Use the multiplicative identity element in writing a set of equivalent fractions having as an element a given fraction.
C. Rounding off fractions	8. Express two or more fractions in equivalent form having the lowest common denominator by use of prime factorization.
D. Equivalent fractions	9. Find the G.C.P. and L.C.M. of any two or more given numbers.
E. G.C.D. & L.C.M.	10. By use of a ruler, a number line, and thermometer find a mixed number given an improper fraction and vice versa.
F. Computations of fractions and mixed numbers	11. By use of ruler and objects compute the sum, and difference of two or more given fractions.
1. Addition	12. Compute with accuracy addition, subtraction, multiplication and division using the properties of rational numbers. (A new property is introduced to rational numbers--a given number times its reciprocal equals one)
2. Subtraction	13. Find solutions to problems stating fractional relationships between numbers. (The three cases)
3. Multiplication	14. Solve verbal problems using common fractions as given numbers.
4. Division	
G. Fractional relationships between numbers	
1. Fractional part of a number	
2. What fractional part one number is of another	
3. Finding the number when a fractional part of it is known	

OBSERVATIONS AND SUGGESTIONS

III-1. Illustrate fractions by drawings of rectangles and circles divided into parts or by magnetic board.

2. Use ruler to show parts of an inch.

3. Use number line to show how fractions are parts of a whole.

4. Fractions are nothing more than indicated division, numerator as the dividend, denominator as the divisor.

5. Show that ratio may be written as a fraction, or that ratio is a quotient.

6. The number obtained when a whole number is divided by any whole number except 0, is called a rational number.

7. Emphasize that complex fractions can be evaluated easily when considered as an indicated division.

8. Point out the principle of multiplying or dividing by 1, written $\frac{3}{3}, \frac{6}{6}, \frac{7}{7}$ as needed to change a fraction to another form; i.e.,

$\frac{8}{12} \div 1 = \frac{8}{12} \div \frac{4}{4} = \frac{8 \div 4}{12 \div 4} = \frac{2}{3}$

$\frac{1}{4} \times 1 = \frac{1}{4} \times \frac{3}{3} = \frac{3}{12}$

9. Point out that when two fractions are equivalent the cross products are equal; and when the cross products are equal, the two fractions are equivalent.

Example: $\frac{2}{3} = \frac{4}{6} \leftrightarrow 3 \cdot 4 = 2 \cdot 6$

$\frac{3}{5} \neq \frac{5}{8} \leftrightarrow 3 \cdot 8 \neq 5 \cdot 5$

10. Emphasis should be placed on not being able to change a proper fraction to a mixed number.

Example: $\frac{3}{4} \neq 1\frac{1}{4}$

11. Use the number line to illustrate B. through F. of major areas.

REFERENCES AND FILMS

III. Textbooks

1 Chapter 6
3 Chapters 4, 8
4 Chapter 2
5 Chapter 2
6 Chapters 4, 7
7 Chapters 6, 7
8 Chapter 2
10 Chapter 3
11 Chapter 5
13 Chapter 5
14 Chapter 2
16 Chapter 7
17 Chapters 3, 4

Audio-Visual Materials:

Filmstrips:

Ordered Pairs and Conditions
45 fr. (color) (MH)

Using Approximations
41 fr. (color) (MH)

OBSERVATIONS AND SUGGESTIONS (cont)

III-12. Use the following method to teach division:

$$\frac{3}{8} \div \frac{2}{5} = \frac{\frac{3}{8}}{\frac{2}{5}} \times 1 = \frac{\frac{3}{8} \times \frac{5}{2}}{\frac{2}{5} \times \frac{5}{2}} =$$

$$\frac{\frac{3}{8} \times \frac{5}{2}}{1} = \frac{3}{8} \times \frac{5}{2} = \frac{15}{16}$$

13. For fractional relationship between numbers use the factor times factor equals product method.

F X F = P ? x 2 = 8 4 x 2 = ?

4 x 2 = 8 4 . ? = 8

Conclusion: When a factor is missing divide the other factor into the product. When product is missing multiply.

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
IV. Operations With Decimal Fractions	IV-1. State and recognize the fact that decimal fractions have positional value based on tenths (Going from left to right)
A. Place value	2. Recognize that decimal fractions have denominators in powers of ten.
B. Reading, writing, and naming decimal fractions	3. State the function of the decimal point.
C. Rounding decimals	4. State and recognize the numerator and denominator of a given decimal fraction.
D. Order of decimals	5. Read and write a given decimal fraction or mixed decimal.
E. Computations of decimal fractions	6. State the meaning of each numeral in a given decimal fraction.
1. Addition	7. Use a decimal scale to round decimals to a given place.
2. Subtraction	8. Round off decimals to a given place by sight.
3. Multiplication	9. Write in order a given set of decimal fractions (Largest to smallest and vice versa)
4. Division	10. By the use of a ruler, a drawing, and equivalent common fractions perform the fundamental operations with more decimal fractions.
5. Multiplying and dividing by powers of ten	11. Compute with accuracy sums, differences, products, and quotients using decimal fractions.
6. Changing decimals to common fractions	12. Use the power of tens to multiply and divide a given decimal fraction (short cut method).
7. Changing common fractions to decimals	13. Given a decimal fraction, change to equivalent common fraction and vice versa.
8. Decimal relationship between numbers	14. Find solutions to problems stating fractional relationships between numbers (The three cases).
a. Decimal part of a number	15. Solve verbal problems using decimal fractions as given numbers.
b. What decimal part one number is of another	
c. Finding the number when a decimal part of it is known	

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
IV-1. It is important for the student to realize that rational numbers may be expressed by numerals in common fraction form or in decimal form, and that all the properties of operations with rational numbers apply both to fractions and to decimals. 2. Use the number scale to illustrate A. through D. 3. Use the idea of regrouping for operations with decimal fractions. 4. Use the following method for showing division: $.06\overline{)1.8} = \frac{1.8}{.06} \times 1 = \frac{1.8 \times 100}{.06 \times 100} = \frac{180}{6} = 30$ $\therefore \; .06_{\wedge}\overline{)1.80_{\wedge}}$ (30.) 5. Use the factor times factor equals product method in working problems about decimal relationships between numbers.	IV. Textbooks 1 Chapter 7 3 Chapters 4, 12 4 Chapter 2 5 Chapter 3 6 Chapters 5, 7 7 Chapters 8, 9 8 Chapter 3 10 Chapter 4 13 Chapter 6 14 Chapter 2 16 Chapter 7 17 Chapter 3

SENIOR MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
V. Per Cents	V-1. State the meaning of per cent.
A. Meaning of per cent	2. Name the numerator and denominator in a given per cent.
B. Expressing per cents as decimal fractions and common fractions	3. Change a given per cent to a decimal fraction and then to a common fraction and vice versa.
C. Expressing common fractions and decimal fractions as per cents	4. Write and read a given per cent as a ratio.
D. Computations of per cents	5. Recognize and identify equivalents of basic percentage.
1. Finding a per cent of a number	6. Find the missing number in the three cases of per cent.
2. Finding what per cent one number is of another	7. Solve given word problems that involve per cent.
3. Finding the number when a per cent of it is known.	

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
V-1. Emphasize per cent means one hundredth and that it is a ratio expressed as hundredths. 2. Per cents cannot be used in solving problems as they are but must be converted to an equivalent fraction or decimal fraction. 3. Per cent problems appear to be the most difficult type of problem for students. Much drill is needed, but preceded by understanding. 4. Computations of per cents (D) can best be solved by the factor times factor equals product method. 5. Per cent is merely a convenient way of expressing a fraction as though it were a whole number. For example: 300% of $5.00 sounds better than 300 hundredths of $5.00.	V. Textbooks 1 Chapter 11 2 Chapter 3 5 Chapter 5 6 Chapter 6 7 Chapters 10, 11 8 Chapter 4 9 Chapter 10 10 Chapter 5 11 Chapter 6 13 Chapter 7 14 Chapter 2 15 Chapter 4 17 Chapters 3, 10 Audio-Visual Materials: Filmstrips: Meaning and Understanding of Percent (color) (SVE)

SENIOR MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
VI. Verbal Problems	VI-1. Define the important words given in a word problem.
A. Word meanings	2. Answer the question "What am I to find?" in a given word problem.
B. Reconstructing a problem	3. Rephrase a given problem in your own words.
C. Estimating answers	4. When possible, construct a drawing for a given problem.
	5. Choose the word or phrase that describes what operation must be done in a given problem.
	6. In a given problem relate what facts are given and how they are related to the problem.
	7. Give reasonable estimates of solutions of problems.
	8. Solve problems and verify results.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
VI-1. Most difficulties in working verbal problems are because of the following factors: a. Inability to understand what is read. b. Not knowing what is to be found in a problem. c. Not understanding related facts in a problem. d. Not knowing what operations are to be used on the related facts. 2. It might be helpful to do the following: a. Make up problems that are real to the student. If possible use his name or the family's name in making up the problem. b. Have the student read the problem several times and look for clue words for operations and give an estimate as to what the answer should be. c. Reconstruct the problem by using whole numbers in place of fractions or mixed numbers and discover what operation you would use with these whole numbers. The same operation will apply to the fraction or mixed numbers. (Have student do this) d. Whenever possible have the student make a drawing or rephrase the problem in his own words.	VI. Textbooks 1 Chapter 8 3 Chapter 20 7 Chapter 12 16 Chapter 7

SENIOR MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
VII. Ratios and Proportions	VII-1. Define a ratio
A. Meaning	2. Write a ratio in various ways.
B. Problem solving	3. Reduce a ratio to lowest terms.
	4. Define a proportion.
	5. Name the terms of a proportion.
	6. Write a proportion in various ways.
	7. State the relationship of the terms in a given proportion.
	8. Solve a given proportion problem for the missing term.
	9. Set up a given verbal problem in various ways using proportion. Solve the problem.
	10. Solve percentage problems by the use of proportions.
	11. Discuss which method is easier in solving a verbal problem, by proportion of any other method.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS
VII-1. This unit and its application leads the student into an understanding of the meaning of ratio and proportion. Their use in solving problems leads into an appreciation of the power of proportions in practical applications. 2. Emphasize that a ratio is a comparison by division. 3. Emphasize that a proportion is two ratios that are equal and that their cross products are equal. 4. The student should be capable of setting up a proportion in various ways. They should learn that a definite pattern is used in setting up a proportion.	VII. Textbooks 1 Chapter 9 2 Chapter 9 3 Chapter 11 7 Chapter 28 8 Chapter 5 9 Chapter 7 10 Chapter 7 14 Chapter 5 15 Chapters 9, 10 17 Chapter 9 Audio-Visual Materials: Films: Indirect Measurement 10 min. (black & white) Ratio and Proportion In Mathematics 11 min. (black & white) Filmstrips: Ratio and Proportion 51 fr.

SENIOR MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
VIII. Measurement	VIII-1. Make and identify the parts of a given ruler.
A. Ruler	2. With a ruler measure and draw a given line to the nearest given fraction or whole number.
B. Protractor	3. Estimate the length of given objects or lines.
C. Finding perimeters	4. Define an angle.
D. Finding areas	5. Classify a given angle as to acute, obtuse, etc.
E. Finding volumes	6. With a protractor measure and draw a given angle.
	7. Find the perimeter and area of a given geometric figure.
	8. Find the volume of a given geometric solid.
	9. Translate a given formula into an English sentence.
	10. State a conclusion about the accuracy of measurements.

OBSERVATIONS AND SUGGESTIONS	REFERENCES AND FILMS

VIII-1. Emphasize all measurements are approximate and that they have to be made within a certain degree of tolerance. This may be demonstrated by having students measure an object with different measuring scales.

2. A point to bring out to the students is that precision is related to the size of the unit of measure chosen and that accuracy is related to the relative error of the measurement.

   Relative error= $\frac{\text{½ the smallest unit}}{\text{of measure}}$

3. Demonstrating the use of the ruler and protractor can best be done with an overhead projector.

4. When working problems in finding the area, volume or perimeter require diagrams with dimensions, formula, computation, and answer in order to clarify understandings.

5. The student should memorize basic formulas such as: perimeter of square and rectangle, area of square, rectangle, triangle, circle, volume of rectangular prism. Other formulas should be recognized by the student. Include the circumference of a circle as a formula to be memorized.

6. Develop the formulas for the areas of various geometric figures by rearranging its shape to form a rectangle.

7. Do not become involved in solving problems concerning geometric figures and solids that are complicated in nature. Use figures and solids that are most likely to occur in every day living.

8. Make up real problems such as: finding the number of tile needed for a kitchen ceiling or ceiling of a recreation room, etc.

VIII. Textbooks

1
1 Chapter 10
3 Chapters 10, 21, 22, 24
4 Chapter 5
5 Chapter 4
6 Chapters 18, 20, 21, 22
7 Chapters 21, 22, 23
8 Chapters 6, 13
9 Chapter 13
11 Chapters 10, 11
12 Chapter 18
13 Chapters 9, 14, 15
14 Chapter 2
15 Chapters 2, 5, 7, 8
16 Chapter 8
17 Chapter 6, 13

Audio-Visual Materials:

Films:

Angles 10 min. (black & white)
Areas 10 min. (black & white)
The Circle 10 min. (black & white)
Donald in Mathmagic Land
30 min. (color)
The Meaning of Pi 10 min. (B&W)
Measurement 10 min. (black & white)
Polygons 10 min. (black & white)
Solids in the World Around Us
15 min. (color)
Surface Area of Solids, Part I
15 min. (color)
Surface Area of Solids, Part II
15 min. (color)
Triangles: Types and Uses
11 min. (black & white)
Volume and Its Measurement
11 min. (color)
Volumes of Cubes, Prisms, and Cylinders
30 min. (color)
Volumes of Pyramids, Cones, and Spheres
15 min. (color)

Filmstrips:

Areas (SVE)
Basic Angles and Experimental Geometry (SVE)
Basic Triangles (SVE)
Introduction to Circles (SVE)
Introduction to Plane Geometry (SVE)
Quadrilaterals (SVE)

SENIOR MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
IX. Mathematical Symbols and Sentences A. Interpreting an open sentence B. Solving open sentences C. Writing open sentences	IX-1. Translate an open sentence from mathematical symbols to an English sentence and vice versa. 2. Using the transformation properties of equality, solve open sentences. 3. Solve verbal problems using symbols and open sentences.

SUGGESTIONS AND OBSERVATIONS	REFERENCES AND FILMS

IX-1. Emphasize the fact that an open sentence does not express a true or false statment. It becomes true or false when an element from a given set is replaced for the variable.

2. The student should learn the following mathematical symbols:

$= \neq < > \not< \not> \{\}$

$( )$

3. The algebra taught in this section should be limited to the simple open sentences.

4. Encourage students to use drawings and other schemes, if necessary, to clarify problems.

5. Puzzles and mathematical tricks can make this unit interesting and alive for the student.

IX. Textbooks

1 Chapter 12
2. Chapter 10
3 Chapter 16
4 Chapter 3
5 Chapter 10
6 Chapters 9, 12
7 Chapter 26, 27
8 Chapters 16, 17
9 Chapter 2
11 Chapter 14
13 Chapter 11
14 Chapter 4
15 Chapter 6
16 Chapter 1
17 Chapters 6, 7

Audio-Visual Materials:

Films:

Algebra: A Way of Thinking About Numbers 11 min. (color)

Filmstrips:

Arithmetic of Algebra 47 fr. (JH)
Equations and Formulas 64 fr. (JH)
Positive and Negative Numbers 61 fr. (JH)
Solution Sets and the Number Line 45 fr. (color) (MH)
Addition and Subtraction of Signed Numbers (SVE)
Introduction to Algebra (SVE)
Introduction to Equations (SVE)

SENIOR MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
X. Taxation	X-1. List the services that city taxes, state taxes, and federal taxes buy.
A. Purpose of taxation	2. Explain the difference between an indirect and direct tax.
B. Kinds of taxes	3. Discuss how a citizen can get the most for his tax dollar
1. Direct and indirect	4. Explain how taxes are determined and collected.
2. Fixed rate or progressive	5. Discuss who benefits the most from the tax dollar.
C. Sources of taxes	6. Determine and recognize the uses of forms (W-2, 1040A, 1040)
1. Local	7. Compute and fill out properly the short form (1040A) and the long form (1040) according to a given problem.
2. State	8. Determine which is the best form or proper form to use in solving a given problem.
3. Federal	9. Discuss whose responsibility it is to fill out a tax form.
D. Federal income tax	10. Name the different types of sales taxes.
1. Use of table to determine withholding tax	11. Compute the sales tax from a given rate and a given selling price.
2. W-2 forms	12. Define personal property and real estate taxes.
3. Exemptions	13. Compute the tax on a given valuation given different tax rates.
4. Deductions	14. Given a tax rate, change to equivalent tax rates (2% to $2 out of $100, etc.)
5. Use of the tax table for income under $5000	
6. Computation of tax using the schedules	
7. Completion of short form (1040A)	
8. Completion of long form (1040)	
E. Sales and Excise Taxes	
1. Sources	
2. Rates	
3. Computation	
F. Property and Real Estate Tax	

SUGGESTIONS AND OBSERVATIONS	REFERENCES AND FILMS
X-1. Emphasize that taxation is a co-operative action on the part of the government to provide many things that we cannot afford as individuals. Therefore, every citizen has a two-fold obligation as far as taxation is concerned. First, he should know the economic implications of taxation and how much he pays in taxes, and second, he must assume the responsibility of protecting himself and others by watching the use of tax money. The student must realize that he must contribute his fair share towards the services that taxation offers. It is vital that he knows the sources of taxation, and how taxes are determined, collected and spent. 2. The student should become acquainted with the various forms that are required to be filled out for taxation purposes. The main emphasis should be placed upon the fact that forms are necessary and required, and that the fact that forms may be altered or revised in the future does not alter the importance of following and understanding directions. The student should be taught not to be apprehensive or get the feeling of being lost in filling out so-called complicated forms. 3. The Federal government provides student materials for income tax purposes. This can be of great value for the class. Duplicate the forms provided by the government on transparencies and use them on the overhead projector. This can become a good teaching aide on filling out forms. 4. Taxes should be taught, if possible, between January and April. This is the time when tax forms are filed by individuals. You will find many students in the class who will actually be filing tax forms at this time; therefore, this unit can be of immediate value.	X. Textbooks 1 Chapters 13, 16 5 Chapter 8 7 Chapter 15 8 Chapter 11 10 Chapter 17 12 Chapters 8, 10 13 Chapter 15 14 Chapter 3 15 Chapter 14 17 Chapter 10 Audio-Visual Materials: Filmstrips: Federal Taxes (color) (SVE) State and Local Taxes (color) (SVE)

SUGGESTIONS AND OBSERVATIONS (cont)
X-5. Make up tax problems and situations that can be real to the student. Use his name and create a family and situation for him. 6. Invite a member from the Internal Revenue to give a talk to the class and provide a question and answer session. Many questions that cannot be answered by a teacher during this unit can be saved for the guest speaker.

SENIOR MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XII. Spending Money Wisely A. Definition of credit 1. Pros and cons of credit 2. Credit rating B. Charge accounts 1. Regular 2. Installment 3. Budget accounts 4. Credit cards C. Borrowing money 1. Personal loan from banks 2. Personal loan from small loan companies 3. Illegal lenders D. Budgets 1. Personal budgets a. student budgests b. budgets for single workers c. family budgets d. time budgets E. Depreciation F. Careful shopping 1. Discounts 2. Deceptive packaging 3. Repossessions 4. Advertisements and brand names 5. Seasonal buying	XII-1. Discuss and define credit, credit rating, and credit rates. 2. Recognize and compute given problems about various types of credit. 3. Discuss the merits and disadvantages of credit cards. 4. Discuss why the rate of borrowing money may vary according to the amount and the place borrowed. 5. Define bank discount and true annual interest rate. 6. Compute given problems on various types of loans as to the amount paid on interest and the true annual interest rate. 7. Define "loan sharks" and discuss how they operate and who their victims are. 8. Compute the true annual interest rate on illegal loans. 9. Define budget and name the various types of budget. 10. Discuss the pros and cons about budgets. 11. Make a time budget concerning the individual student. 12. Make a realistic money budget for a senior student, a single person, and a family. 13. Define the meaning of depreciation. 14. Discuss what things may depreciate. 15. Solve given problems concerning depreciation. 16. Define careful shopping. 17. Discuss how a consumer can be aware of quality and the true price of a product. 18. Define and discuss impulse buying. 19. Discuss how the merchant uses psychology in creating a market. 20. Discuss the problems a merchant has in dealing with the public. 21. Discuss the pros and cons about the profits a merchant earns. 22. Discuss how a person can receive the most for his dollar. 23. Solve problems in determining the price per unit, discounts, and profits of consumer products. 24. Solve problems concerning comparative buying showing which product is the least expensive.

SUGGESTIONS AND OBSERVATIONS	REFERENCES AND FILMS
XI-1. Emphasis should be placed on the fact that statements, bills, receipts, cancelled checks, and payroll stubs are important records to be saved. 2. The student should become acquainted in filling out forms for bank deposits. They should know the proper method in keeping a checking account. They should have the proper knowledge and techniques in writing a check and cashing checks. 3. The overhead projector can be of great value in this unit. 4. The student should become aware that not all banks, savings and loan organizations offer the same rates of interest or safety on money placed on deposit. Shopping around for the highest interest, safety, and services should be a prime factor in finding a bank or savings and loan organization to deposit one's money. 5. As resource material have the students bring in gathered information and forms from various banks and associations. Invite a member from a bank or association to speak to the class. 6. The student should learn to compute the amount of money he earns and should understand the deductions that become a part of every wage earner. Through this understanding he will know the check he receives should be correct, if not he should know how to go about getting it corrected.	XI. Textbooks 1 Chapter 13 2 Chapters 3, 7, 10, 11 5 Chapter 9 7 Chapters 14, 16 8 Chapter 9 9 Chapter 10 10 Chapters 9, 10, 19, 20 12 Chapters 1, 4, 7, 11, 13 13 Chapter 15 14 Chapter 3 15 Chapter 14 17 Chapter 10 Audio-Visual Materials: Filmstrips: Commission-Meaning and Application (color) (SVE)

SENIOR MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XI. Consumer Mathematics	XI-1. Read and interpret bills and statements.
A. Statements and bills	2. Make a receipt for a given problem.
B. Receipts	3. Discuss the importance of a receipt.
C. Banking	4. Name and define the different types of bank accounts.
1. Savings accounts	5. Compute problems about simple and compound interest.
2. Checking accounts	6. Fill out a bank deposit slip, write a check, and balance a checking account for given problems.
a. Making a deposit	7. Compute given problems about commission and overtime pay, regular pay, and payroll deductions.
b. Writing a check	8. Discuss the statement "gross pay is not the same as net pay."
c. Keeping a checkstub account	9. Define profit and margin.
d. Endorsing checks	10. Solve problems determining profit and margin.
e. Reconciling checkstub with bank statement	
f. Determining the cost of a checking account	
D. Computing earnings	
1. Commissions	
2. Regular pay	
3. Overtime pay	
4. Payroll deductions	
5. Profits and margin	

SUGGESTIONS AND OBSERVATIONS	REFERENCES AND FILMS
XII-1. The student should know when to seek credit, how to compute true interest rates on installment loans, and from what sources credit can be obtained. The student should also know the pitfalls of credit such as poor credit rating, bankruptcy, and illegal lenders. They should understand the differences in borrowing money from banks, small loan companies, credit unions, and on their insurance policies. 2. Discuss and study situations encountered by students' families, such as: loans from banks or finance companies, installment buying, lay-away, etc. 3. Have the students make a report on advantages and disadvantages of borrowing from any person, a friend, a loan company, and a bank. 4. Have the students investigate and compare the cost of loans from various lending agencies. 5. Invite a local merchant to give a talk on buying and selling of merchandise and the problems involved in dealing with the public 6. Emphasize the importance of budgets and that a budget must be realistic and flexible in order to work. The student should realize that a proper budget can provide things that ordinarily may not be obtainable. 7. The student can realize through careful shopping and wise buying he can stretch the buying power of his dollar. 8. Obtain from the school library current and back issues of Changing Times, Consumer's Report, and the Annual Consumer Report and distribute them to the class for analyzing as to what are the best buys for articles that interest them. Have them make a report orally to the class on their findings.	XII. Textbooks 1 Chapters 13, 14 2 Chapters 10, 11 5 Chapters 7, 9 7 Chapters 16, 17, 18 8 Chapter 10 9 Chapter 10 10 Chapters 8, 11, 21, 22, 25 12 Chapters 2, 3, 4, 6, 8, 12 13 Chapter 15 14 Chapter 3 15 Chapter 14 Audio-Visual Materials: Films: Story of Our Money System Filmstrips: Buying and Selling-Application of Percent (color) (SVE) Interest-Borrowing and Investing (color) (SVE)
SUGGESTIONS AND OBSERVATIONS (cont.)	
XII-9. Books such as: The Naked Society by Vance Packard, A Nation of Sheep by William Lederer, The Great Discount Delusion by Walter Nelson, etc. can become required readings followed by oral reports. 10. A programmed learning book, Wise Buying by David H. Knowles can be of great value because of the new approach in teaching as well as the information to be imparted.	

SENIOR MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XIII. Insurance A. Characteristics of insurance B. Definition of terms used in insurance C. Life insurance 1. Characteristics a. Protection b. Savings c. Investment 2. Types of policies a. Term b. Ordinary life (whole life) c. Limited payment life d. Endowment e. Annuity f. Industrial g. Group 3. Rates and mortality tables 4. Types of insurance plans for individual situations D. Health, accident and disability 1. Determination of premiums 2. Health and accident policies 3. Hospitalization 4. Major medical insurance 5. Workmen's compensation E. Liability insurance F. Property insurance 1. Types of property insured a. Buildings b. Furnishings c. Personal property d. Crops 2. Kinds and extent of coverage 3. Determination of rate 4. Calculation of cost G. Automobile insurance 1. Kinds a. Comprehensive (fire and theft) b. Collision and upset c. Bodily injury (public liability) d. Property damage 2. Determination of premium rates a. Amount of insurance b. Age of driver c. Driver education and driver training d. Safe-driver rebate	XIII-1. Define the meaning of insurance and give its characteristics. 2. Give the definition of the terminology used in insurance (premium, beneficiary, mortality table, etc.) 3. Discuss the differences and likeness on various types of insurance policies. 4. Determine which is the best buy in life insurance. 5. List the possible insurance policies an adult would need. 6. List the other types of insurance other than life insurance. 7. Discuss health and accident, hospitalization, major medical insurance, workmen's compensation, social security, and employment security as to who is eligible and their benefits and costs. 8. Define liability insurance and property insurance. 9. List the kinds of automobile insurance. 10. Discuss the rates charged for automobile insurance as to sex, age, type of driver, and location. 11. List in order the policies a person should have in owning a car. 12. Solve problems concerning all types of insurance concerning premiums, benefits and total cost, etc.

MAJOR AREAS (cont.)	
XIII - H. Social Security 1. Old age and Survivor's Insurance a. Payroll deduction for Social Security b. Computation of retirement benefits c. Family and survivor's benefits 2. Employment security a. Unemployment insurance b. Public employment services	

SUGGESTIONS AND OBSERVATIONS	REFERENCES AND FILMS
XIII-1. The student should realize that insurance is a plan for sharing economic risks. It cannot prevent a happening but can alleviate financial loss by spreading it among other policy holders. 2. Most students already have some form of insurance. The teacher should capitalize on this fact. 3. The emphasis in this unit should be placed on the understanding and the functions of various types of insurance policies and their cost of protection. 4. Invite a representative from an insurance agency to visit the class and explain the various insurance coverages. 5. Have the students bring in various types of policies to the class for analyzing. 6. Emphasize the fact that no one type of life insurance policy is the best for everyone. Personal needs may differ. 7. Stress the need for automobile insurance, especially liability. 8. The student should become aware that in purchasing an automobile the financer of the automobile is only concerned in having collision insurance. Make sure that the student investigates when buying a policy that he is fully protected to his needs. 9. Emphasize the benefits available to an individual provided by Social Security and Employment Security. 10. The student must realize that a large portion of his earnings throughout his life will be spent on insurance. He must learn not to bemoan this fact but must be made to realize that insurance not only provides protection but peace of mind.	XIII. Textbooks 1 Chapter 15 2 Chapters 4, 5, 6, 8, 10 5 Chapter 7 7 Chapter 13 8 Chapters 8, 9 10 Chapters 12, 15, 16, 18 12 Chapters 7, 8, 7,9 13 Chapter 15 14 Chapter 3 15 Chapter 14 Audio-Visual Materials: Filmstrips: Insurance (color) (SVE)

SENIOR MATHEMATICS

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XIV. Automobile Ownership	XIV-1. Discuss the need for car ownership in today's society.
A. New car vs. used car	2. Discuss the pros and cons of a new car vs. a used car as to cost and dependability concerning a budget.
B. How to finance a car	3. List the various places a person can finance a car and arrive at a true annual interest rate on financing.(approximate)
C. Wise shopping	4. Discuss how a person can shop wisely for a new or used car.
D. Automobile expenses	5. List the expenses in owning an automobile.
1. Insurance	6. Solve problems concerning automobile ownership.
2. Taxes and license	7. Discuss the problems a typical high school student has in owning an automobile.
3. Depreciation	
4. Interest on loan	
5. Operation and maintainance	

SUGGESTIONS AND OBSERVATIONS	REFERENCES AND FILMS
XIV-1. Many students already own or are considering the purchase of an automobile. Therefore, they should be made aware of the problems of financing the purchase and the cost of operating and maintaining the automobile. 2. To practically every student in the class the automobile becomes one of the most important physical possessions in their present life. The teacher can use this fact as a point of motivation in studying this unit. The problems concerning the automobile are real and vital. The student should have much to contribute and much to learn in this unit.	XIV. Textbooks 1 Chapter 14 5 Chapter 7 7 Chapter 19 10 Chapter 12 12 Chapter 9 13 Chapter 15 14 Chapter 3 15 Chapter 14

MAJOR AREAS	SIGNIFICANT ANTICIPATED OUTCOMES
XV. Buying a home vs. renting a home A. Determining the cost of renting B. Location C. Advantages of renting D. Disadvantages of renting E. Determining the cost of buying a home 1. Agents' fees 2. Interest on mortgage 3. Insurance 4. Property tax 5. Repairs and upkeep 6. Depreciation 7. Interest lost on original investment F. Financing a home 1. Down payment 2. Sources of loans 3. Types of loans a. Conventional b. F.H.A. c. G.I. 4. Types of mortgages a. Regular b. Amortized c. Land contract d. Open-end e. Second mortgage 5. Methods of repaying 6. Closing costs (attorney's fees, transfer of title, title check, surveyor's fees, appraisal fees) 7. Clear title G. Advantages of owning a home H. Disadvantages of owning a home I. Cost of furnishing a home	XV-1. List the expenses involved in renting and owning a home. 2. Discuss the pros and cons in renting and owning a home. 3. List the physical requirements a person should consider in renting or buying a home. 4. List the various costs involved in buying a home 5. List the various types of financing available and give the rates of interest charged for each type. 6. Discuss "is it cheaper to rent or buy a home"? 7. Define the terminology used in real estate in financing a home (conventional loan, amortized, land contract, second mortgage, clear title, closing costs, etc.) 8. Discuss "should everyone own a home?" 9. Solve problems concerning owning a home, renting a home, and financing a home.

SUGGESTIONS AND OBSERVATIONS	REFERENCES AND FILMS
XV-1. Emphasize much of the trouble associated with home ownership arises from ignorance and insufficient planning. With proper information it is possible to avoid unwise investments and secure the greatest possible benefits. 2. The student should learn the price of the home is only the beginning. 3. Invite a realtor to speak to the class about the subject of buying a home and what to look for in your dream home. 4. The student must realize that the greatest single purchase in his life will be his home. 5. The choice of buying or renting a home is left up to each individual and no one choice is best for all. 6. The class should be encouraged to have good discussion, because of the impact it will have on their future lives. 7. It should be emphasized that selling a home for less money than purchased is not necessarily a financial loss. 8. Emphasize that it is wise to shop for loans on a home and that there are various ways to purchase a home. 9. Use the programmed learning material The Household Budget by David H. Knowles if available.. It can provide much insight. The basic elements of this book can be covered in approximately 2 weeks.	XV. Textbooks 5 Chapter 7 7 Chapters 16, 18, 20 8 Chapter 10 10 Chapters 13, 14 12 Chapter 8 13 Chapter 15 14 Chapter 3 15 Chapter 14

SENIOR MATHEMATICS

B-I-B-L-I-O-G-R-A-P-H-Y

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5. Hart, Walter W., Veryl Schult, and Lee Irvin. Mathematics in Daily Use. Boston: D.C. Heath and Co., 1961.

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10. McNeily, A.E., L.J. Adams, and Milton C. Olson. Business and Consumer Arithmetic. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1964.

11. Nichols, Eugene D. Pre-Algebra Mathematics. New York: Holt, Rinehart, and Winston, Inc., 1965.

12. Piper, Edwin B. and Joseph Gruber. Applied Business Mathematics. Chicago: South-Western Publishing Co., 1965.

13. Stein, Edwin I. Fundamentals of Mathematics. Chicago: Allyn and Bacon, Inc., 1964.

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15. Thordarson, T.W. and R. Perry Anderson. Basic Mathematics for High School. Chicago: Allyn and Bacon, Inc., 1965.

16. VanEngen, Henry, Maurice L. Hartung, Harold C. Trimble, Emil J. Berger, and Ray W. Cleveland. Seeing through Mathematics. Chicago: Scott, Foresman, and Co., 1962.

17. Wilcox, Marie S. Mathematics-A Modern Approach. Palo Alto, California: Addison-Wesley, 1966.

SENIOR MATHEMATICS

LIST OF FILMSTRIP PRODUCERS

(FH) Film Strip House Inc.
432 Park Avenue South
New York, New York 10016

(MH) McGraw Hill
330 West 42nd Street
New York, New York 10036

(SVE) Society for Visual Education
1345 Diversy Parkway
Chicago, Illinois 60614

(JH) The Jam Handy Organization
2821 East Grand Boulevard
Detroit, Michigan 48211

SCHOOL CITY OF GARY

Gary, Indiana

BASIC MATHEMATICS TEST

DIRECTIONS FOR STUDENTS: (TO BE READ ALOUD BY TEACHER)

You will have 45 minutes to answer the 60 items in this test. This is a test of how well you understand problem solving, the number system, and the terms and operations used in Mathematics.

Four answers are given for each item, but only one of these answers is correct. Choose the answer that you think is better than the others. Mark on the answer sheet the answer you have chosen. Make your answer heavy and black. Mark only one answer for each item. If you make a mistake or wish to change an answer, be sure to erase your first choice completely.

EXAMPLE:

1c. The sum of 3 and 4 is

A) 5
B) 6
C) 7
D) 8

Answer Sheet

	A	B	C	D
1c.			■	

Use scratch paper to work problems. Do not make any marks in your test booklet.

Be sure to read each of the choices of every item.

DO NOT SPEND TOO MUCH TIME ON ANY ONE ITEM.

GO THROUGH THE ENTIRE TEST AND ANSWER THE ITEMS THAT YOU KNOW, THEN TRY TO ANSWER THE HARDER ITEMS.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO START.

BASIC MATHEMATICS TEST

1. The value of the 1 in 10000_{two} is

   a) 10
   b) 16
   c) 1
   d) 8

2. Find n: $(12 \times 7) + 7 = n$

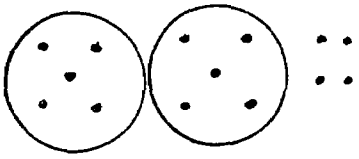
   a) 12
   b) 84
   c) 10
   d) 77

3. The value of $4 \times 10^3 + 3 \times 10^2 + 6 \times 10^1 + 7 \times 10^0$ is

   a) 2000
   b) 4367
   c) 2400
   d) 4360

4. The following grouping of dots may be written as

   a) 114_{five}
   b) 554_{five}
   c) 24_{five}
   d) 14_{five}



5. What is the correct quotient of $1052 \overline{)325068}$ to the nearest whole number

   a) 309
   b) 310
   c) 306
   d) 311

6. The set $\{0,2,4,6...\}$ is closed under

I. Addition	a) I and III
II. Subtraction	b) II and IV
III. Multiplication	c) None of the above
IV. Division	d) All of the above

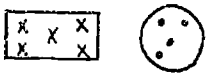
7. Which of the following is a prime number?

   a) 15
   b) 7
   c) 9
   d) 21

8. Find n: $7,040,603 - 6,989,594 = n$

   a) 51,019
   b) 51,009
   c) 61,119
   d) 51,109

9. The following sets



   are

   a) in one-to-one correspondence
   b) equivalent
   c) not equal
   d) equal

10. Which of the following represent (s) an odd number?

I. $220 + 5$	a) I, II, and III
II. $221 - 3$	b) I and IV
III. $220 - 4$	c) II and III
IV. $221 + 2$	d) None of the above

11. If $T = \{1,2,3,4,5,6,7\}$, which of the following statements are true?

I. $6 \in T$	a) I, II, and III
II. $10 \notin T$	b) II, III, and IV
III. $3 \notin T$	c) I, III, and IV
IV. $0 \notin T$	d) I, II, and IV

12. The set of common factors of 16 and 24 is

   a) $\{1,2,4,8\}$
   b) $\{2,4,6,8\}$
   c) $\{3,6,8,12\}$
   d) $\{1,2,3,4\}$

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13. The set $\{1,3,5,7...\}$ is closed under

I. Addition	a) I and III only
II. Subtraction	b) II only
III. Multiplication	c) III only
IV. Division	d) IV only

14. The following statement, $4 + 12 \neq 15$, is read
   a) The product of 4 and 12 is not equal to 15.
   b) The sum of 4 and 12 is not equal to 15.
   c) The sum of 4 and 12 is equal to 15.
   d) All of the above.

15. The missing numbers in
   $4 \times (8 + 2) = 4 \times \_\_ + 4 \times \_\_$ are
   a) 8 and 2
   b) 10 or 12
   c) 12 and 6
   d) 4 and 4

16. Find n if: $6 \times (3 + 5) = n \times 3 + n \times 5$
   a) 15
   b) 18
   c) 6
   d) None of the above

17. The following number rounded to the nearest hundred is: 145, 643, 210
   a) 145, 643, 200
   b) 145, 644, 000
   c) 145, 643, 100
   d) 145, 643, 300

18. The value of 2^6 is
   a) 12
   b) 36
   c) 64
   d) None of the above

19. Find n: $501 \times 302 = n$
   a) 151302
   b) 151322
   c) 16032
   d) 154302

20. Which of the following are correct statements?

I. $16 + 8 = 8 + 16$	a) I and III
II. $16 - 8 = 8 - 16$	b) II and IV
III. $16 \times 8 = 8 \times 16$	c) I and II
IV. $16 \div 8 = 8 \div 16$	d) II and III

21. Find the value of $1101_{two} + 1001_{two}$
   a) 10110_{two}
   b) 10001_{two}
   c) 10010_{two}
   d) 11100_{two}

22. Which property is illustrated by:
   If $8 > 6$ and $6 > 4$ then $8 > 4$.
   a) Symmetric
   b) Transitive
   c) Reflexive
   d) Equality

23. The value of $\frac{16 + 4}{5 - 5}$ is
   a) 0
   b) 2
   c) 20
   d) None of the above

24. Find the quotient of $64,288 \div 196$
   a) 328
   b) 327
   c) 326
   d) 318

25. Eight divided by four may be written

a) $4\overline{)8}$

b) $8 \div 4$

c) $\frac{8}{4}$

d) All of the above

26. What is the lowest common denominator of $\frac{5}{6}$, $\frac{5}{8}$, and $\frac{3}{4}$?

a) 8

b) 6

c) 24

d) 12

27. Find the value of $4\frac{3}{5} + 2\frac{1}{2} + 5\frac{7}{10}$

a) $11\frac{4}{5}$

b) $12\frac{4}{5}$

c) $12\frac{3}{5}$

d) $11\frac{8}{10}$

28. Find n: 567 X 82 = n

a) 46,494

b) 46,394

c) 46,354

d) 46,504

29. Sixty-four is less than nine times eight may be written as

a) 64 - 9 X 8

b) 64 < 9 X 8

c) 60 + 4 - 9 X 8

d) (64 - 9) X 8

30. In solving this subtraction problem the best answer would be

a) .109

b) .019

c) .09

d) .009

$$\begin{array}{r} .265 \\ -\ .256 \\ \hline \end{array}$$

31. In a recent year, corporations paid $10,759,586 in income taxes to the Federal Government. Which of these numbers is the closest approximate expression for this amount ?

a) $10.5 million

b) $10.7 million

c) $10.8 million

d) $11.0 million

32. In the exercise $12.72 \div .8 = 159$, the decimal point is omitted in the quotient. Which of these is the correct answer?

a) 1.59

b) .159

c) 159

d) 15.9

33. Which of these numbers is the largest?

a) .25

b) $\frac{3}{5}$

c) .8

d) $\frac{3}{4}$

34. 4% of 600 is

a) 2.40

b) 0.24

c) 24.0

d) 240

35. In a class of 40 pupils, 25 are boys. What percent of the class are boys?

a) 1000%

b) 106%

c) $62\frac{1}{2}$ %

d) $.62\frac{1}{2}$ %

36. How would you write .185 as a percent ?

a) 1.85%

b) 18.5%

c) .185%

d) 185%

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37. What does the circled zero mean in 10,000 ?
   a) ten thousands
   b) no ten thousands
   c) no thousands
   d) no units

38. Which has a 5 in the hundredths place ?
   a) .0450
   b) .0513
   c) .5325
   d) .0045

39. Which number is less than 2.02?
   a) 2.035
   b) 2.1
   c) 2.039
   d) 2.014

40. b = 100 r = 20% p = br
   To find p, which would you use?
   a) p = 100 + .20
   b) p = 100 - 20%
   c) p = 100 ÷ .20
   d) p = 100 x .20

41. Which of these is the largest number?
   a) 1.24
   b) 1.183
   c) .915
   d) 1.3

42. How would omitting the decimal point in 18.52 change the number?
   a) Makes it 10 times as large
   b) Makes it 100 times as large
   c) Makes it $\frac{1}{10}$ as large

43. Which of these numbers has a 2 in the hundreds place and a 3 in the hundredths place ?
   a) 430.128
   b) 319.625
   c) 258.138
   d) 217.483

44. Multiply 3 ft. 7 in. by 7
   a) 25 ft. 9 in.
   b) 25 ft. 1 in.
   c) 25 ft. 2 in.
   d) 259 ft.

45. Which of the following is a set of equivalent fractions ?
   a) $\left\{\frac{8}{9}, \frac{32}{36}, \frac{4}{5}, \frac{40}{45}\right\}$
   b) $\left\{\frac{12}{18}, \frac{2}{3}, \frac{16}{24}, \frac{8}{12}\right\}$
   c) $\left\{\frac{18}{48}, \frac{3}{8}, \frac{12}{32}, \frac{15}{24}\right\}$
   d) $\left\{\frac{21}{49}, \frac{16}{42}, \frac{3}{7}, \frac{12}{28}\right\}$

46. Which of the following fractions would be a mixed number if it was changed to its simplest form (lowest terms) ?
   a) $\frac{8}{27}$
   b) $\frac{38}{6}$
   c) $\frac{42}{86}$
   d) $\frac{72}{9}$

47. Add

$$\begin{array}{r} 3\ \frac{6}{7} \\ +\ 6\ \frac{5}{7} \\ \hline \end{array}$$

   a) $10\ \frac{1}{7}$
   b) $10\ \frac{4}{7}$
   c) $9\ \frac{4}{7}$
   d) $10\ \frac{3}{7}$

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48. Solve

$27 - 7\frac{13}{15} =$

a) $19\frac{2}{15}$

b) $20\frac{13}{15}$

c) $34\frac{13}{15}$

d) $20\frac{2}{15}$

49. The largest rectangle is divided into equal parts. What part of the largest rectangle is shaded?

a) .04
b) 0.6
c) 4.0
d) 0.4

50. In multiplying the problem .01 , the answer would be written

$$\underline{\times\ 8}$$

a) .8
b) .08
c) 8.
d) .008

51. In which case are the numbers correctly arranged for addition?

a)	b)	c)	d)
1.45	1.45	1.45	1.45
.037	.037	.037	.037
.16	.16	.16	.16

52. Which of these is a pair of like fractions ?

a) $\frac{1}{2}, \frac{3}{6}$

b) $\frac{3}{5}, \frac{3}{6}$

c) $\frac{1}{5}, \frac{3}{5}$

d) $\frac{1}{2}, \frac{1}{5}$

53. Which of these fractions has the largest numerator?

a) $\frac{3}{8}$

b) $\frac{1}{6}$

c) $\frac{2}{5}$

d) $\frac{5}{4}$

54. Which of these is a common denominator for the fractions?

$\frac{1}{2}$, $\frac{1}{5}$,and $\frac{1}{3}$?

a) 10
b) 15
c) 20
d) 30

55. What is the reciprocal of $\frac{8}{6}$?

a) $\frac{16}{12}$

b) $\frac{6}{8}$

c) $\frac{4}{3}$

d) $1\frac{1}{3}$

56. Solve

$13\frac{5}{8} + 16\frac{7}{8} =$

a) $29\frac{1}{2}$

b) $29\frac{3}{4}$

c) $30\frac{1}{2}$

d) $30\frac{2}{8}$

57. To understand multiplication of fractions, one must see that $\frac{1}{2} \times 8$ is

a) 16
b) $\frac{1}{2}$ as much as 1×8
c) $4\frac{1}{2}$
d) None of these

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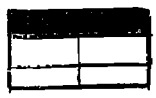
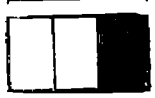
58. Which shaded figure shows one-half of one-third ?

a) 

b) 

c) 

d) 

59. 14 pints =

a) $3\frac{1}{2}$ quarts

b) 1 gal. 3 pt.

c) $4\frac{2}{3}$ qt.

d) 1 gal. 3 qt.

60. Subtract
$$\begin{array}{r} 8 \text{ hr. } 19 \text{ min. } 15 \text{ sec.} \\ 2 \text{ hr. } 30 \text{ min. } 42 \text{ sec.} \\ \hline \end{array}$$

a) 5 hr. 88 min. 73 sec.

b) 6 hr. 48 min. 33 sec.

c) 5 hr. 48 min. 33 sec.

d) 10 hr. 49 min. 57 sec.

END