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A9 MATHEMATICS (SLOW LEARNERS) - AN INSTRUCTIONAL BULLETIN.

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This instructional bulletin was prepared to assist teachers in planning and presenting the sequence of mathematics topics to slow learners. The course is designed to fulfill the high school graduation requirement of one semester of mathematics in the ninth grade. This course combines simple presentations of topics from modern mathematics with new approaches to the fundamental operations involving whole numbers and positive rational numbers. The mathematical content and the teaching suggestions for this course are designed to provide effective learning opportunities for pupils who previously have had little success in mathematics courses. (RP)

FOREWORD

This instructional bulletin has been prepared to assist the teacher in planning and presenting the sequence of topics in A9 Mathematics to slow learners. This course is one of those authorized to fulfill the high school graduation requirement of one-semester of mathematics in the ninth grade.

Combining simple presentations of topics from modern mathematics with new approaches to the fundamental operations, the teacher of this course can provide effective learning opportunities for pupils who previously have had little success in mathematics courses.

The Instructional Planning Branch expresses its appreciation to MARION BUTLER of Sutter Junior High School, who prepared this instructional bulletin while serving as a professional expert.

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TO THE TEACHER

The authorized textbook for this course, Modern Mathematics for Achievement, by M. C. Herrick, consists of a series of eight booklets and will provide the pupils with a novel learning aid. Since the booklets were designed for a one-year program, adaptations were inserted to meet the requirements of a one-semester course. It was necessary to delete topics that were not essential to the sequential development and to designate others for enrichment. Although each lesson is planned for a class period, sometimes it is suggested that selected problems from two related exercises be combined into a single lesson in order to allow sufficient time for pupils to complete all the topics which are covered in the series.

Because the booklets will be used by pupils who previously have had little success in mathematics courses, it is suggested that the teacher introduce topics by using the new approaches utilized in the series. Whenever possible, the teacher should employ visual and manipulative aids to clarify concepts.

In addition to providing answers to the problems, the Teacher's Edition contains helpful suggestions and notes printed adjacent to the exercises. Additional comments appear in the Teacher's Guide.

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TABLE OF CONTENTS

UNIT I: THE SET OF WHOLE NUMBERS (Book 1) — 6 Teaching Days

LESSONS	TOPICS	TEACHING SUGGESTIONS
1	Whole numbers	Describe the counting numbers as 1, 2, 3, 4, and so on. The counting numbers and 0 form the set of whole numbers. Lead the pupils to discover the relationship between the number of dots and the number of line segments in the table on p. 2. It is hoped that the pupil will discover the pattern but not necessarily the relation $s = \frac{d^2-d}{2}$.
2	Number line	
4	Numbers and numerals	Assign parts of these first lessons to be done orally.
5	Commutative property of addition	
6,7,9	Mathematical sentences	Point out the use of the identity element for addition on p. 13.
14	Addition of multiples of ten	Encourage the more capable pupils to explore problems 37 and 38 on p. 28 as enrichment exercises.
15-18	Organization of data	These lessons provide interesting mathematical activities.
19-21	Units of measure	Explain the term acre-foot as a unit of measure used in irrigation. Point out that the use of the term pound on p. 38 refers to a type of money used by the British. Assign "Challenge" problems whenever time permits.

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UNIT II: COMBINING WHOLE NUMBERS (Book 2)		8 Teaching Days
LESSONS	TOPICS	TEACHING SUGGESTIONS
1,2	Names for numbers	
3,4	Addition of whole numbers	Select problems from these exercises to provide practice in both horizontal and vertical addition. Assign the addition table on p. 10 to be completed by those pupils who do not know the addition facts.
7	Associative property of addition	
8	Patterns in addition	
9,10	Decimal system of numeration	Include problems 21-30 on p. 20 as preparation for future work with expanded numerals.
11	Symbols of equality and of inequality	
13,14	Addition using the expanded form	Illustrate addition using the expanded form of numerals to emphasize the process of combining numbers, and direct the pupils' attention to the exploitation of the associative property of addition in this process. (Page 27)
15	Checking answers in addition	Point out that checking by adding in the opposite direction is possible because addition is commutative.
17	Practice in addition	
20,21	Short cuts in addition	Encourage the use of short cuts, but do not force their use when pupils are not ready.

UNIT III: NUMBER RELATIONSHIPS (Book 3		6 Teaching Days
4,5	Practice in addition	Extend addition using expanded numerals to practice with three-digit addends.
6	Number line	

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UNIT III: NUMBER RELATIONSHIPS (contd.)

LESSONS	TOPICS	TEACHING SUGGESTIONS
7	Sets	Pupils often find that activities like those in lessons 7 and 8 are a departure from the usual and are interesting to discuss.
8	Sets of multiples	
10,11	Money relationships	Assign problems from lesson 10 to prepare pupils for future practice in making change.
14	Associative property of addition	Reinforce the understanding of the associative property, and apply it to finding the sum of three or more addends.
16,17	Even and odd numbers	Provide activities in discovering properties as an enrichment lesson.
18,19	Introduction to algebra	Include work with open sentences and replacement sets if time permits.
21	Units of measure	

UNIT IV: UNDERSTANDING SUBTRACTION (Book 4) 13 Teaching Days

1-3	Introduction to subtraction	Use the number line to illustrate the process of subtraction and to prepare pupils for future work with integers.
5,6	Subtraction using the expanded form	Write numerals in expanded form to illustrate renaming the minuend.
7,8,11	Practice and checking subtraction	Encourage pupils to improve their accuracy in subtraction by checking.
13,14	Money problems	Apply additive subtraction to making change.
15	Shapes in space	Provide physical models to enable pupils to visualize space figures.

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UNIT IV: UNDERSTANDING SUBTRACTION (contd.)

LESSONS	TOPICS	TEACHING SUGGESTIONS
16,17	Rational numbers	Allow time for a careful introduction to rational numbers, and use visual aids to develop understanding of the idea of fractional numbers between two successive whole numbers.
19	Comparison of numbers	
20	Comparison of numbers by ratio	
21,22	Addition of fractions	Note that the development here consists of a sequential arrangement of exercises which provide experiences with fractions using the number line and diagrams. Rules or generalizations are not to be formalized at this time.

UNIT V: PROPERTIES OF MULTIPLICATION (Book 5) — 14 Teaching Days

1-4	Introduction to multiplication	Introduce the operation of multiplication by using rectangular arrays to suggest multiplication facts. Stress the meanings of the terms factor and product.
5	Commutative property of multiplication	Encourage pupils to apply the commutative property to simplifying computation by rewriting a problem, such as $\begin{array}{r} 3 \\ \times\ 24 \\ \hline \end{array}$ as $\begin{array}{r} 24 \\ \times\ 3 \\ \hline \end{array}$ The ability to exploit advantageously the idea of the commutative property is a more desirable goal than recognizing its name.
6	Multiplication with multiples of ten	Provide practice in multiplying with multiples of ten as preparation for multiplication using the expanded form.

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UNIT V: PROPERTIES OF MULTIPLICATION (contd.)

LESSONS	TOPICS	TEACHING SUGGESTIONS
8	Associative property of multiplication	Encourage pupils to apply the associative property to simplifying computation. $7 \times 5 \times 2 = 7 \times (5 \times 2) = 7 \times 10 = 70$
9	Distributive property	
13,14	Use of the distributive property	Introduce the lesson with sufficient examples, and provide continued guidance during the work period.
15	Multiplication in money problems	
16-18	Factors and prime numbers	Point out that 3 x 2 is obtained from 2 x 3 by applying the commutative property and that this is not considered to be a different factored form.
19	Multiplication of fractions	
20	Fractions in lowest terms	Include the step of identifying the common factor before writing the fraction in lowest terms.
21,22	Equivalent ratios	

UNIT VI: UNDERSTANDING DIVISION (Book 6) — 14 Teaching Days

1,2	Factors	
3,4	Practice in addition and multiplication	Reinforce computational skills by assigning selected problems from Lessons 3 and 4.
5	Introduction to division	
6-7	Practicing division	At times, instruct pupils to circle equal subsets in rectangular arrays, as illustrated in Lesson 5, to provide a visualization of the division process.
8	Relationship between division and multiplication	

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UNIT VI: UNDERSTANDING DIVISION (contd.)

LESSONS	TOPICS	TEACHING SUGGESTIONS
9,10	Practice in division	Emphasize the necessity of placing a 0 in the quotient to denote when there are no groups of the divisor contained in the number to be divided.
11,13-15	Long division	Avoid the familiar algorithm for long division because most pupils have not been successful with its use; develop the new methods of performing the operation as illustrated in the book. Illustrate division as a process in repeated subtraction, and utilize this idea in the method of estimating and subtracting.
16	Parts of a number	
17	Names for one	
18	Comparison of numbers	
19,20	Equivalent ratios	Emphasize that two measurements must be expressed in the same unit before they can be compared as a ratio.
22	Addition of fractions	

UNIT VII: THE SET OF POSITIVE RATIONAL NUMBERS (Book 7) 12 Teaching Days

2	Fractional parts	
3	Addition and subtraction of fractions	Note that at this time no effort is made to express answers in simplest form.
4	Multiplication of fractions	

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UNIT VII: THE SET OF POSITIVE RATIONAL NUMBERS (contd.)

LESSONS	TOPICS	TEACHING SUGGESTIONS
5,6	Equivalent fractions	Encourage pupils to express numerator and denominator in factored form, showing the common factor, before writing the fraction in lowest terms.
7,8	Meaning of decimals	Provide additional practice in writing decimals and common fractions in equivalent forms. $\frac{7}{10} = .7$ $.39 = \frac{39}{100}$
9-11	Addition and subtraction of decimals	Extend the ability to compute sums and differences of money to adding and subtracting decimals.
13	Multiplication of decimals	Instead of having the pupils rely entirely on rules for placing the decimal point in a product, relate multiplication of decimals to multiplication of fractions.
14	Division of decimals	
15	Identification of inequalities	Assign this topic as an enrichment lesson.
17	Ratios and per cents	Introduce per cent as a special ratio having a denominator of 100.
18,19	Square measure and area	
22	Lines and line segments	Point out that $\overline{xy}$ and $\overline{yx}$ are two different names for the same line segment.

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UNIT VIII: APPLYING NUMBER IDEAS (Book 8) — 11 Teaching Days

LESSONS	TOPICS	TEACHING SUGGESTIONS
1	The set of integers	Illustrate adding positive and negative integers by movement to the right and to the left on the number line.
2	Sets	Point out the difference between {1,2,3, . . .,9} and {1,2,3, . . .}.
5	Averages	Provide additional practice in addition and division of whole numbers and rational numbers through use of problems on finding averages.
8,9,11	Change making and money problems	Vary the change making problems by suggesting that half dollars are scarce, or that nickels are scarce.
13	Wage computing	Challenge the more capable pupils with problems on overtime, figured at 1½ times the regular rate.
14	Purchase of food	Direct the more capable pupils to figure the cost of 1 can of soup at 2 for 31¢. Acting out the purchase with real coins can be a revelation to many pupils.
15	Equivalent decimal and fractional forms	
16	Ratios and per cents	
17,18	Per cent of a number	Provide sufficient examples of finding per cents, and give continued guidance during the lesson. Assist pupils in rounding off answers which involve sums of money.

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UNIT VIII: APPLYING NUMBER IDEAS (contd.)

LESSONS	TOPICS	TEACHING SUGGESTIONS
19	Tipping	Tipping is the kind of topic that provokes interesting discussion. This lesson could be a change of pace as well as an experience in working with per cent problems.
20-22	Line segments and areas	

REVIEW AND EVALUATION — 3 Teaching Days

		Evaluate each pupil's progress frequently through use of short quizzes covering a single topic or operation. Note that each of the eight booklets includes a progress test midway in the contents and a summary test at the conclusion; however, be selective in using these tests because some of the material may not have been covered when lessons have been omitted.