

Contents

Chapter 1	
<i>MATHEMATICS IN THE ELEMENTARY SCHOOL TODAY</i>.....	1
The Psychology of Understanding Mathematics-1 • Arithmetic-1 • Geometry-2 • Algebra-3 • The Structure of the Number System-3 • Precision of Ex- pression-4 • Summary-5 • Individual Term Projects-6	
Chapter 2	
<i>COGNITIVE DEVELOPMENT AND LEARNING MATHEMATICS</i>	9
The Piaget Model-10	
Chapter 3	
<i>CONTRASTING PSYCHOLOGIES OF LEARNING RELATED TO MATHEMATICS</i>.....	21
A Basis for the Teacher's Role-21 • Contrasting Ob- jectives-23 • A Contrast in Philosophy-25 • Readiness and Acceleration-25 • Training Research on Accelera- tion-25 • Transfer of Training-28 • Learning and Development-28 • The Developing vs. the Programmed Teacher-29	
Chapter 4	
<i>SETS AND LOGICAL CLASSIFICATION</i>.....	31
Basic Mathematical and Psychological Structures-31 • Sets and Classification-32 • Stages in Ability to	

Chapter 5

ORDERING AND SERIATION 51

A Research Study on Seriation-54 • Summary of Development in Ability to Seriate-55 • Serial and Ordinal Correspondence-56 • Relating Ordinal Numbers to Cardinal Numbers (Ordinal and Cardinal Correspondence)-58 • Sets On Which No Relation Such As Length Has Been Imposed-61 • Learning To Write Number Symbols or Numerals-62 • The Number Line-65

Chapter 6

CARDINAL NUMBER..... 67

The Relation of Logical Classification and Number As Developmental Processes-67 • Conservation of Number-68 • Socialization To Number-70 • Testing for Conservation-71 • Steps in Understanding Number-74 • Place Value, Addition, and Base Ten-76 • Set Terminology and Notation-81

Chapter 7

UNDERSTANDING PLACE VALUE 85

Egyptian System of Numeration-85 • The Roman System of Numeration-88 • The Mayan System of Numeration-91 • The Hindu-Arabic System of Numeration-94 • Numbers and Numerals-95 • Expanded Notation and Zero As An Exponent-97 • Bases Other Than Ten-99

Chapter 8

ADDITION AND SUBTRACTION OF WHOLE NUMBERS 107

Addition As An Operation-107 • Introducing Children to Addition-110 • Learning the Basic Addition Facts-113 • The Commutative Property of Addition-119 • The Associative Property of Addition-121 • Adding Numbers Symbolized with Two or More Digits-125 • Mathematical Basis for the Algorithm of Column Addi-

tion-131 • Subtracting Numbers Expressed with Two or More Digits-132 • Subtraction Algorithms-136 • The Additive-Equal Addition Method-137 • The Complementary Method-137 • Addition and Subtraction in a Nondecimal Base-139

Chapter 9

MULTIPLICATION..... 147

Multiplication As Related to Addition-147 • Readiness for Multiplication-148 • Learning the Basic Multiplication Facts (0×0 to 9×9)-148 • Multiplication As a Cartesian Product-154 • Properties of Multiplication of Whole Numbers-159 • Introducing the Algorithm for Multiplication to Children-163 • Multiplication in Nondecimal Bases-169

Chapter 10

DIVISION..... 174

Division As the Inverse of Multiplication-174 • Division Applied to the Physical World-174 • Introducing the Basic Division Facts-178 • Division by Zero-180 • Introducing the Division Algorithm-181 • Prime Numbers and Division-190 • Division in Nondecimal Bases-192

Chapter 11

MATHEMATICAL APTITUDE, LANGUAGE, AND EXPERIENCE 196

Aptitude for Mathematics-196 • The Language of Mathematics-197 • The Role of Experience in Teaching-198 • Individualization or Socialization-200 • Learning by Discovery and Invention-201 • The Role of the Teacher-202

Chapter 12

MATHEMATICS AND THE EXCEPTIONAL CHILD 204

Methods of Teaching-204 • Categories of Exceptional Children-205 • References-216

Chapter 13

GEOMETRY FOR THE FIVE TO NINE YEAR OLD 217

Why Study Geometry?–217 • Geometry for Children
Five to Nine–220 • Teaching Topological Concepts–226
• Teaching Projective Geometry (Perspective)–230 •
Activities for Children–230

Chapter 14

UNDERSTANDING TIME..... 233

Ordering or Succession–234 • Duration–234 •
Isochronism–235 • Synchronism–235 • The Con-
struction of Time Units–238 • Proportions–238 •
Conclusion–239

Chapter 15

**NONMETRIC GEOMETRY FOR THE NINE TO TWELVE
YEAR OLD 242**

Euclidean Space–242 • Basic Euclidean Shapes–245 •
Polygons–247 • Geoboards–251 • The Golden
Rectangle–251 • Lines, Rays, Planes, and Angles–254 •
Symmetry–259 • The Tangram–262 • Constructions–
264 • Construction Activities for Children–265

Chapter 16

MEASUREMENT 269

Readiness for Learning Measurement–269 • Beginning
Activities in Measurement–274 • History of Measure-
ment–275 • The Metric System–279 • Introducing
Children to the Metric System–282 • Measurement
Activities with a Geoboard–291 • Other Measurement
Activities for Children–293

Chapter 17

FRACTIONAL NUMBERS 296

Readiness for Understanding Fractions–296 • Introduc-
ing Fractional Numbers–297 • Renaming Fractional
Numbers–298 • Addition of Fractional Numbers–301 •
Subtraction of Fractional Numbers–309 • Multiplication
of Fractional Numbers–314 • Division of Fractional

Numbers-321 • Sample Activities for Children-327 •
Rational Numbers-330

Chapter 18

***RATIONAL NUMBERS AS DECIMAL FRACTIONS AND
PER CENT*** 335

Origins of Decimal Notation-336 • Introducing Decimal
Fractions-337 • Introducing the Addition and Sub-
traction of Decimal Fractions-339 • Multiplication of
Decimal Fractions-342 • Division of Decimal Fractions
-342 • Types of Decimal Fractions-344 • Expressing
a Decimal Fraction As a Common Fraction-345 •
Decimal Fractions and Scientific Notation-346 • Ratio
and Proportion-349 • Per Cent-350

Chapter 19

***THE MATHEMATICS LABORATORY—AN INDIVIDUALIZED
APPROACH TO LEARNING*** 356

How To Begin a Math Laboratory-359 • Moral Be-
havior-364 • Materials and Their Use-365 • Learning
the Basic Addition and Multiplication Facts-366 •
Care of Materials-373 • Sample Assignments for
Children-378 • Exercises for Teachers-382

APPENDIX—Solutions to Exercises 383

INDEX 401