About
Everyday Mathematics

A Parent Resource Manual

Anchorage School District
Anchorage, Alaska

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A Parent Resource Manual

This parent resource manual is designed to be used throughout your child's elementary school years. Please keep this resource manual on hand as a reference.

Anchorage School District
Anchorage, Alaska
1999

Anchorage
School
District

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Dear Parents:

Everyday Mathematics is the elementary curriculum of the University of Chicago School Mathematics Project (UCSMP). This research based curriculum which began in 1983, had the goal of establishing a mathematics program that takes advantage of the mathematics children intuitively know. This curriculum is based on the philosophy that:

- Children can learn much more than is usually expected of them.
- Children come to school knowing more than they currently get credit for.
- Mathematics means more when it is rooted in real-life problems and situations.
- Schools should take advantage of the teaching tools that technology presents.
- The key to retaining a process lies in the student's ability to understand not only how the process works, but also why.

As your child advances through the Everyday Math curriculum, you may experience some questions about the content or the processes used in the program. This manual is designed to assist you in understanding the underlying concepts, strands, processes, and vocabulary which make up the Everyday Math program. Also included are the math goals of Alaska and the Anchorage School District. In addition, you will find some ideas on how to share math with your child, a program overview, a summary of terms and concepts used, instructions for mathematical activities (games) that are played at various grade levels, a glossary of terms, and a math literature list.

The Everyday Math program creates an environment that involves children in thinking, exploring, discovering, and doing math. You may observe your child working on basic math concepts and skills using a different approach than you experienced as a child. We hope the information in this manual will address your questions or concerns, and provide you with math activities that will support classroom instruction and assist your child in learning and enjoying math.

Our goal is to provide for all children quality math instruction that makes the study of mathematics an engaging, enriching, and successful experience.

Sandy Schoff
Math Coordinator

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Anchorage School District Math Curriculum Overview

The Anchorage School District mathematics curriculum has been designed to cover a range of mathematical concepts and to serve a diverse number of students. In the past, math instruction was focused on the teaching of arithmetic skills. In today's world, however, mathematics instruction must include problem solving, geometry, algebra preparation, data collection, measurement, probability, and statistics. The district's K-6 math content standards were developed by the end of the 1993-94 school year to help insure that these new math concepts would be taught at the appropriate levels.

The focus of the math content standards is to help students value mathematics, make connections to the real world and to other subjects, develop problem solving skills, communicate mathematically, and learn reasoning skills. These goals are in alignment with the national standards, state standards, our district's unique needs, and the needs being expressed by representatives of business, and industry. The ASD content standards were written with the expectation that they would promote life-long learning and opportunities for all students to be successful.

Embedded in the curriculum is the understanding that students learn best by doing. An emphasis is therefore placed on problem solving and activities that promote higher level thinking skills. Instruction on basic facts is important. In addition, these facts are reinforced through other strands such as geometry, measurement, probability, statistics, and algebra. To accomplish mastery of the objectives included in the content standards, topics spiral through out the year, being revisited and reinforced in a variety of ways.

Appropriate use of technology is included at each grade level. Calculators are an integral part of every math classroom. They allow students to become risk takers and to gain confidence in problem solving situations.

It is important for students to be able to work together. Cooperative learning strategies help prepare students for the ways they will use math in the future. These strategies also have been shown to be effective in building confidence in math because students have a support system and are willing to take risks and to try new ideas.

Different methods of teaching automatically lead to alternative methods of assessment. These include projects, journals, portfolios, group work, open-ended problems, presentations, and observations, as well as written and standardized tests.

The adoption of the *Everyday Mathematics* program supports the shifts in instruction and the national, state, and district standards. It will be a key resource in the change process as we prepare our students for success in the 21st century.

A. A student should understand mathematical facts, concepts, principles, and theories.

A student who meets the content standard should:

1) understand and use numeration, including
   - A) numbers, number systems, counting numbers, whole numbers, integers, fractions, decimals, and percents; and
   - B) irrationals and complex numbers;
2) select and use appropriate systems, units, and tools of measurement, including estimation;
3) perform basic arithmetic functions, make reasoned estimates, and select and use appropriate methods or tools for computation or estimation including mental arithmetic, paper and pencil, a calculator, and a computer;
4) represent, analyze, and use mathematical patterns, relations, and functions using methods such as tables, equations, and graphs;
5) construct, draw measure, transform, compare, visualize, classify, and analyze the relationships among geometric figures; and
6) collect, organize, analyze, interpret, represent, and formulate questions about data and make reasonable and useful predictions about the certainty, uncertainty, or impossibility of an event.

B. A student should understand and be able to select and use a variety of problem-solving strategies.

A student who meets the content standard should:

1) use computational methods and appropriate technology as problem-solving tools;
2) use problem solving to investigate and understand mathematical content;
3) formulate mathematical problems that arise from everyday situations;
4) develop and apply strategies to solve a variety of problems;
5) check the results against mathematical rules;
6) use common sense to help interpret results;
7) apply what was learned to new situations; and
8) use mathematics with confidence.

C. A student should understand and be able to form and use appropriate methods to define and explain mathematical relationships.

A student who meets the content standard should:

1) express and represent mathematical ideas using oral and written presentations, physical materials, pictures, graphs, charts, and algebraic expressions;
2) relate mathematical terms to everyday language;
3) develop, test, and defend mathematical hypotheses; and
4) clarify mathematical ideas through discussion with others.

D. A student should be able to use logic and reason to solve mathematical problems.

A student who meets the content standard should:

1) analyze situations;
2) draw logical conclusions;
3) use models, known facts, and relationships to explain the student's reasoning;
4) use deductive reasoning to verify conclusions, judge the validity of arguments, and construct valid arguments; and
5) use inductive reasoning to recognize patterns and form mathematical propositions.

E. A student should be able to apply mathematical concepts and processes to situations within and outside of school.

A student who meets the content standard should:

1) explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models or representations;
2) use mathematics in daily life; and
3) use mathematics in other curriculum areas.

Math Program Goals

Program Statement

Mathematical literacy is essential for every individual in today's technological society. A working knowledge of mathematics is needed to deal with the qualitative, quantitative, and spatial relationships that are encountered in everyday life. Therefore, the overall goal of the mathematics program for the Anchorage School District is to provide the opportunity for all students to learn, use, communicate, apply, appreciate, and enjoy the mathematics appropriate for their age, needs and ambitions.

General Program Goals

Students will be able to:

- Use problem-solving approaches to investigate and understand mathematical content
- Formulate problems from everyday and mathematical situations
- Develop and apply strategies to solve a wide variety of problems
- Verify and interpret results with respect to the original problem
- Generalize solutions and strategies to new problem situations
- Acquire confidence in using mathematics meaningfully; believe that mathematics makes sense
- Relate physical materials, pictures, and diagrams to mathematical ideas; relate various representations of concepts or procedures to one another
- Model situations using oral, written, concrete, pictorial, and graphical methods
- Reflect on and clarify thinking about mathematical ideas and situations
- Relate everyday language to mathematical language and symbols
- Develop common understandings of mathematical ideas, including the role of definitions
- Realize that representing, discussing, reading, writing, and listening are vital parts of learning math
- Use the skills of reading, listening, and viewing to interpret and evaluate mathematical ideas
- Discuss mathematical ideas and make conjectures and convincing arguments
- Appreciate the value of mathematical notation and its role in the development of mathematical ideas
- Recognize and apply deductive and inductive reasoning
- Use models, known facts, properties, and relationships to explain thinking
- Understand and apply spatial reasoning and reasoning with proportions and graphs
- Make and evaluate mathematical conjectures and arguments; justify answers and solutions; processes; validate thinking
- Use patterns and relationships to analyze mathematical situations
- Appreciate the pervasive use and power of reasoning as a part of mathematics
- Link conceptual and procedural knowledge; recognize relationships among different topics in mathematics; see mathematics as an integrated whole
- Explore problems and describe results using graphical, numerical, physical, and verbal models or representations
- Use mathematical ideas to further understandings of other mathematical ideas
- Use and apply mathematics in other curriculum areas; use mathematics in daily life
- Value the role of mathematics in culture and society

K-3 Math Program Content Standards

Estimation

State Standards: A.2, A.3, B.3, B.5, B.6, C.2, C.4, D.1, D.2, D.3

KINDERGARTEN

- Compare the number of objects in different sets; tell which set has more and which has less.
- Acquire the skill of estimation. In early stages this involves a comparison with familiar objects within the range of the child's early development.

FIRST GRADE

- Identify the number of objects in a set by counting or estimating.
- Decide whether estimation or counting is appropriate.

SECOND GRADE

- Identify the number of objects in a set by counting or estimating.
- Decide whether estimation or counting is appropriate.

THIRD GRADE

- Estimate measurement.
- Estimate time.
- Estimate and find volume, capacity, length, and weight using metric and standard units

Number Sense

State Standards: A.1, B.6, B.7, C.1, C.2, C.3, E.2

KINDERGARTEN

- Develop number sense for numbers up to 100.
- Develop a familiarity with numbers 1 - 100.
- Count by multiples of 2, 5, 10 to 100.
- Read and write numerals for the numbers 1 - 50.
- Physically show halves and fourths.
- Explore the concepts of money.

FIRST GRADE

- Read and write numerals 1 - 100.
- Read and write number words to one - hundred.
- Recognize numbers 1 - 100.
- Count by multiples of 2, 5, 10, to 100.
- Fractions: 1/2, 1/4.
- Understand that fractions are parts of a whole.
- Read and write numerals for simple fractions.
- Understand basic place value concepts for whole numbers (ones, tens, hundreds).
- Become familiar with attributes of monetary value.

SECOND GRADE

- Count by multiples of 2, 5, 10, 100.
- Understand basic place value concepts for whole numbers (ones, tens, hundreds).
- Fractions 1/2, 1/4, 1/3. Understand that fractions are parts of a whole. Be able to demonstrate an understanding of fractions physically or pictorially. Relate fractions to real world examples.
- Read and write numerals for simple fractions.
- Become familiar with the use of numbers in newspapers, magazines, television, and other sources within society.
- Acquire skills associated with values of coins and bills. This includes all appropriate vocabulary, the recognition of coins and bills up to $5, the knowledge of their value (coins in cents, bills in dollars), and the following equivalencies: one dime = 2 nickels; one quarter = 5 nickels; one half- dollar = 2 quarters; one dollar = 2 half-dollars, 4 quarters, or 10 dimes.

THIRD GRADE

- Round whole numbers.
- Skip count by whole numbers.
- Understand, represent and find real world applications for fractions and decimals using models, pictures, and symbols.
- Explore bases other than ten to develop understanding of place value concepts.
- Find change by counting up from amount of purchase.
- Understand and use decimal notation for monetary values.
- Using models, pictures, symbols, and words, identify, represent, and explain place value concepts.
- Read, write, compare and order whole numbers.
- Explore whole number relationships.
- Using models, pictures, and symbols, find and identify multiples of whole numbers.

K-3 Math Program Content Standards

Concepts of Number Operations

State Standards: A.1, B.2, B.4, B.5, B.6, B.7, B.8, C.1, C.2, C.4, E.1

KINDERGARTEN

- Develop a concrete understanding of addition and subtraction for the numbers 0 - 10.

FIRST GRADE

- Use objects, pictures, and problem situations to model and interpret different definitions of addition and subtraction of whole numbers.

SECOND GRADE

- Use objects, pictures, and problem situations to model and interpret different definitions of addition, subtraction, and multiplication of whole numbers.
- Write word problems representing different addition and subtraction situations and solve them.

THIRD GRADE

- Use concrete objects to invent and model different procedures for finding sums, differences, products, and quotients of whole numbers.
- Use concrete objects to model and interpret different problem situations for addition, subtraction, and multiplication of whole numbers.
- Choose appropriate operations to solve problems.
- Recognize the relationships between addition, subtraction, multiplication, and division.
- Write, experience, and explain processes in problem solving situations.

Computation

State Standards: A.1, A.3, B.1, B.5, B.6, B.7, B.8

FIRST GRADE

- Accurately and with minimal hesitation, provide response for basic addition and subtraction facts, 0 - 10.

SECOND GRADE

- Accurately and with minimal hesitation provide response for basic addition and subtraction facts.
- Carry out a series of computations using a calculator involving addition and/or subtraction and involving up to four steps.

THIRD GRADE

- Demonstrate reasonable proficiency with basic multiplication and division facts.
- Demonstrate reasonable proficiency with addition and subtraction of multi-digit numbers.
- Develop concept of error analysis.
- Use mental math when appropriate.
- Use a calculator when appropriate.

K-3 Math Program Content Standards

Geometry

State Standards: A.5, B.3, B.4, E.1, E.2

KINDERGARTEN

- Sort sets on the basis of one attribute.
- Relate physical world examples to the ideas and concepts of geometry.
- Explore familiar two- and three- dimensional objects.
- Properties such as inside, outside, straight, round, square, large, and small should be included.

FIRST GRADE

- Relate physical world examples to the ideas and concepts of geometry.
- Identify and classify the following figures through visual observations and properties: triangles, squares, rectangles, hexagons, trapezoids, rhombus, cubes, pyramids, spheres, circles, and ovals.
- Explore simple patterns of symmetry in the environment and the natural world.

SECOND GRADE

- Relate physical world examples to the ideas and concepts of geometry.
- Identify and classify the following figures through visual observations and identified properties: triangles, squares, rectangles, cubes, spheres, circles, and ovals.
- Explore simple patterns of symmetry in the environment and the natural world.

THIRD GRADE

- Identify angles.
- Recognize, identify, and describe 2- and 3-dimensional geometric shapes.
- Recognize, identify and describe properties of congruent shapes.
- Relate symmetry concepts to geometric shapes.
- Recognize, identify, and describe characteristics of lines and angles.
- Develop spatial sense using manipulatives.

Measurement

State Standards: A.2, C.1, C.2, E.1, E.2

KINDERGARTEN

- Explore the concepts of time, length, volume (conservation).

FIRST GRADE

- Explore the process of measurement. This includes choosing an appropriate unit of measure and selecting the proper measuring instrument.
- Become familiar with attributes of length, weight, area, liquid capacity, time, and temperature.
- Measure objects using non-standard units (i. e. beads, Unifix cubes, etc.).

SECOND GRADE

- Become familiar with attributes of length, weight, area, liquid capacity, time, and temperature.
- Acquire length and weight measurement skills: inch, foot, yard, meter, centimeter, ounce, pound, gram, kilogram; relative size of one unit to another.
- Use a ruler to draw a segment of a given length to nearest inch or centimeter.
- Acquire time measurement skills: calendar (days, weeks, months, years), equivalencies (one week = 7 days, one year = 12 months), clock (hours, minutes, fractional parts of hours), tell time to the nearest quarter-hour.

THIRD GRADE

- Find perimeters using concrete objects, student-diagrams, and various units of measurement.
- Find elapsed time.
- Explore map scales.
- Measure temperature (Celsius and Fahrenheit).
- Tell time.
- Find areas of squares and rectangles.
- Explore volume capacity, length, weight using metric and standard units.

K-3 Math Program Content Standards

Statistics

State Standards: A.6, B.6, C.1, C.2, C.4, D.1, D.2, E.1, E.2, E.3

KINDERGARTEN

- Construct simple bar graphs and pictographs. State impressions obtained from these graphs. The data for these visual displays should come from realistic problem situations that occur in the classroom.

FIRST GRADE

- Construct graphs. State impressions obtained from these graphs. The data for these visual displays should come from realistic problem situations that occur in the classroom.
- Use simple charts for reference, comparisons, and record keeping.

SECOND GRADE

- Construct graphs. State impressions obtained from these graphs. The data for these visual displays should come from realistic problem situations that occur in the classroom.
- Use simple charts for reference, comparisons, and record keeping.
- Become familiar with use of graphs in newspapers, magazines, television, and other sources within society.

THIRD GRADE

- Collect, organize, and describe data.
- Construct charts, tables, and graphs.
- Interpret, explain, and describe data from charts, tables, and graphs.
- Make predictions from data.
- Investigate concepts of averages.

Probability

State Standards: A.6, B.3, C.1, C.2, C.3, C.4, E.1, E.2

KINDERGARTEN

- Explore the concepts of chance based on repeated observations of real world events such as weather, games, or contests.

FIRST GRADE

- Explore the concepts of chance based on repeated observations of real world events such as weather, games, or contest.

SECOND GRADE

- Explore the concepts of chance based on repeated observations of real world events such as weather, games, or contests.

THIRD GRADE

- Use spinners, dice, and coins to explore probability.
- Assess fairness of a probability experiment.
- Begin generalizing events of likely, unlikely, certain, and luck using everyday experiences.
- Create probability story problems.

K-3 Math Program Content Standards

Patterns

State Standards: A.4, B.3, B.4, B.5, B.6, B.7, D.1, D.2, D.3, E.1, E.2

KINDERGARTEN

- Develop pattern recognition. This would be carried out primarily by working with simple sequences that are determined by numerical or geometric properties, or by other attributes such as color or orientation. Construct an ABC pattern and repeat it at least 6 times.

FIRST GRADE

- Develop pattern recognition. This would be carried out primarily by working with simple sequences that are determined by numerical or geometric properties, or by other attributes such as color or orientation. The pattern may be represented physically, pictorially, or symbolically. The child should be able to describe the rule or relation that determines the sequence and continue the sequence.

SECOND GRADE

- Develop pattern recognition. This would be carried out primarily by working with simple sequences that are determined by numerical or geometric properties, or by other attributes such as color or orientation. The pattern may be represented physically, pictorially, or symbolically. The child should be able to describe the rule or relation that determines the sequence and continue the sequence.

THIRD GRADE

- Develop an awareness of patterns in relationship to mathematics and the natural world.
- Find, recognize, describe, and extend patterns.
- Discover and demonstrate patterns using manipulatives.
- Discover, demonstrate, describe, and recognize number operation patterns.
- Formulate rules to describe patterns and apply the rules to extend the patterns.

Algebra

State Standards: A.4, B.2, C.2, C.4, E.1

FIRST GRADE

- Write number sentences to represent problems involving different addition and subtraction situations and solve the sentences.

SECOND GRADE

- Write number sentences to represent problems involving different addition and subtraction situations and solve the sentences.
- Use numbers to replace a box representing an unknown quantity in a number sentence (for example $9 + q = 14$) and determine if the replacement makes the sentence true.

THIRD GRADE

- Use shapes or letters to represent numbers in number sentences.
- Use manipulatives to represent equations containing an unknown.
- Write and solve story problems using equations containing a variable for an unknown.

4-6 Math Program Content Standards

Estimation

State Standards: A.2, A.3, B.4, B.5, B.6, C.2, E.2, E.3

FOURTH GRADE

- Use appropriate estimation strategies.
- Understand relationship between computation and estimation.
- Apply appropriate estimation strategies when solving problems.

FIFTH GRADE

- Use appropriate estimation strategies.
- Understand relationship between computation and estimation.
- Apply appropriate estimation strategies when solving problems.

SIXTH GRADE

- Use appropriate estimation strategies.
- Understand relationship between computation and estimation.
- Apply appropriate estimation strategies when solving problems.

Number Sense

State Standards: A.1, B.2, B.4, B.5, C.1, D.3, D.4, D.5, E.1, E.3

FOURTH GRADE

- Identify, represent, and explain place value concepts using models, money, pictures, symbols, and words.
- Read and write numbers.
- Understand place value concepts.
- Use equivalent names for numbers.
- Read and write Roman numerals.
- Build rectangular arrays for whole numbers.
- Identify, represent, and explain factors using models, pictures, symbols, and words.
- Identify real world applications for fractions.
- Compare and order fractions using models and pictures.
- Explore ancient numeration systems (relate to social studies).

FIFTH GRADE

- Identify, represent, compare, and order fractions, mixed numbers, decimals, and percentages using models, pictures, symbols, and words.
- Simplify fractions.
- Recognize the relationship between fractions, decimals, and percents.
- Explore bases other than ten to develop understanding of base ten system.
- Identify, represent, and explain prime number concepts using models, pictures, symbols, and words.

SIXTH GRADE

- Extend their understanding of number concepts to include fractions, decimals, integers, i.e., 10 rational numbers.
- Apply decimals and fractions to real world situations.
- Understand ratio and proportion concepts.
- Explore whole number, fraction, decimal, and percent relationships.

4-6 Math Program Content Standards

Concepts of Number Operations

State Standards: A.1, B.1, B.2, B.4, C.1, C.2, C.3, C.4, E.1, E.2

FOURTH GRADE

- Write, experience, and explain processes in problem solving situations.
- Use manipulatives to invent, model, and describe different procedures for finding sums, differences, products, and quotients.
- Model, interpret, and describe different problem situations for addition, subtraction, multiplication and division.

FIFTH GRADE

- Use manipulatives to model, invent, interpret, and describe different problem situations for addition and subtraction of fractions and decimals.
- Write, experience, solve, and explain processes in problem solving situations.

SIXTH GRADE

- Use manipulatives to model, invent, interpret and describe different problem situations for decimal and fraction operations.
- Identify real world applications for decimal and fraction operations.
- Write, experience, solve, and explain thought processes in problem solving situations involving multiple operations.

Computation

State Standards: A.1, A.3, B.1, B.3, B.5, B.6, B.7, B.8, E.1

FOURTH GRADE

- Demonstrate reasonable proficiencywith multiplication and division.
- Demonstrate reasonable proficiency with addition, subtraction, multiplication, and division involving money values.
- Use mental math when appropriate.
- Select appropriate method for computation (pencil and paper, mental math, calculator, computer).
- Expand use of error analysis to include all operations.

FIFTH GRADE

- Demonstrate reasonable proficiency with multiplication and division involving whole numbers or money values.
- Demonstrate reasonable proficiency with addition and subtraction of decimals and fractions.
- Expand use of error analysis to decimal and fraction computation.
- Select appropriate method for computation (pencil and paper, mental math, calculator, computer)

SIXTH GRADE

- Demonstrate reasonable proficiency with addition, subtraction, multiplication, and division of decimals and fractions.
- Add and subtract integers with like and unlike signs.
- Find percent of a number, i.e. simple interest.
- Use mental math when appropriate.
- Expand use of error analysis to include fraction and decimal computation.
- Compare various technological tools for computation.

4-6 Math Program Content Standards

Geometry

State Standards: A.5, B.2, B.3, B.4, E.1, E.2, E.3

FOURTH GRADE

- Explore the various characteristics of 2- and 3-dimensional geometric shapes.
- Apply symmetry concepts to geometric shapes.
- Recognize, identify, and describe properties of congruent shapes.
- Explore properties of 2-dimensional shapes through drawing, modeling, comparing, measuring, and classifying.
- Develop spatial sense by exploring different perspectives (views) of 3-dimensional shapes.
- Locate points on the coordinate plane.

FIFTH GRADE

- Explore, identify, and describe characteristics of 2-and 3-dimensional geometric shapes.
- Perform translations and rotations of 2-dimensional shapes.
- Identify geometric shapes properties in architecture and natural structures.
- Draw line segments determined by locating points on a coordinate plane.

SIXTH GRADE

- Apply characteristics of 2- and 3-dimensional geometric shapes to everyday life.
- Apply characteristics of congruency to person-made and natural structures.
- Apply geometric concepts to practical situations.

Measurement

State Standards: A.2, B.3, B.4, B.5, B.6, B.7, C.1, C.2, C.3, C.4, E.1, E.2, E.3

FOURTH GRADE

- Solve real life problems involving elapsed time.
- Find perimeters of regular and irregular shapes.
- Find areas of regular shapes.
- Estimate areas of irregular shapes.
- Develop and use formulas for finding perimeters of geometric shapes.
- Solve real life problems involving map scales.
- Solve real life problems involving temperature.
- Solve real life problems involving metric and standard units of volume, capacity, weight, and length.

FIFTH GRADE

- Develop and use formulas for finding areas of polygons.
- Find circumferences of circles.
- Measure angles with a protractor.
- Draw to scale.
- Solve real life problems involving area and perimeter.
- Find surface areas of cubes and prisms.
- Solve real life problems involving measurement.
- Become familiar with rate concepts.
- Estimate areas of circles.

SIXTH GRADE

- Use a protractor to measure and draw angles.
- Find surface areas of cubes, prisms, and pyramids.
- Find volumes of cubes and rectangular prisms.
- Develop an understanding of the formulas for finding circumferences and areas of circles.
- Solve real life problems involving measurement concepts.
- Apply measurement concepts to real life situations.
- Solve real life problems involving rate.

4-6 Math Program Content Standards

Statistics

State Standards: A.6, B.2, B.4, C.1, C.2, C.3, C.4, D.1, D.2, D.3, D.4, D.5, E.1, E.2, E.3

FOURTH GRADE

- Collect, organize, and describe data.
- Construct charts, tables, and graphs.
- Interpret, explain, and describe data from charts, tables, and graphs.
- Predict trends using charts, graphs, and tables.
- Find averages.

FIFTH GRADE

- Collect, organize, and describe data.
- Construct charts, tables, and graphs.
- Interpret, explain, and describe data from charts, tables, and graphs.
- Predict trends using charts, graphs, and tables.
- Evaluate data to determine validity, propaganda, and prejudice.

SIXTH GRADE

- Find median, mode, and range.
- Solve average problems.
- Collect, organize, and describe data.
- Construct charts, tables, and graphs.
- Interpret, explain, and describe data from charts, tables, and graphs.
- Predict trends using charts, graphs, and tables.
- Evaluate data to determine validity, propaganda, and prejudice.
- Make inferences and convincing arguments based on data.
- Understand the use of statistics in the real world.

Probability

State Standards: A.6, B.7, B.8, C.1, C.2, C.3, C.4, D.1, D.2, D.3, E.2

FOURTH GRADE

- Make predictions based on own experience and experiments.
- Explore a variety of probability experiments.
- Generalize events of likely, unlikely, certain, and luck based on experiments, experience, and data.
- Analyze and present probability data using simple fractions.
- Create probability story problems.

FIFTH GRADE

- Analyze and present probability data.
- Identify probability in real life situations.
- Conduct probability experiments where data is gathered in a variety of ways such as surveys, science experiments, newspapers, and spinners.
- Create probability story problems.

SIXTH GRADE

- Analyze and present probability data using percents and ratios.
- Apply probability to real life situations.
- Design and conduct experiments and simulations using probability.
- Continue to use probability as a logical approach to problem solving.
- Create probability story problems.
- Predict probabilities of simple events.
- Compute probabilities of simple events.
- Compare predicted and computed probabilities with experimental probabilities.

4-6 Math Program Content Standards

Patterns

State Standards: A.4, B.7, C.1, C.2, C.3, C.4, D.1, D.2, D.3, D.4, D.5, E.1, E.2, E.3

FOURTH GRADE

- Develop an awareness of patterns in relationship to mathematics and the natural world.
- Discover, demonstrate, and extend patterns using manipulatives.
- Formulate rules to describe patterns and apply the rules to extend the patterns.
- Formulate descriptions of patterns and their relationship to number operations.
- Explore patterns represented in tables, graphs, rules, and problem solving situations.
- Explore how change in one quantity results in change in another.

FIFTH GRADE

- Develop an awareness of patterns in relationship to mathematics and the natural world.
- Conduct and analyze experiments that demonstrate how change in one quantity results in change in another.
- Extend and describe patterns represented in tables, graphs, rules, formulas, and problem solving.

SIXTH GRADE

- Develop an awareness of patterns in relationship to mathematics and the natural world.
- Conduct, and analyze real world experiments that demonstrate how change in one quantity results in change in another.
- Demonstrate how patterns in mathematics result in algorithms and formulas.
- Develop an awareness of how patterns influence decision making in their lives.

Algebra

State Standards: A.4, B.2, B.3, B.4, B.5, B.6, C.1, C.2, C.3, C.4, D.1, D.5, E.1, E.2, E.3

FOURTH GRADE

- Use shapes or letters to represent numbers in number sentences.
- Find solutions for open sentences.
- Use manipulatives to describe and solve equations with an unknown.
- Write and solve story problems using equations containing a variable for an unknown.

FIFTH GRADE

- Use shapes or letters to represent numbers in number sentences.
- Use symbols to represent variables in number sentences; find solutions for number sentences containing variables.
- Write and solve story problems using equations containing a variable for an unknown.
- Graph number sentences.
- Analyze graphs and tables; make predictions from graphs and tables.
- Find relationships using patterns involving multiple variables.

SIXTH GRADE

- Use shapes or letters to represent numbers in number sentences.
- Use concrete examples and manipulatives to solve algebraic problems from everyday life experiences that involve identity properties, order of operations, exponents, inverse operations, and inequalities.
- Use a variety of methods to solve one-step equations.
- Informally investigate inequalities and nonlinear equations.
- Write and solve story problems using equations containing a variable for an unknown.
- Graph number sentences.
- Analyze graphs and tables; make predictions from graphs and tables.

Everyday Mathematics (EDM) was developed through the University of Chicago School Mathematics Project (UCSMP) to enable children in elementary grades to learn more and become better mathematical thinkers.

International studies show that U.S. students learn much less math than students in other countries. Several corporations and organizations such as the Amoco Foundation, National Science Foundation, Ford Motor Company, General Electric Foundation, Citicorp, Exxon, and the Carnegie Foundation saw the need for reform in mathematics and grouped together to fund UCSMP. Writers researched math instruction around the world and developed the program one level at a time so materials could be well tested before publication.

A high priority is placed on children developing automatic recall of the basic number facts and recognizes that computation is an important and practical part of mathematics. It has been designed to ensure that all students can compute accurately in a variety of ways. EDM continues to recognize that practice is necessary in developing competency in math. It also uses calculators as a tool for learning mathematics, not simply computation.

Skills and concepts are balanced in EDM because neglecting one will eventually undermine the other. Children with weak conceptual understandings are hindered in their skill development and children with weak skills are handicapped as they work towards higher levels of conceptual understanding.

Everyday Mathematics uses a variety of instructional techniques that are tailored to students' developmental levels. The program understands that students learn in different ways and that different topics need to be approached differently. So it provides a reasonable balance between discovery learning and more direct teaching approaches. The program challenges students to apply their mathematics knowledge to solve real-life problems. These problems are presented in a variety of contexts and solved in a variety of ways. Students are taught to question and verify the reasonableness of their own and others' strategies and conclusions. It includes a mix of different techniques because the ultimate goal of the curriculum is that students really understand and are successful at math.

Students using EDM have been found to be mathematically literate on a wide variety of measures: state-mandated tests, commercially available standardized tests, tests constructed by USCMP staff and tests written by independent researchers. Some of these results are summarized in the *Everyday Mathematics* "Student Achievement Studies."

Everyday Mathematics materials let children explore the full range of mathematics across all grade levels. Math activities are connected to past experiences and studied in a problem-rich environment with links to many areas both within mathematics and other subject areas. Each grade level includes content from the area listed below:

Numeration and Counting: saying, reading, and writing numbers; counting patterns; place value; whole numbers, fractions and decimals

Operations and Relations: number facts; operation families; informal work with properties

Problem Solving and Number Models: mental and written arithmetic along with puzzles, brain teasers and real-life problems.

Measures and Reference Frames: measures of length, width, area, weight, capacity, temperature and time; clocks; calendars; timelines; thermometers; ordinal numbers

Exploring Data: collecting and ordering data; tables, charts and graphs; exploring uncertainty; fairness; making predictions

Geometry: exploring two- and three-dimensional shapes

Rules and Patterns: functions, relations, attributes, patterns and sequences

Algebra and Uses of Variables: generalizing patterns, exploring variables, solving equations

Children often work together with partners and small groups, sharing insights about math and building on each other's discoveries. Talking about math is an important part of thinking about math, and verbalizing helps clarify concepts. Cooperative grouping helps children work together as a team, develops good listening habits, and stimulates their learning.

People rarely learn something new the first time they experience it. For this reason, key ideas are repeated, usually in slightly different contexts, several times throughout the year. New material follows the 2/5 rule - that is, a concept is informally introduced for two years before it is formally studied, and once introduced, the concept is practiced in five or more different settings.

The materials that you see and hear about vary somewhat by grade level but may be a bit different than those that you remember from elementary school.

The **journal** contains the problem material and pages on which the children record the results of their activities. It provides a record of their mathematical growth over time and is used in place of student worksheets, workbook, and textbook.

Math boxes are 4 to 6 short problems for review and practice. In the upper grades these are included as a part of the student journals.

Explorations are independent or small group activities that allow children to investigate and develop math concepts. These are a key part of the math program in the early grades and often involve manipulative materials.

Yearlong **projects** such as the World Tour in fourth grade or the fifth grade American Tour, link mathematics to social studies. Third grade children trace sunrise, sunset, and length of day, exploring and using the connections between math and science.

Home Links/ Study Links/Skills Link provide an important connection between home and school. Most are activities that require interaction with parents, other adults, or another child. They are designed to provide follow-up, practice, and review of skills and concepts, and an extension of the material covered in the daily lessons.

Students use a variety of math tools throughout the year. Ruler, tape measure, geometry template, counter, and money are among the items kept in the **math tool kit.** Children learn responsibility for their learning tools and have them available when needed.

The following entries provide some of the key features of the Everyday Math program. It is obviously not possible in this manual to list all aspects of the program, but every effort has been made to give the information most often requested by parents. As always, your most important resource is your child's teacher.

Algorithms and Computation

An algorithm is a set of rules for solving a math problem which, if done properly, will give a correct answer each time. Algorithms generally involve repeating a series of steps over and over as in the borrowing and carrying algorithms and in the long multiplication and division algorithms. The *Everyday Mathematics* program includes a variety of suggested algorithms for addition, subtraction, multiplication, and division. Current research indicates a number of good reasons for this — primarily, that students learn more about numbers, operations, and place value when they explore math using different methods.

Arithmetic computations are generally performed in one of three ways: (1) mentally, (2) with paper and pencil, or (3) with a machine, e.g. calculator or abacus. The method chosen depends on the purpose of the calculation. If we need rapid, precise calculations, we would choose a machine. If we need a quick ballpark estimate or if the numbers are "easy," we would do a mental computation.

The learning of the algorithms of arithmetic has been, until recently, the core of mathematics programs in elementary schools. There were good reasons for this. It was necessary that students have reliable, accurate methods to do arithmetic by hand, for everyday life, business, and to support further study in mathematics and science. Today's society demands more from its citizens than knowledge of basic arithmetic skills. Our students are confronted with a world in which mathematical proficiency is essential for success. There is general agreement among mathematics educators that drill on paper/pencil algorithms should receive less emphasis and that more emphasis be placed on areas like geometry, measurement, data analysis, probability and problem solving, and that students be introduced to these subjects using realistic problem contexts. The use of technology, including calculators, does not diminish the need for basic knowledge, but does provide children with opportunities to explore and expand their problem solving capabilities.

Sample Algorithms

Listed below and on the following pages are examples of a few procedures that have come from children's mental arithmetic efforts. As parents, you need to be accepting and encouraging when your children attempt these computational procedures. As they experiment and share their solutions strategies, please allow their ideas to flourish.

Addition Algorithms

1. Left to right algorithm:

A.

	2	6	8
+	4	8	3
	6	14	11
	7	4	11
	7	5	1

1. Add.
2. Adjust 10's and 100's.
3. Adjust 1's and 10's.

B.

	2	6	8
+	4	8	3
	6^1	4^1	1
	7	5	1

1. Left to right Algorithm

A. Starting at the left, add column-by-column, and adjust the result.

B. *Alternative procedure:* For some students the above process becomes so automatic that they start at the left and write the answer column by column, adjusting as they go without writing any in between steps. If asked to explain, they say something like this: *"Well, 200 plus 400 is 600, but (looking at the next column) I need to adjust that, so write 7. Then, 60 and 80 is 140, but that needs adjusting, so write 5. Now, 8 and 3 is 11, no more to do, write 1."*

This technique easily develops from experiences with manipulatives, such as base-10 blocks and money, and exchange or trading games.

2. Partial-sums algorithm:

```
  268
+ 483
  600     1. Add 100's.
  140     2. Add 10's.
+  11     3. Add 1's.
  751     4. Add partial
             numbers.
```

2. Partial-Sums Algorithm

Add the numbers in each column. Then add the partial sums.

Students who use this type of algorithm often show an awareness of place value not typical of those who learned the traditional method. This procedure works well for larger numbers, too.

3. Rename the first addend, and then the second.

```
  268 → (+2) →   270 → (+30) →   300
+ 483 → (-2) → + 481 → (-30) → + 451
                          Add.   751
```

Explanation: Adjust by 2, and then by 30.

Rename the second addend, and then the first.

```
  268 → (-7) →   261 → (+10) →   251
+ 483 → (+7) → + 490 → (-10) → + 500
                          Add.   751
```

Explanation: Adjust by 7, and then by 10.

3. Rename-Addends Algorithm (Opposite Change)

If a number is added to one of the addends and the same number subtracted from the other addend, the result remains the same. The purpose is to rename the addends so that one of the addends ends in zeros. This strategy indicates a good number sense and some understanding of equivalent forms.

4. 268 + 483.
Begin 268 and count by 100's, 4 times: 368, 468, 568, 668; then count by 10's, 8 times: 678, 688, 698, 708, 718, 728, 738, 748; continue to count by 1's, 3 times: 749, 750, 751.

Alternate method: With larger numbers children may use a combination of counting on and counting back: 268, 368, 468, 568, 668, (add 100 but go back 10 twice) 768, 758, 748, (and counting by ones) 749, 750, 751.

4. Counting-On Algorithm

Child "adds" by counting from a specified number.

Subtraction Algorithms

1. Add-up algorithm:

```
356    +   4
360 ↙  +  40
400 ↙  + 500
900 ↙  +  32
932 ↙
Add.     576
```

1. Add-Up Algorithm

Add up from the subtrahend (bottom number) to the minuend (top number).

```
  932
- 356
```

Students may mentally keep track of the numbers that are added and use paper to record the addends on the side. Most of us often use some form of this method when making change.

2. Left-to-right algorithm:

```
                       932
1. Subtract 100's    - 300
                       632
2. Subtract 10's     -  50
                       582
3. Subtract 1's      -   6
                       576
```

2. Left-to-Right algorithm

Starting at the left, subtract column by column.

```
  932
- 356
```

3. Add the same number.

```
          932 → (+4) →   936 → (+40) →   976
       -  356 → (+4) → - 360 → (+40) → - 400
                               Subtract.  576
```

Explanation: Adjust by 4, and then by 40.

Subtract the same number.

```
          932 → (-6) →   926 → (-50) →   876
       -  356 → (-6) → - 350 → (-50) → - 300
                               Subtract.  576
```

Explanation: Adjust by 6, and then by 50.

3. Rename-Subtrahend Algorithm (Same Change)

If the same number is added to or subtracted from both the minuend (top number) and subtrahend (bottom number), the result remains the same. The purpose is to rename both the minuend and the subtrahend so that the subtrahend ends in zero. This type of solution method shows a strong ability to hold and manipulate numbers mentally.

4. Unusual algorithms:

	932
1. Subtract 100's:	- 356
900-300	600
2. Subtract10's: 30-50	- 20
3. Subtract 1's: 2-6	- 4
3. Add the partial differences. (600-20-4, done mentally)	576

4. Unusual Algorithms
   A. Subtract by adding column-by-column with adjustments. Some students who use the add-up algorithm extend that to subtraction. They just write the answer with no other remarks.
   B. Write partial difference, negative if necessary, and adjust. A few students who love negative numbers use some variation of the procedure shown in the margin.

This method may be less common than some of the others. Yet, some students seem to have an informal sense of working with negatives (deficits).

Multiplication Algorithms

In Third Grade *Everyday Mathematics*, a partial products algorithm is the initial approach to finding products with formal paper-and-pencil procedures. This algorithm is done from left to right, so that the largest partial product is calculated first. As with left-to-right algorithms for addition, this encourages quick estimates of the magnitude of products without necessarily finishing the procedure to find exact answers. In order to use this algorithm efficiently, students need to be very good at multiplying multiples of 10, 100, and 1000, for example, 30 (50's). The fourth-grade program contains a good deal of practice and review of these skills, which also serve very well in making ballpark estimates problems that involve multiplication or division, and introduces the * as a symbol of multiplication.

1.

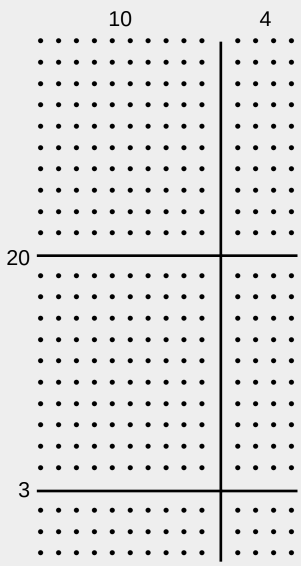
	67
	x 53
50 x 60	3000
50 x 7	350
3 x 60	180
3 x 7	+ 21
	3551

1. Partial Product Algorithm

In the partial-product multiplication algorithm, each factor is thought as a sum of ones, tens, hundreds, and so on. For example, in 53*67, think 53 as 50 +3, and 67 as 60 +7. Then each part of one factor is multiplied by each part of the other factor, and all of the resulting partial products are added together, as shown in the margin.

The principles behind this algorithm are taught in the *Multiplication Wrestling* game in grade 4, in which every part of one factor "wrestles" every part of the other factor. We suggest it as the multiplication algorithm for students who have not already settled on a procedure they like better.

1. Partial product algorithm: 23 * 14 array



$23 * 14 = (20 + 3) * (10 + 4)$
$= (20 * 10) + (20 * 4) + (3 * 10) + (3 * 4)$
$= 200 + 80 + 30 + 12$
$= 322$

The algorithm can be demonstrated visually with arrays, which were among the first representations of products in *Everyday Mathematics.* The margin shows a 23-by-14 array which represents all of the partial products in 23 * 14:

$$23 * 14 = (20 + 3) * (10 + 4)$$
$$= (20 * 10) + (20 * 4) + (3 * 10) + (3 * 4)$$
$$= 200 + 80 + 30 + 12$$
$$= 322$$

One value of the partial-product algorithm is that it previews a procedure for multiplication that is taught in high school algebra, and is part of some algebra that will be optional in Sixth Grade *Everyday Mathematics.* Everything is multiplied by everything, and the partial products added. For example:

$$(x + 2) * (x + 3) = (x * x) + (2 * x) + (3 * x) + (2 * 3)$$
$$= x^2 + 5x + 6$$

There are many procedures other than this partial-product algorithm or the traditional algorithm that is almost universally taught by the end of fourth grade in U. S. schools. Two algebra-based examples are shown.

This method reinforces the understanding of place value and emphasizes the multiplication of the largest product first.

1. Partial product algorithm: algebra-based examples

With the rule $(a+b)^2 = a^2 + 2ab + b^2$, 25^2 can be calculated as $(20 + 5)^2 = 400 + (2 * 100) + 25 = 625$.
With the rule $(a+b)(a-b) = a^2 - b^2$, 23 x 17 can be calculated as $(20 + 3)(20 - 3) = 400 - 9 = 391$.

2. Modified repeat addition:

	67
	x 53
	670
	670
50 [67's]	670
or	670
5 [670's]	670
	67
3 [67's]	67
	+ 67
	3551

2. Modified Repeat Addition

Contrary to what is often taught, **multiplication is not merely repeated addition,** even for whole numbers and certainly not for decimals and fractions. For example, it would be tedious to add 67 fifty-three times in order to solve 53 * 67. But if we think of ten 67's as 670, then we can first add the 670's (there are five of them) and then the three 67's as indicated in the margin.

3. Modified standard U.S. algorithm

a.	**b.**	**c.**
67	67	67
* 53	* 53	* 53
201	201	3350
335	3350	201
3551	3551	3551

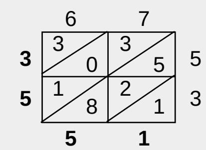
3. Modified Standard U.S. Algorithm

Example **a** is the standard U.S. algorithm.

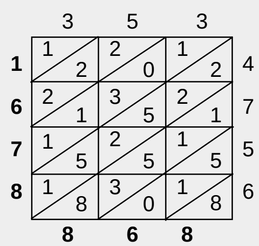
Example **b** replaces the blank with a zero, which makes it clear that the second partial product, we are multiplying by 50 (five 10's) and not just by 5.

Example **c** works from left to right, but is otherwise the same as the standard algorithm with zero in place of the blank. This method may be less common than some of the others yet students using it display a sense of number.

4. Lattice method:



53 * 67 = 3551



353 * 4756 = 1,678,868

4. Lattice Method

This algorithm is included mainly for its historical interest, and the fact that it provides fine practice with the multiplication facts and adding single-digit numbers. It is not easy to explain exactly why it works, but it does have the reliability that all algorithms must have. It is also very efficient, no matter how many digits are in the factors, as indicated by the second example in the margin.

The lattice method appeared in what is said to be the first printed arithmetic book, printed in Treviso, Italy, in 1478. It was in use long before that, with some historians tracing it to Hindu origins in India before 1100.

This is a student favorite because of the direct relationship to multiplication facts and its easy expandability to very large numbers.

Lattice Method Explanation:

- Make a box for each digit and divide it in half with a diagonal line from lower left to upper right.
- Write the digits for the first number across the top (one for each box).
- Write the digits for the second number along the side (one for each box).
- Multiply each digit across the top with the digit(s) down the side, placing the tens digit of the each product above the diagonal, and the ones digit below the diagonal.
- Start at the bottom right corner and add the digits along each diagonal. Place the sum(s) at the bottom of each diagonal (outside the box) carrying the tens digit to the next diagonal, if needed.
- The answer is read down the left side and across the bottom, left to right.

A Division Algorithm

Division algorithms:

```
a. 12)158   10
      120
       38    3
       36
        2   13

b. 12)158   10
      120
       38    2
       24
       14    1
       12
        2   13
```

The key question to be answered in many problems is "How many of these are in that," or How many *n*'s are in *m*?" This can be expressed as division: "*m* divided by *n*," or "*m/n*."

One way to solve division problems is to use an algorithm that begins with a series of "at least/less than" estimates of how many *n*'s are in *m*. You check each estimate. If you have not taken out enough *n*'s from the *m*'s, take out some more; when you have taken out all there are, add the interim estimates.

For example 158/12 can be thought of as the question, "How many 12's are in 158?" You might begin with multiples of 10, because they are simple to work with. A quick mental calculation tells you that there are at least ten 12's in 158 (10 * 12 = 120), but less than twenty (since 20 * 12 = 240). You would record 10 as your first estimate and remove (subtract) ten 12's from 158, leaving 38. The next question is, "How many 12's in the remaining 38?" You might know the answer right away (since three 12's are 36), or you might sneak up on it: "More than 1, more than 2, a little more than 3, but not as many as 4..." Taking out three 12's leaves 2, which is less than 12, so you can stop estimating.

To obtain the final result, you would add all of your estimates (10 + 3 = 13) and note what, if anything, is left over (2). There is a total of thirteen 12's in 158; 2 is left over. The quotient is 13, and the remainder is 2 *(example a)*.

It is important to note that, in following this algorithm, students may not make the same series of estimates. In *example b*, a student could have used 2 as a second estimate, taking out just two 12's and leaving 14 still not accounted for — another 12, and a remainder of 2. The student would reach the final answer in three steps rather than two. One way is not better than another.

Example b is one method of recording the steps in the algorithm. One advantage of this algorithm is that students can use numbers that are easy for them to work with. Students who are good estimators and confident of their extended multiplication facts will need to make only a few estimates to arrive at a quotient, while others will be more comfortable taking smaller steps. More important than the course a student follows is that the student understands how and why this algorithm works and can use it to get an accurate answer.

Division algorithm:

c. 12	)158.0	10
	120.0	
	38.0	3
	36.0	
	2.0	0.1
	1.2	
	.8	13.1

Another advantage of this algorithm is that it can be extended to decimals since students have a pretty good sense of “how many *n*’s are in *m*?” Sometimes it may be desirable to express the quotient as a decimal. Sometimes *n* may be larger that *m* (the divisor larger than the dividend), or all the information is in decimal form. For the example 158/12, the estimates could be continued by asking, “How many 12’s in the remainder 2?” A student with good number sense might answer, “At least one-tenth, since 0.1 * 12 is 1.2, but less than two-tenths, since 0.2 * 2 = 2.4. The answer then could be “13.1 (12’s) in 158, and a little bit left over (*example c)*.

The question behind this algorithm, “How many of these are in that?” also serves well for estimates where the information is given in scientific notation. The uses of this algorithm with problems that involve scientific notation or decimal information will be explored briefly in grades 5 and 6, mainly to build number sense and understanding of the meanings of division.

Calculators

Evidence is growing that student’s intelligent use of calculators enhances understanding and mastery of arithmetic and helps develop good number sense. Moreover, teacher experience and considerable research show that most children develop good judgment about when to use and when not to use calculators. Students learn how to decide when it is appropriate to solve an arithmetic problem by estimating or mentally calculating, by using paper and pencil, or by using a calculator.

Calculators are useful teaching tools. They make it possible for young children to display and read numbers before they are skilled at writing numbers. Calculators can be used to count by any number, forward and backward. They also allow children to solve interesting, everyday problems requiring calculations that might otherwise be too difficult for them to perform.

Please encourage children to use their calculators whenever they encounter interesting numbers or problems that may be easier to handle with calculators than without them. This includes numbers or problems that may come up outside of the mathematics period. Do not worry that the children will become dependent on calculators and will be unable to solve problems with paper and pencil or in their heads.

By playing *Beat the Calculator* and similar games, children will discover that they can do many calculations more quickly in their heads.

Diagrams

If you ask a random sampling of adults what they think grade school mathematics is, you will probably get answers similar to: “You know… add, subtract, multiply, divide…” This was their experience, and unfortunately, it is still the primary experience of current grade school children. But the authors of *Everyday Mathematics* trust that your acquaintance with this program and your reading of this handbook have assured you that this curriculum sees mathematics as far more than arithmetic with four operations.

However, the importance of understanding arithmetic in order to be successful in everyday life cannot be denied. By mixing activities that are directly focused on understanding the operations with activities that apply arithmetic in geometry, data exploration, measurement, and other contexts, *Everyday Mathematics* makes sure that its students encounter as much practice with arithmetic skills as children of other curricula.

Rather than seeing only addition and subtraction in first and second grades, multiplication in third and fourth, and division in fifth and sixth, children in this program see many informal uses of all the operations from an early age, and then build on and connect these uses year after year.

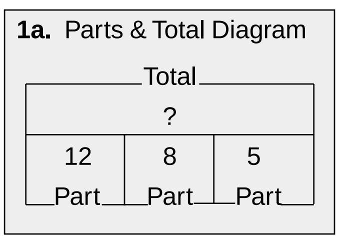
In a traditional curriculum where much of the arithmetic is separated from everyday situations, *add* means add, *multiply* means multiply, and so on. This is because understanding arithmetic has been reduced to simply using the skills involved in getting a sum or product. In *Everyday Mathematics*, understanding an operation means much more than how to get a result. It also means learning to choose an operation that is right for a given situation.

One strategy for figuring out which operation may help solve a problem is based on the observation that each operation is used in different ways. For example, one use of multiplication is to calculate the area of an 8-ft. by 12-ft. wall. Area of a rectangle is length times width, so you multiply. This use of multiplication, however is no help if you want to figure out how many miles you walk in 3 hours at 2 miles per hour.

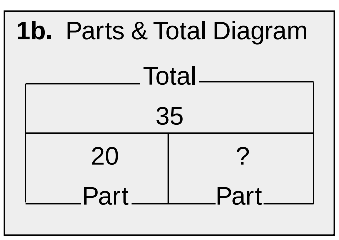
To organize different uses of operations, *Everyday Mathematics* presents several **operations diagrams** that break down the major uses of each operation. The diagrams are templates to be filled in for particular problems. Diagrams first appear in second grade.

Addition and Subtraction Diagrams

The diagrams described below help students keep track of what is known, what is needed, and which operation to use to solve addition and subtraction problems.



1a. Parts & Total Diagram



1b. Parts & Total Diagram

1. Parts and Total Diagrams. A parts and total diagram is used to represent problems in which two or more quantities (parts) are combined to form a total quantity.

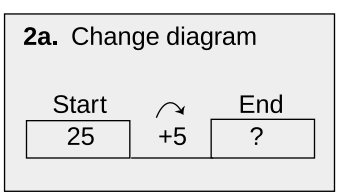
   Example 1a: Twelve fourth graders, 8 third graders and 5 first graders are on a bus. How many children in all are on the bus?

   The parts are known. You are looking for the total. Possible number model: 12 + 8 + 5 = 25. *Solution:* There are 25 children on the bus.

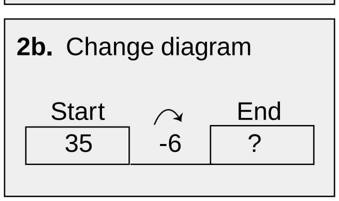
   If you know the total but not all of the parts, then you could use subtraction instead of addition to find the unknown part.

   Example 1b: Thirty-five children are riding on the bus. Twenty of them are boys. How many girls are riding on the bus?

   One part and the total are known. You are looking for the other part. Possible number models: 20 + 15 = 35   35 - 20 = 15
   Solution: There are 15 girls on the bus.



2a. Change diagram



2b. Change diagram

2. Change Diagrams. Change diagrams are used to represent problems in which a given quantity (start) is increased or decreased.

   Example 2a: Twenty-five children are riding on the bus. At the next stop, 5 more children get on. How many children are on the bus now?

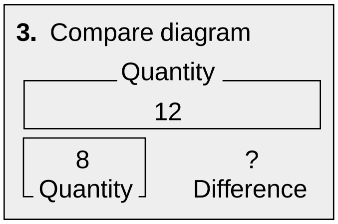
   The number with which you started has been increased. Possible number model: 25 + 5 = 30

   Solution: There are 30 children on the bus now.

   Example 2b: A bus leaves school with 35 children. At the first stop, 6 children get off. How many children are left on the bus?

   The number with which you started has been decreased. Possible number models: 35 - 6 = 29   6 + 29 = 35

   Solution: There are 29 children left on the bus.



3. Compare Diagrams. Compare diagrams are used to represent problems in which two quantities are given and you try to find how much more or how much less one quantity is than the other (the difference).

Example: There are 12 fourth graders and 8 third graders. How many more fourth graders are there than third graders?

You are comparing the number of fourth graders with the number of third graders. Possible number models: 12 - 8 = 4
8 + 4 = 12 (for children who count up, or add, to find differences)

Solution: There are 4 more fourth graders than there are third graders.

It is important to remember that diagrams are simply devices to help organize problem solving. They are not ends in themselves.

Multiplication and Division Diagrams

There are three type of multiplication/division diagrams: rate, acting-across, and scaling. Note in the following examples for each diagram that there are three parts to each diagram. Two of the three are simple measure or counts. The third part is compound, meaning that it is either a product or a quotient of the two simple parts.

- In a **rate diagram,** the compound part is a quotient of two different units, such as miles per hour.
- In an **acting across diagram,** the compound part is a product of two units: Sometimes different, such as kilowatt-hours; and other times the same, such as square feet or ft^2.
- In a **scaling diagram,** the compound part is a ratio of the same units. In these diagrams the compound part has no unit.

1. **Rate Diagrams** In rate multiplication situations, the number of groups and the number of objects in each group are known. You need to find the total number of objects. These are sometimes called **array multiplication** situations.

1a. Rate diagram

Units	rows	chairs per row	chairs
Numbers	6	4	?

There are 24 chairs in all.

Example 1a: There are 6 rows with 4 chairs in each row. How many chairs are there in all?

To find the total number of chairs, you can multiply. Possible number model: 6 * 4 = 24 *Solution:* There are 24 chairs in all.

1b. Rate diagram

Units	children	cards per child	cards
Numbers	4	?	24

Each child gets 6 baseball cards.

In **equal-sharing** situations, the number of groups and the total number of objects are known. You need to find the number of objects in each group.

Example 1b: Twenty-four baseball cards are shared equally by 4 children. How many cards does each child get?
To find the number of cards per child, you can divide, or ask, "What times 4 is 24?" Possible number models: 24 / 4 = 6; 4 * 6 = 24

Solution: Each child gets 6 baseball cards.

1c. Rate diagrams

Units	tables	chairs per table	chairs
Numbers	?	6	33

Five tables can have chairs. There are 3 chairs left over.

In **equal-grouping** situations, the number of objects per group and the total number of objects are known. You need to find the number of groups.
Example 1c: Each table must have 6 chairs. There are 33 chairs. How many tables can have 6 chairs? To find the number of tables, you can divide. Possible number model: 33 / 6 ➞ 5 R3.

Solution: Five tables can have chairs. There are 3 chairs left over.

2. **Acting-Across Diagrams** In multiplication acting-across situations, quantities with different units are multiplied. The diagrams show that the product is expressed in compound units, such as square feet or people-hours.

2a. Acting-across diagram

Units	ft.	ft.	sq. ft.
Numbers	3	6	?

The area of the rug is 18 sq. ft. or 18 $ft.^2$

Example 2a: What is the area of a 3-ft by 6-ft rug?
Possible model: 3 * 6 = 18
Solution: The area of the rug is 18 square feet.

In division acting-across situations, you know a quantity with a compound unit and a quantity with an associated simple unit. Division gives the other quantity with the other simple unit.

2b. Acting-across diagram

Units	people	people-hours	hours
Numbers	8	20	?

Each person worked an average of 2.5 hours.

Example 2b: The 8 people on the pep squad worked a total of 20 people-hours on the assembly. What is the average number of hours each person worked?
Possible number model: 20/8 = 2.5
Solution: Each person worked an average of 2.5 hours.

3. **Scaling Diagrams** In multiplication scaling situations, a quantity is multiplied by the ratio, which is called a scalar or scaling factor. The diagrams show that the scaling factor has no units. The unit of the product is the same as the unit of the other factor.

3a. Scaling diagram

Units		lb.	lb.
Numbers	3	6	?

Hector weighed 18 pounds at 15 months.

Example 3a: Hector weighed 6 lb. at birth. At 15 months, he weighed 3 times his birth weight. What was his weight at 15 months?
The empty unit boxes in the diagrams show that the scalar has no unit.
Possible number model: 3 * 6 = 18
Solution: Hector weighed 18 pounds at 15 months.
Scalars may also be expressed as fractions or percents.

3b. Scaling diagram

Units		$	$
Numbers	1/2	30	?

The sale price will be $15.

Example 3b: A store has 1/2 off (or 50% off) sale. What will an item that regularly cost $30 cost during the sale?
Possible number model: 1/2 * 30 = 15
Solution: The sale price will be $15.

There are two different division scaling situations. In one, two quantities are known and their ratio, the scaling factor, is found by division. In the other, a final quantity and the scaling factor are known; division gives the starting quantity.

3c. Scaling diagram

Units		lb.	lb.
Numbers	?	6	18

At 15 months, Hector weighed 3 times his birth weight.

Example 3c: If Hector weighed 6 lb. at birth and 18 lb. at 15 months, how many times his birth weight was his weight at 15 months?
Solution: At 15 months Hector weighed 3 times his birth weight.

3d. Scaling diagrams

Units		$	$
Num-bers	6	?	18

The shirt costs the shop owner $3.

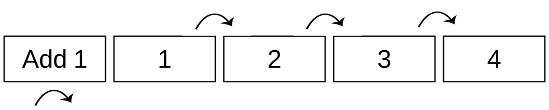
Example 3d: If a shop owner sells a shirt for $18, and if this is 6 times her wholesale cost, what does the shirt cost her?

Solution: The shirt costs the shop owner $3.

Possible number model for both: 18 / 6 = 3

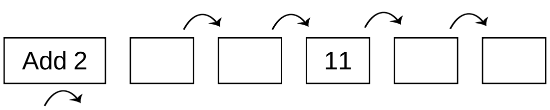
Frames and Arrows Diagrams

Frames and Arrows diagrams consist of frames connected by arrows to show the path for moving from one frame to another. Each frame contains a number in the sequence; each arrow represents a rule that determines what number goes in the next frame. Frames and Arrows diagrams are also called chains. Here is a simple example of a Frames and Arrows diagram for the rule "Add 1."



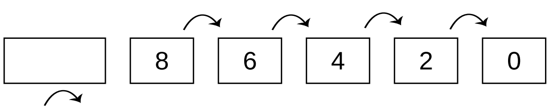
In Frames and Arrows problems, some of the information has been left out of the diagram. Children solve the problem by supplying the missing information. A few sample problems follow.

The rule is given. Some of the frames are empty. Fill in the blank frames.



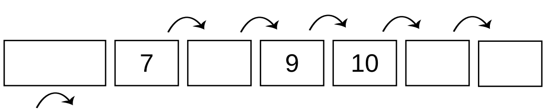
Solution: Write 7, 9, 13, and 15 in the blank frames.

The frames are filled in. The rule is missing. Find the rule.



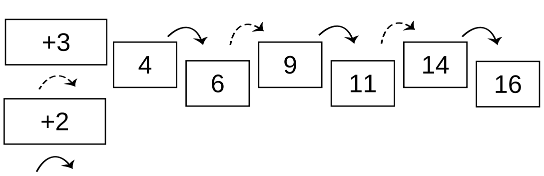
Solution: The rule is subtract 2, minus 2, or -2

Some of the frames are empty. The rule is missing. find the rule and fill in the empty frames.

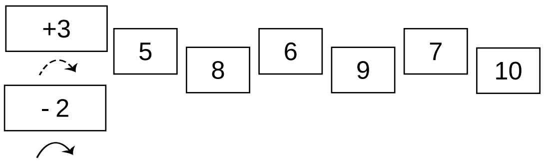


Solution: The rule is add 1. Write 8, 11, and 12 in the empty frames.

A chain can have more than one arrow rule. If it does, the arrow for each rule must look different. For example you can use different colors or different designs to distinguish between arrow rules. In the following example, two different arrows are used to distinguish between two different rules.



In the following example, the rules are given and the frames are filled in, but the arrows between frames are missing. Draw the arrows in the proper positions.



Solution: Draw the +3 arrow from 5 to 8, from 6 to 9 and from 7 to 10.
Draw the -2 arrow from 8 to 6 and from 9 to 7.

Explorations

In *Everyday Mathematics,* the term "Explorations" means time set aside for independent, small-group activities. Besides providing the benefits of cooperative learning, small-group work lets everyone have a chance to use manipulatives (such as the pan balance and base-10 blocks) that are limited in supply. Exploration activities might include the following:

- play and familiarization with manipulatives
- concept development through the use of manipulatives and the recording of outcomes
- assignments with specific objectives, which are especially helpful linking manipulative-based activities to more abstract concepts
- data collecting; includes the use of measuring tools as well as classifying and ordering of data
- games and skills reviews
- problem solving using manipulatives and extending to more abstract levels
- teacher interactions with small groups, both for teaching and for assessment

Fact Power, Fact Families, and Fact Triangles

"Knowing" the basic number facts is as important to learning mathematics as "knowing" words by sight is to reading. Students are often told that habits —good and bad—come from doing something over and over until they do it without thinking. Developing basic number fact reflexes can be likened to developing good habits.

In *Everyday Mathematics,* fact habits are referred to as *fact power.* Children in grades 1-3 keep Fact Power tables of the facts they know. By the end of the school year, most second graders should master the addition and subtraction facts. In third grade, the emphasis shifts to learning the multiplication and division facts. While some students may not be able to demonstrate mastery of all these facts, they should be well on their way to achieving this goal by the end of the year.

Practicing the facts is often tedious and traditionally involves many pages filled with drill-and-practice problems. In addition to number games and choral drills (short drills that review facts often written on the board), teachers of *Everyday Mathematics* have had success with fact families, a method that avoids much of the tedium.

Fact Families

Everyday Mathematics has found that young children not only can understand the inverse relationships between arithmetic operations (addition "undoes" subtraction, and vice versa; multiplication "undoes" division, and the other way around), they often "discover" them on their own. In *First and Second Grade Everyday Mathematics,* the inverses for sums and differences of whole numbers up to 10 are called the basic fact families. A fact family is a collection of four related facts linking two inverse operations. For example, the following four equations symbolize the fact family relating 3, 4, and 7 with addition and subtraction:

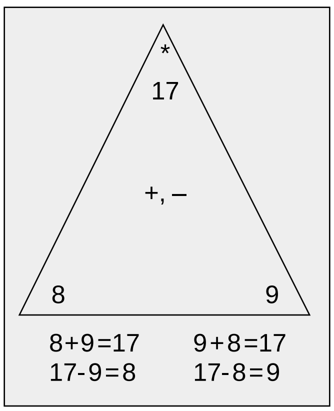
3 + 4 = 7   4 + 3 = 7   7 - 3 = 4   7 - 4 = 3

Basic fact families are modeled with Fact Triangles.

Everyday Mathematics call properties of arithmetic shortcuts, and the four facts in a fact family are all related by shortcuts. A major reason for teaching fact families is to give children ways to solve problems that may seem new or difficult by remembering a shortcut and then rewording or rewriting the problem. For example, faced with 7 - 3 = ?, a first grader may think, “Hmm, I don’t know. What plus 3 is 7? Ah, that’s easy; it’s 4.”

Beginning in second grade, children learn the basic multiplication and division facts and families. In all grades, new facts are usually introduced through games, and in early grades, by concrete manipulations with dice or dominoes and by a connection to previously known facts. Fact extensions are powerful mental arithmetic strategies for all operations with larger numbers. They begin in first grade and are extended throughout the program. For example, if children know 3 + 4 = 7, they also know 30 + 40 = 70, and 300 + 400 = 700. If children know 6 * 5 = 30, they also know 60 * 5 = 300, 600 * 5 = 3000, and so on.

Fact Triangles

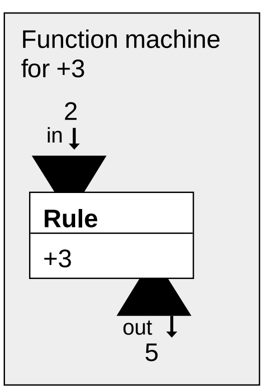


Fact Triangles are tools used to help build mental arithmetic reflexes. You might think of them as the *Everyday Mathematics* version of flash cards. Fact Triangles are more effective for helping children memorize facts, however, because of their emphasis on fact families. A Fact Triangle for one of the fact families is shown in the margin.

In first grade, children play with Fact Triangles for addition/subtraction fact families through 9 + 9 and 18 - 9. These families are reviewed in second grade, and multiplication/division Fact Triangles are introduced. In third grade, children get addition/subtraction and multiplication/division Fact Triangles. In all grades, a useful long-term project is to have students write the appropriate four number models on the back of each Fact Triangle.

Fact Triangles are best used with partners. One player covers a corner with a finger and the other player gives an addition or subtraction (or multiplication or division) fact that has the hidden number as an answer. This simple game makes it easy for children to play at home, so Fact Triangles are often recommended in Home Links.

Function Machines and What’s My Rule?



Function Machines in *Everyday Mathematics* children use **function machines** such as the one on the left to help visualize how a rule associates an input value with an output value. The activity for organizing this concept development is called What’s My Rule? and is described below.

What’s My Rule? Simple What’s My Rule? games begin in *Kindergarten Everyday Mathematics*. The first are attribute or rule activities that determine whether or not children belong to a specified group. For example, children with Velcro™ shoe closures belong while children with laces, buckles, and so forth, do not.

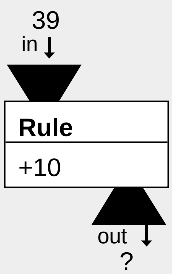
In first through third grades, this idea is extended to include numbers and rules for determining which numbers belong to specific sets of numbers. For example, odd numbers, even numbers, one-digit numbers, numbers with zero in the ones place, and so. This idea evolves further to incorporate sets of number pairs in which the numbers in each pair are related to each other according to the same rule. The connections between input, output, and the rule can be represented by a function machine, and pairings are displayed in a table of values.

What's My Rule? problems

1. The rule and the input numbers are known. Find the output numbers.

Rule: +10

In	Out
39	
54	
163	



In a What's My Rule? problem (*example, left*), two of the three parts (input, output, and rule) are known. The goal is to find the unknown part. There are three types of What's My Rule? problems.

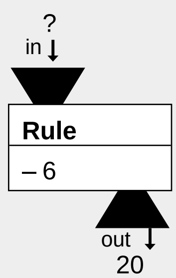
1. The rule and the input numbers are known. Find the output numbers.
2. The rule and the output numbers are known. Find the input numbers.
3. The input and output numbers are known. Find the rule.

You can combine more than one type of problem in a single table. For instance, you could give the table in Problem 2 but give the input value 26 and replace the 20 with a blank. If you give enough input and output clues, children can fill in blanks as well as figure out the rule, as in problem 4.

2. The rule and the output numbers are known. Find the input numbers.

Rule: –6

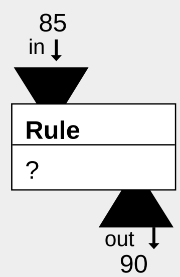
In	Out
	6
	10
	20



3. The input and output numbers are known. Find the rule.

Rule: ?

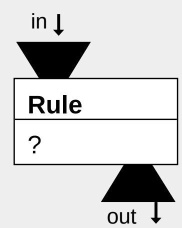
In	Out
55	60
85	90
103	108



4. Combined problem

Rule: ?

In	Out
15	25
4	14
7	
	63



Home Links (K-3)/Study Links (4-6)

Dialog and discussion, as well as experimentation, are at the heart of *Everyday Mathematics.* Parents who have been accustomed to conventional mathematics programs may think that because children are not bringing home daily arithmetic sheets, they are not learning or doing mathematics. The Home Links and Study Links serve as reassurance that this is not the case. Additionally:

- They promote follow-up and provide enrichment, as well as a means of involving parents or guardians in their children's mathematics education.
- The assignments encourage children to take initiative and responsibility.
- The activities help reinforce newly learned skills and concepts.
- Many of the assignments relate what is learned in school to the children's lives outside of school. This helps tie mathematics to their everyday world.
- The assignments can serve as informal assessment tools.
- Most of the Home Links/Study Links are homework assignments that require your interaction. Also, be sure to read the letters your child's teacher sends home throughout the year. Many of these accompany specific Home Links/Study Links in order to help further explain a given activity.

Math Boxes

Math Boxes are used to review material on a regular basis. *Everyday Mathematics* includes Math Boxes for almost every lesson.

Math Boxes are divided into either 4 or 6 boxes, or cells. Some of these cells contain review problems. Other cells have been left empty so that the teacher can write problems to meet the particular review needs of the children.

Each Math Boxes page is designed for use as an independent activity. Children may work on their Math Boxes individually or with partners.

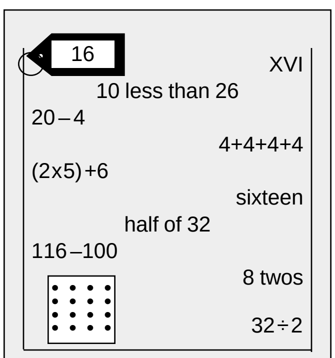
Math Messages

Many teachers begin each day with a Math Message to be completed by the children before the start of the lesson for that day. Math Messages consist of problems to solve, directions to follow, tasks to complete, note to copy, sentences to complete or correct, or brief quizzes. Most are used as lead-in activities for the lessons of the day or as reviews of previously learned topics. Follow-ups to the Math Messages usually occur during the lesson itself.

Minute Math (K-3)/5-Minute Math (4-6)

Minute Math (or 5-Minute Math) are brief activities for transition times and for spare moments throughout the day. The activities serve as a source of continuous review and provide problems for mental problem-solving and arithmetic.

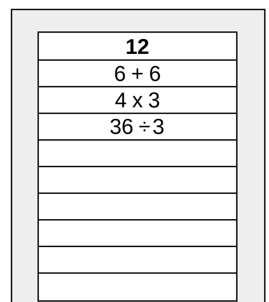
Name Collection Boxes



16-box

Beginning in first grade, children use name-collection boxes to help manage equivalent names for numbers. These devices offer a simple way for children to experience the notion that numbers can be expressed in many different ways.

In kindergarten through third grade, a name-collection box diagram is an open-top box with a label attached to it. In fourth through sixth grades, the name-collection box is simpler and more compact. The name on the label identifies the number whose names are collected in the box. For example, the boxes show a 16-box and a 12-box.



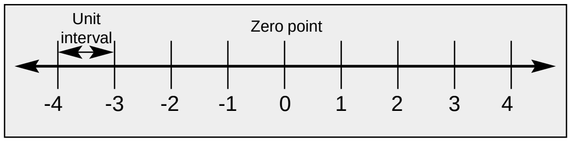
12-box

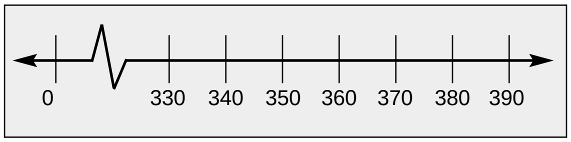
Names can include sums, differences, products, quotients, the results of combining several operations, words in English or other languages, tally marks, arrays, Roman numerals, and so on.

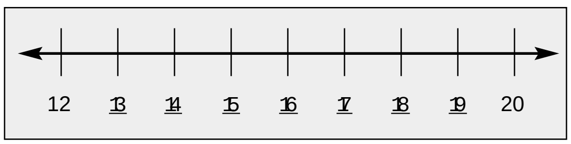
Number Grids, Line, and Scrolls

“Grid” is short for “gridiron,” a term used to refer to a framework of metal bars or wires used to grill meat or fish. (The association of a gridiron with football is primarily a United States connection.) Generally, a grid is any set of equally spaced parallel lines or squares used to help establish locations of objects. In *Everyday Mathematics*, children use grids in many ways, including number lines, number grids, and grids for interpreting maps.

Number Lines







To make a number line you need a **line,** an **origin** or **zero point,** and a unit interval, *left*. As with any line, a number line extends infinitely in either direction. Any drawing of a number line is just a model of part of the line. Sometimes you see a broken-line symbol as in the second line, *left*. This means that a piece of the line between 0 and 330 has been omitted. This device is often used in technical drawings to focus in on important details and still show the reader that part of the object is missing.

Beginning in kindergarten, children use number lines for a variety of counting activities. A “Growing Number Line” is kept on the classroom wall and added to whenever new horizons in counting are achieved. The “Incomplete Number Line” (*third line, left*) begins in first grade.

Note that the rule does not actually need to be stated in this type of problem since the number of tick marks determines the scale.

Children use number lines in context throughout the program. In first and second grades, children use a number line to keep track of the number of school days in the school year. They also use number lines on thermometers (two different scales: Fahrenheit and Celsius), and on linear measuring tools. Number lines in coordinate graphing systems are introduced in third grade.

Number Grids

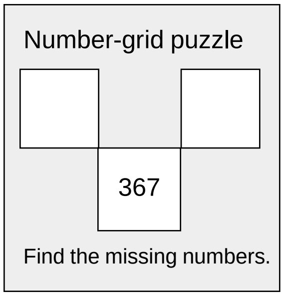
									0
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110

A number grid consists of rows of boxes, ten to each row, containing a set of consecutive whole numbers. Children are introduced to the number grid to the left for 0 to 110 in *First Grade Everyday Mathematics.*

The grid lends itself to number activities that reinforce place-value concepts. By exploring the patterns in the digits in rows and columns, children discover that for any number on the number grid, the number that is:

- 1 more is 1 square to its right
- 1 less is l square to its left
- 10 more is 1 square down
- 10 less is 1 square up

Stated another way, as you move from left to right in any one row, the ones digit increases by 1 while the tens digit remains unchanged. As you move down any one column, the tens digit increases by 1 while the ones digit remains unchanged. This is true not only for the numbers in the 100-grid, but for any 10-across number grid consisting of a set of consecutive whole numbers.



Children practice these place-value concepts by solving number-grid puzzles. These are pieces of a number grid in which some, but not all of the numbers are missing. For example, in the puzzle to the left, the missing numbers are 356 and 358.

Number grids can also be used to explore number patterns that are not necessarily related to base-10 concepts. For example, children can color the appropriate boxes as they count by 2's. If they start with 0, they will color the even numbers; if they start with 1, the odd numbers. If they count by 5's, starting at 0, they will color the boxes containing numbers with 0 and 5 in the ones place.

Number grids are also useful as an aid for finding the difference between two numbers. For example, to find the difference between 84 and 37, you could start at 37, count the number of tens going down to 77 (4 tens or 40) and then count the ones going from 77 to 84 (7 ones or 7). The difference between 84 and 37 is 4 tens and 7 ones, or 47. This difference is sometimes referred to as the distance between the points 37 and 84 on a number line (or grid).

-19	-18	-17	-16	-15	-14	-13	-12	-11	-10
-9	-8	-7	-6	-5	-4	-3	-2	-1	0
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Number grids may also be extended to negative numbers. This is especially useful when illustrating the order of negative numbers or as an aid for finding differences.

Number Scrolls

A number scroll is an extension of a number grid. It is made by adding more single sheets of 100 numbers to existing ones—either forward (positively) or backward (negatively). Among other things, scrolls give children the chance to experience the ongoing repetitive patterns of our base-10 number system beyond 100; "101, 102, 103, . . . " Teachers have found that many children get excited when they discover these patterns and realize the power they have of being able to write bigger and bigger numbers based on their discoveries. Meanwhile, they practice their handwriting skills and work out kinks in their counting skills, too.

Children can also fill in their grids in patterns: checkerboards rather than every cell; every second, third, or fourth cell; diagonals; letters of the alphabet; designs; and so forth.

A first grade teacher reported on a pair of children who worked on a scroll together. One partner was frustrated by physically writing the numbers but was excited about knowing what to write, while the other child had beautiful penmanship but hadn't caught on to the patterns. They both benefited from their joint creation.

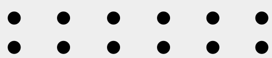
Scrolls are suggested for first and second grades, but may be used with third graders or older children if necessary. Number-grid puzzles are used through third grade, mostly for numbers in the hundreds and thousands.

Another Grid - Arrays

An array is a systematic arrangement of objects or numbers in rows and columns. The number grids and scrolls described earlier are example of arrays of numbers. Marching bands spend a good deal of time in rectangular arrays, and the seats in an auditorium also form a rectangular array.

Arrays may be used to help count large groups of objects. For example, making little piles with five or ten pennies per pile can make counting a big pile of pennies much simpler. Tally marks are often arrayed in groups of five to make a final count easier.

Beginning in *Second Grade Everyday Mathematics*, the informal use of arrays is expanded to help



Two rows, six per row

Rate multiplication diagram

Units	rows	Eggs per row	Eggs
Numbers	2	6	?

children understand multiplication. After making a bulletin board display of examples of arrays from magazines and newspapers, children are invited to find ways to count the number of items in an array. For example, “Two rows of eggs, 6 eggs per row: How many eggs?” may be modeled both with counters and with the rate multiplication diagram shown to the left. To find the total number of eggs, multiply the number of rows by the number of eggs per row. The array model for multiplication is also a fine representation of multiplication as repeated addition.

Projects

The Projects suggested in this program cover an assortment of mathematics activities and concepts, and are built around various themes that interest children.

The Projects are cross-curricular in nature and often include the following science processes:

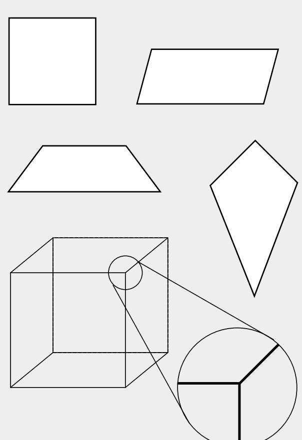
- Observing
- Communicating
- Identifying
- Collecting, organizing, graphing data
- Using numbers
- Measuring
- Determining patterns and relationships

Social studies and art skills and concepts are also involved in many of the Projects. And, of course, reading and other language-arts skills are always involved.

Unlike the Explorations, which are short activities, Projects may take a day or more to complete and are memorable to children.

Straws and Twist-Ties (Geometric Figures)

Constructing 2- and 3-dimensional objects with straws and twist-ties is a popular activity, beginning in *First Grade Everyday Mathematics.*



Straw constructions

Children may be asked to make these constructions at home as part of a Home Links assignment. It is important to remember that the activity results in representations of geometric shapes. Two-dimensional shapes, such as polygons and circles, are defined as boundaries of flat regions, without the interiors.

For example, a polygon is made up of line segments; the region inside a polygon is not part of the polygon. Similarly, 3-dimensional shapes, such as prisms, pyramids, and cylinders, are made up of flat or curved surfaces not including the interiors. For example, a rectangular prism is the empty box of cereal, without the cereal. Polygons constructed with straws are true representations of such shapes—the straws actually show the line segments. On the other hand, 3-dimensional straw constructions only suggest the actual shapes —the straws are the edges of the 2-dimensional shapes that make up the faces.

Skills Link

Skills Link is a supplement for the *Everyday Mathematics* program. It is organized to provide explicit, repetitive, and quick practice on basic facts and computation. Skills Link provide problems using multiple strategies such as paper and pencil, mental computation, and estimation. It incorporates familiar *Everyday Mathematics* routines and activities as well as shows how models, rules, and/or examples are used to assist with at-home support. It is a tool for students needing additional independent practice with mathematical concepts and foundations. It is easy to use in class or as homework.

Unit Boxes

Units
cents ¢

Children are helped in their symbolic thinking if they think of numbers as quantities or measurements of real objects. For this reason, encourage children to attach appropriate labels or units of measure such as cents, lions, and feet to the numbers with which they are working.

Because labeling each number can become tedious, *Everyday Mathematics* suggests the use of unit boxes for addition and subtraction problems. These rectangular boxes are usually displayed beside the problem or at the top of a page of problems. Unit boxes contain the labels or units of measure used in the problem(s).

Children start to explore geometry with three-dimensional shapes by collecting real objects, observing similarities and differences, and exploring spatial relationships. Two-dimensional figures are introduced by generating them from three-dimensional shapes. Students experience the properties of different figures by constructing the shapes for themselves, observing common characteristics and different relationships among the different shapes.

As children explore geometric figures and shapes, they are exposed to many words with which you may not be familiar. Children learn the correct name used in natural conversations. Teachers use appropriate mathematical terms informally, in conversation, as they would any other words. For example, a child may call an angle "corner" because corner is familiar, but as the teacher uses the word "angle" repeatedly in natural conversation, this word will also become familiar to the child.

On the next two pages are examples of some two- and three-dimensional shapes. Additional terms may be found in the glossary section later in the handbook.

Glossary

A

absolute value The absolute value of a positive number is the number itself. For example, the absolute value of 3 is 3. The absolute value of a negative number is the opposite value of the number. For example, the absolute value of -6 is 6.

abundant number A number in which the sum of all its proper factors is greater than the number itself. For example, 12 is an abundant number because the sum of its proper factors is 1 + 2 + 3 + 4 + 6 = 16 and 16 is greater than 12.

acre A unit of area equal to 43,560 square feet.

addend Numbers being added are called **addends.** In 12 + 33 = 45, 12 and 33 are addends. *See also* **addition.**

addition A mathematical operation based on "putting things together." Numbers being added are called **addends;** the result of addition is called the sum. In 12 + 33 = 45, 12 and 33 are addends, and 45 is the sum. Subtraction "undoes" addition: 12 + 33 = 45; 45 - 12 = 33, and 45 - 33 = 12.

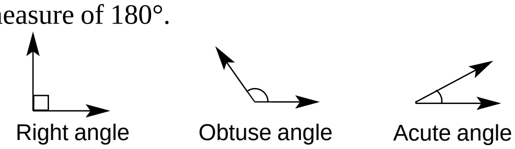
additive inverses The two numbers whose sum is 0. The additive inverse of a number is also called its opposite. Example: 3 + (-3) = 0. The additive inverse of 3 is -3, and the additive inverse of -3 is 3.

algebraic expression An expression that contains a variable. For example, if Maria is 2 inches taller than Joe, and if the variable M represents Maria's height, then the expression M-2 represents Joe's height.

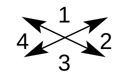
algorithm A set of step-by-step instructions for doing something-carrying out a computation, solving a problem, and so on.

analog clock A clock that shows the time by the positions of the hour and minute hands. A digital clock shows the time in hours and minutes with a colon separating the two.

angle Two rays with a common endpoint. The common endpoint is called the vertex of the angle. An acute angle has a measure greater than 0° and less than 90°. An obtuse angle has a measure greater than 90° and less than 180°. A right angle has a measure of 90°. A straight angle has a measure of 180°.

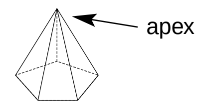


angles, adjacent Two angles with a common side that do not otherwise overlap. In the diagram, angles 1 and 2 are adjacent angles. So are angles 2 and 3, angles 3 and 4, and angles 4 and 1.

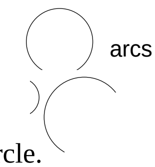


angles, vertical Two intersecting lines form four angles. In the diagram, angles 2 and 4 are vertical angles. They have no sides in common. Their measures are equal. Similarly, angles 1 and 3 are vertical angles.

apex In a pyramid or cone, the vertex that is opposite the base.

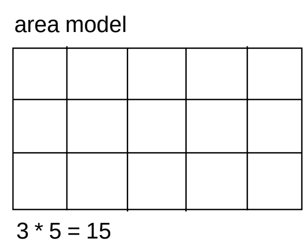


arc Part of a circle from one point on the circle to another. For example, a semicircle is an arc, its endpoints are the endpoints of the diameter of the circle.



area The measure of the surface inside a closed boundary. The formula for the area of a rectangle is A = l x w, where A represents the area, l the length, and w the width. The formula may also be expressed as
A = b x h, where b represents the length of the base and h the height of the rectangle.

area model A model for multiplication problems, in which the length and width of a rectangle represent the factors and the area represents the product.



arithmetic fact Any of the basic addition and multiplication relationships and the corresponding subtraction and division relationships. There are 100 addition facts, from 0 + 0 = 0 to 9 + 9 = 18; 100 subtraction facts, from 0 - 0 = 0 to 18 -9 = 9; 100 multiplication facts, from 0 x 0 = 0 to 9 * 9 = 81; 90 division facts, from 0/1= 0 to 81/9 =9. An extended fact is obtained by multiplying some or all numbers in an arithmetic fact by a power of 10; for example, 20 + 30 = 50, 400 x 6 = 2400, 500-300 = 200, 240/60 =4.

array A rectangular arrangement of objects in rows and columns.

arrow path The route to follow in moving on a number grid. Solving number-grid puzzles with

A

arrow paths use the pattern on the grid. After sufficient practice, arrow paths may be drawn without a number grid.

arrow rule The operation that determines how to find the number that goes in the next frame when moving from one frame to another in a Frames and Arrows diagram.

attribute A common feature (size, shape, color, number of parts, and so on) of a set of figures.

average A typical or middle value for a set of numbers which is found by adding the numbers in the set and dividing the sum by the number of numbers. *See also* **mean.**

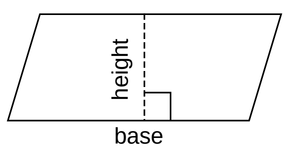
axis Either of the two number lines used to form a coordinate grid.

B

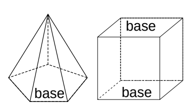
bar graph A graph in which horizontal or vertical bars represent data.

base *See* **exponential notation.**

base of a parallelogram One of the sides of a parallelogram; also, the length of this side. The shortest distance between the base and the side opposite the base is the **height of the parallelogram.**

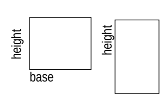


base of a polygon The side on which the polygon "sits"; the side that is perpendicular to the height of the polygon.



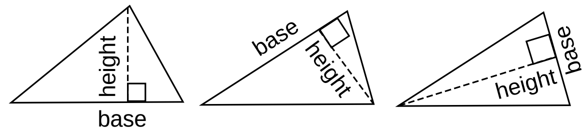
base of a polyhedron The "bottom" face of a polyhedron; the face whose shape is the basis for classifying a prism or pyramid.

base of rectangle One of the sides of a rectangle; also, the length of this side. The length of the side perpendicular to the base is the height of a rectangle.



base of 3-dimensional figure One face or a pair of faces on the figure. The height is the length of a line segment drawn perpendicular to a base of the figure that extends from the base to an opposite face or vertex.

base of triangle One of the sides of a triangle; also, the length of this side. The shortest distance



between the base and the vertex opposite the base is the **height of the triangle.**

base ten The familiar numeration system, consisting of the ten digits 0, 1, 2, ..., 9 and a method of assigning values to these digits depending on where they appear in a numeral (ones, tens, hundreds, and so on, to the left of the decimal point; tenths, hundredths, and so on, to the right of the decimal point.)

benchmark An important or memorable count or measure that can be used to evaluate the reasonableness of other counts or measures.

bisect To divide a segment, angle, or figure into two parts of equal measure.

broken-line graph *See* **line graph.**

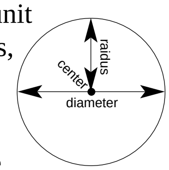
C

capacity A measure of how much liquid a container can hold. *See also* **volume.**

chance The possibility of an outcome in an uncertain event. For example, in tossing a coin there is an equal chance of getting heads or tails.

Celsius A scale for temperature measurement where water freezes at 0° and boils at 100°.

centimeter In the metric system, a unit of length equivalent to 10 millimeters, 1/10 of a decimeter, or 1/100 of a meter.



circle The set of all points in a plane that are a given distance (the radius) from a given point (the center of the circle).

circle graph A graph in which a circle and its interior are divided into parts to represent the pairs of a set of data. The circle represents the whole set of data. Also called a pie graph.

circumference The distance around a circle or sphere.

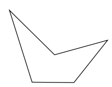
C

column A vertical arrangement of objects or numbers in an array or table.

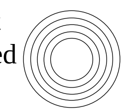
common Shared by two or more numbers. A common denominator of two fractions is any non zero number that is a multiple of the denominators of both fractions. A common factor of two numbers is any number that is a factor of both numbers.

complementary angles Two angles whose measures total 90°.

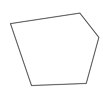
composite number A whole number that has more than two whole-number factors. For example, 10 is a composite number because it has more than two factors: 1, 2, 5, and 10. A composite number is divisible by at least three whole numbers. *See also* **prime numbers.**



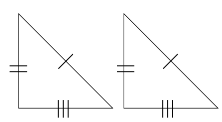
concave polygon A polygon in which at least one vertex is "pushed in." Also called noncovex.



concentric circles Circles that have the same center but radii of different lengths.



cone A 3-dimensional shape having a circular base, curved surface, and one vertex.



convex polygon A polygon in which all vertices are "pushed out."

congruent Two figures that are identical- the same size and shape- are called congruent figures. If you put one on top of the other, they would match exactly. Congruent figures are also said to be congruent to each other.

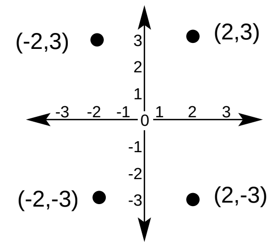
consecutive Following one another in an uninterrupted order. For example, A, B, C, and D are four consecutive letters of the alphabet; 6, 7, 8, 9, and 10 are five consecutive whole numbers.

consecutive angles Two angles that are "next to each other"; they share a common side.

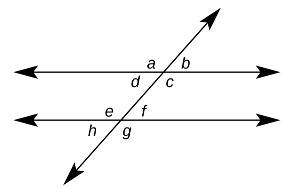
constant A number used over and over with an operation performed on many numbers.

conversion fact A fact such as 1 yard = 3 feet or 1 gallon = 4 quarts.

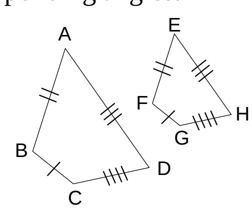
coordinate A number used to locate a point on a number line, or either of two numbers used to locate a point on a coordinate grid.



coordinate grid A device for locating points in a plane by means of ordered number pairs or coordinates. A rectangular coordinate grid is formed by two number lines that intersect at right angles at their 0 points.



corresponding angles Any pair of angles in the same relative position in two figures, or in similar locations in relation to a transversal intersecting two lines. In the diagram, <*a* and <*e*, <*b* and <*f*, <*d*, and <*h*, and <*c* and <*g* are corresponding angles. If any two corresponding angles are congruent, then lines are parallel.



corresponding sides Any pair of sides in the same relative position in two figures. In the diagram, corresponding sides are marked with the same number of slash marks.

counting numbers The numbers used to count things. The set of counting numbers is {1,2,3,4,…}. All counting numbers are integers and rational numbers, but not all integers or rational numbers are counting numbers.

cube *See* **regular polyhedron.**

cubic centimeter (cm^3) A metric unit of volume; the volume of a cube 1 centimeter on a side. 1 cubic centimeter is equal to 1 milliliter.

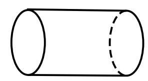
cubic unit A unit used in a volume and capacity measurement.

cubit An ancient unit of length, measured from the point of the elbow to the end of the middle finger, or about 18 inches. The Latin word *cubitum* means "elbow."

customary system of measurement The measuring system used most often in the United States. Units for linear measure (length, distance) include inch, foot, yard, and mile; units for weight include ounce and pound; units for capacity

C

(amount of liquid or other pourable substance a container can hold) include cup, pint, quart, and gallon.



cylinder A 3-dimensional shape having a curved surface and parallel circular or elliptical bases that are the same size. A can is a common object shaped like a cylinder.

D

data Information gathered by observation, questioning, or measurement.

decimal A number written in standard notation, usually one containing a decimal point, as in 2.54, A decimal that ends, such as 2.54 is called a **terminating decimal.** Some decimals continue a pattern without end, for example 0.333…, or 0.3, which is equal to 1/3. Such decimals are called **repeating decimals.** A terminating decimal can be thought of as a repeating decimal in which 0 repeats.

decimal point The period which separates the whole number from the fraction in decimal notation. In expressing money, it separates the dollars from the cents.

deficient number A number for which the sum of all the proper factors is less than the number. For example, 10 is a deficient number because the sum of its proper factors is 1 + 2 + 5 = 8, and 8 is less than 10. *See also* **abundant number and perfect number.**

degree (°) A unit of measure for angles; based on dividing a circle into 360 equal parts. Also, a unit of measure for temperature.

denominator The number of equal parts into which the whole (or ONE or unit) is divided. In the fraction a/b, *b* is the denominator. *See also* **numerator.**

density A rate that compares the mass of an object with its volume. For example, suppose a ball has a mass of 20 grams and a volume of 10 cubic centimeters. To find its density, divide its mass by its volume: $20g/10cm^3 = 2g/cm^3$ (2 grams per cubic centimeter).

diagonal A line that separates the upper left to lower right or from the lower left to the upper right.

diameter A line segment that passes through the center of a circle (or sphere) and has endpoints on the circle (or sphere). The diameter of a circle is twice its radius. *See also* **circle.**

difference *See* **subtraction**

digit In the base-10 numeration system, one of the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. Digits can be used to write any number. For example, the numeral 145 is made up of the digits 1, 4, and 5.

dimension A measure in one direction, for example, length and width.

distributive property A property that relates two operations on numbers; usually multiplication and addition, or multiplication and subtraction.
Distributive property of multiplication over addition: ax (x + y) = (a * x) +(a * y)
Distributive property of multiplication over subtraction: ax (x - y) = (a * x) - (a * y)
This property gets its name because it "distributes" the factor outside the parentheses over the two terms within the parentheses.

dividend The dividend is the total before sharing. *See also* **division.**

divisibility test A test to determine whether a whole number is divisible by another whole number, without actually doing the division. For example, to tell whether a whole number is divisible by 3, check whether the sum of digits is divisible by 3. For example, 51 is divisible by 3 since 5 + 1 = 6, and 6 is divisible by 3.

divisible by One whole number is divisible by another whole number is the result of the division is a whole number (with a remainder of zero). For example, 28 is divisible by 7, because 28 divided by 7 is 4 with a remainder of zero. If a number *n* is divisible by a number *x* , then *x* is a factor of *n*.

division A mathematical operation based on "sharing" or "separating into equal parts." The dividend is the total before sharing. The divisor is the number of equal parts or the number in each equal part. The quotient is the result of the division. For example, in 28/7 = 4, 28 is the dividend, 7 is the divisor, and 4 is the quotient. If 28 objects are separated into 7 equal parts, there are 4 objects in

D

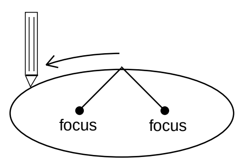
each part. If 28 objects are separated into parts with 7 in each part, there are 4 equal parts. The number left over when a set of objects is shared equally or separated into equal groups is called the remainder. For 28/7 the quotient is 4 and the remainder is 0. For 29/7 the quotient is 4 and the remainder is 1. Multiplication "undoes" division: 28/7 = 4, and 4 * 7 = 28.

divisor The divisor is the number of equal parts or the number in each equal part. *See also* **division.**

dodecahedron *See* **regular polyhedron.**

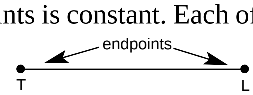
doubles fact The addition and multiplication facts without turn-around partners. A doubles fact names the sum or product of a 1-digit number added to or multiplied by itself, such as 4 + 4 = 8 or 3 * 3 = 9.

E



edge The line segment where two faces of a polyhedron meet.

ellipse A closed, oval, plane figure. An ellipse is the path of a point that moves so that the sum of its distances from two fixed points is constant. Each of the fixed points is called a *focus* of the ellipse.



endpoint The point at either end of a line segment; also, the point at the end of a ray. Endpoints are used to name line segments; for example, segment TL or segment LT names a line segment between and including points T and L. *See also* **ray.**

equation A mathematical sentence that states the equality of two quantities.

equidistant marks Marks equally distant from one to the next.

equilateral triangle A polygon in which all sides are the same length.

equivalent Equal in value, but in a different form. For example,1/2 , 0.5, and 50% are equivalent.

equivalent equations Equations that have the same solution. For example, 2 + x = 4 and 6 + x = 8 are equivalent equations: their solution is 2.

equivalent fractions Fractions that have different numerators and denominators, but the same number. For example, 1/2 and 4/8 are equivalent fractions.

equivalent names Different ways of naming the same number, 2 + 6, 4 + 4, 12 - 4, 18 -10, 100 - 92, 5 + 1 + 2, eight, and VIII are some of the names for 8.

equivalent ratios Ratios that can be named by equivalent fractions. For example the ratios 12 to 20 , and 6 to 10, and 3 to 5 are equivalent ratios, because 12/20= 6/10 =3/5 .

estimate A calculation of a close, rather than exact, answer; a "ballpark" answer; a number close to another number.

even number A whole number such as 2, 4, 6, and so on that can be evenly divided by 2 (dividing by 2 with a 0 remainder.) *Also see* **odd number.**

event A happening or occurrence. The tossing of a coin is an event.

exponent The raised number in a power that tells the number of times the base is used as a factor. For example, the exponent in 4^3 is raised three, indicating that 4 is a factor three times, 4 * 4 * 4.

exponential notation A shorthand way of representing repeated multiplication of the same factor. For example, 2^3 is exponential notation for 2 * 2 * 2. The small, raised 3, called the **exponent,** indicated how many times the number 2, called the **base,** is used as a factor.

expression A group of mathematical symbols (numbers, operation signs, variables, grouping symbols) that represents a number (or can represent a number if values are assigned to any variables it contains).

extended fact An extended fact is obtained by multiplying some or all numbers in an arithmetic fact by a power of 10; for example, 20 + 30 = 50, 400 * 6 = 2400, 500 - 300 = 200, 240/60 =4. *Also see* **arithmetic fact.**

F

face A flat surface on a 3-dimensional shape.

F

fact *See* **arithmetic fact.**

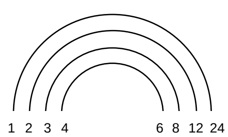
fact extensions Calculations with larger numbers by using knowledge of basic facts. Knowing 5 + 8 = 13 makes it easier to solve problems such as 50 +80 = ?, 35 + 8 = ?, and 65 + ? = 73. Extensions can also be applied to subtraction facts.

fact family A group of addition or multiplication facts together with the related subtraction or division facts. For example, 5 + 6 = 11, 6 + 5 = 11, 11 - 5 = 6, and 11 - 6 = 5 form a family fact. 5 * 7 = 35, 7 * 5 = 35, 35/7 = 5, and 35/5 =7 form another fact family.

fact triangle Triangular card labeled with the numbers of a fact family for practice with addition/subtraction and multiplication/division facts. The two one-digit numbers and their sum or product (marked with an asterisk) appear in the corners of the triangle.

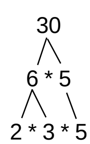
factor *(noun)* A number that is multiplied by another number. Factors may be whole numbers or rational numbers expressed as fractions or decimals. For example, 4, 3, and 2 are factors in the expression 4 * 3 * 2; 0.5 and 25 are factors in 0.5 * 25; 1/2 and 9 are factors in 1/2* 9; and -2 and -5 are factors in -2 * (-5). *See also* **multiplication.**

factor *(verb)* To represent a number as a product of factors.



Factors of 24

factor rainbow A way of showing factor pairs in a list of all the factors of a number. This can be helpful in checking whether a list of factors is correct.



factor tree A method used to obtain the **prime factorization** of a number. The originial number is represented as a product of factors, and each of those factors is represented as a product of factors, and so on, until the factor string consists of prime numbers.

factorial A product of a whole number and all the smaller whole numbers except 0, for example, 3 * 2 * 1. The exclamation point,!, is used to write factorials. For example: 3! = 3 * 2 * 1 = 6 3! is read as "three factorial."

Fahrenheit A scale at for temperature measurement where water freezes at 32 degrees and boils at 212 degrees.

flat surface or face A non-curved side of a 3-dimensional shape.

flowchart A diagram consisting of symbols and arrows to sequentially show a series of steps to complete a task.

formula A general rule for finding the value of something. A formula is often written in abbreviated form with letters, called **variables.** For example, a formula for distance traveled can be written as *d* = *r* * *t*, where the variable *d* stands for distance, *r* for speed, and *t* for time.

fraction A number in the form $\frac{a}{b}$, or a/b where *a* and *b* are whole numbers and *b* is not 0. Fractions are used to name part of a whole object or part of a whole collection of objects, or to compare two quantities. A fraction can represent division; for example, 2/3 can be thought of as 2 divided by 3.

frequency The number of times an event or value occurs in a set of data.

frequency graph A diagram to represent the relationship of the data summarized on the frequency table.

frequency table A chart on which data is tallied to find the frequency of given events or values.

fulcrum The center support of a pan balance.

function machine A diagram of an imaginary machine programmed to process numbers according to a certain rule. A number is input into the machine and is transformed into a second number (output) through the application of the rule.

G

geometric solid A 3-dimensional shape bounded by surfaces. Common geometric solids include the rectangular prism, square pyramid, cylinder, cone, and sphere. Despite its name, a geometric solid is "hollow"; it does not include the points in its interior.

greatest common factor The largest factor that

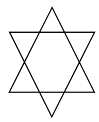
H

two or more numbers have in common. For example, the common factors of 24 and 36 are 1, 2, 3, 4, 6, and 12. The greatest common factor of 24 and 36 is 12.

height of a parallelogram *See* **base of a parallelogram.**

height of a rectangle *See* **base of a rectangle.**

height of a 3-dimensional figure *See* **base of a 3-dimensional figure.**



height of a triangle *See* **base of a triangle.**

heptagon A 7-sided figure.

hexagon A 6-sided figure.

hexagram A star formed by extending each side of a regular hexagon into an equilateral triangle.

hypotenuse In a right triangle, the side opposite the right angle.

I

icosahedron *See* **regular polyhedron.**

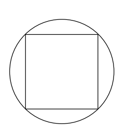
improper fraction A fraction that names a number greater than or equal to 1; a fraction whose numerator is equal to or greater than its denominator. *See also* **top-heavy fraction.**

interior The set of all points of the plane "inside" a closed 2-dimensional figure such as a polygon or circle, or all the points of space "inside" a closed 3-dimensional figure such as a polyhedron or sphere. The interior is usually not considered to be part of the figure.

inequality A number sequence stating that two quantities are not equal, or might not be equal. Relation symbols for inequalities include $\neq$, $<$, $>$, $\leq$, $\geq$.

input A number inserted into an imaginary function machine which processes numbers according to a designated rule.

integer Any whole number or its opposite, for example, -2, 2, 6, -100.



intersect To meet (at a point, line, and so on).

interval A set of numbers between two numbers *a* and *b*, possibly including *a* or *b*.

inscribed polygon A polygon, all of whose vertices are points on a circle or another figure.

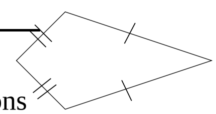
irrational numbers Numbers that cannot be written as fractions where both the numerator and denominator are integers and the denominator is not 0. For example, $\sqrt{2}$ and π are irrational numbers. An irrational number can be represented by a non-terminating, non-repeating decimal. For example, the decimal for π, 3.14159263…, continues without a repeating pattern. The number 1.101001000100001… is irrational; there is a pattern in the decimal, but it does not repeat.

irregular polygons Polygons with sides of different lengths.

J

juxtapose To place side by side in an expression to indicate multiplication. For example, 5*n* means 5 * *n*, and *ab* means *a* * *b*.

K



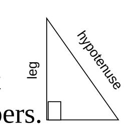
key sequence A set of instructions for performing a particular calculation or function with a calculator.

kite A quadrilateral with exactly two pairs of adjacent congruent sides. (A rhombus is not a kite.)

L

landmark A measure of data. Landmarks emphasized in this program include median, mode, maximum, minimum, and range.

least common denominator The least common multiple of the denominators of every fraction in a given collection of fractions. *See also* **least common multiple.**



least common multiple The smallest that is a multiple of two or more numbers. For example, some common multiples of 6 and 8 are 24, 48, and 72. 24 is the least common multiple of 6 and 8.

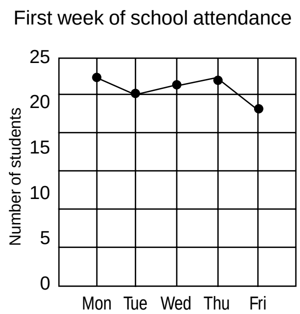
leg of a right triangle A side of a right triangle that is not the hypotenuse.

line A straight path that extends infinitely in

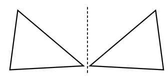
L

opposite directions.

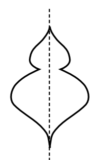
line graph (broken-line graph) A graph in which points are connected by a line or line segment to represent data.



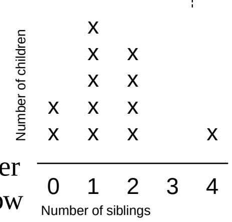
line of reflection (mirror line) A line halfway between a picture or object (pre-image) and its reflected image.



line of symmetry A line through a symmetric figure. Each point in one of the halves of the figure is the same distance from this line as the corresponding point in the other half.



line plot A sketch of data in which checkmarks, X's, or other marks above a number line show the frequency of each value.



line segment A straight path joining two points, called endpoints of the line segment.

line symmetry A figure has line symmetry if a line can be drawn through the figure that divides into two parts so that both parts look exactly alike, but are facing in opposite directions.

M

map legend A diagram that explains the symbols, markings, and colors on a map. Also called a **map key.**

map scale A rate that compares the distance between two locations on a map with the actual distance between them. The rate is often represented by a labeled line segment, similar to a ruler.

mathematics A study of relationships among numbers, shapes, and patterns. Mathematics is used to count and measure things, to discover similarities and differences, to solve problems, and to learn about and organize the world.

maximum The largest amount; the greatest number in a set of data.

mean A typical or middle value for a set of numbers. It is found by adding the numbers in the set and dividing the sum by the number of numbers. It is often referred to as the **average.**

median The middle value in a set of data when the data are listed in order from smallest to largest (or largest to smallest). If there is an even number of data points, the median is the mean of the middle two values.

metric system of measurement A measurement system based on the base-10 numeration system and used in most countries of the world. Units for linear measure (length, distance) include millimeter, centimeter, meter, kilometer; units for mass (weight) include gram and kilogram; units for capacity (amount of liquid or other pourable substance a container can hold) include milliliter and liter.

midpoint A point halfway between two points.

minimum The smallest amount; the least number in a set of data.

minuend The number from which another number is subtracted. In 45 - 12 = 33, 45 is the minuend. *See also* **subtraction.**

mixed number A number that is equal to the sum of a whole number and a fraction. For example, 2 1/4 is equal to 2 + 1/4.

mode The value or values that occur most often in a set of data.

multiplication A mathematical operation. Numbers being multiplied are called factors. The result of multiplication is called the product. In 5 * 12 = 60, 5 and 12 are the factors. 60 is the product. Division "undoes" multiplication; 60/5 = 12 and 60/12 =5.

multiplicative inverses Two numbers whose product is 1. For example, the multiplicative inverse of 5 is 1/5, and the multiplicative inverse of 3/5 is 5/3,or 1 and 2/3. Multiplicative inverses are also called **reciprocals** of each other.

negative number A number less than 0; a number

N

to the left of the 0 on a horizontal number line.

negative rational numbers Numbers less than 0 that can be written as a fraction or a terminating or repeating decimal. For example, -4, -0.333…, and -4/5 are negative rational numbers.

***n*-gon** A synonym for *polygon* in which *n* represents the number of angles or segments that make up the polygon.

number line A line on which points correspond to numbers.

number model A number sentence that shows how the parts of a number story are related; for example: 5 + 8 =13; 27 - 11 = 16; 3 * 30 = 90; 56/8 = 7.

number scroll Multiple number-grid pages taped together.

number sentence A sentence that is made up of numerals and a relation symbol (=, <, >). Most number sequences also contain at least one operation symbol. Number sequences may also have grouping symbols, such as parentheses.

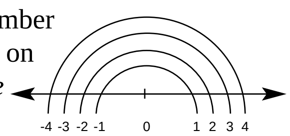
numerator In a whole divided into a number of equal parts, the number of equal parts is being considered. In the fraction *a*/*b*, *a* is the numerator.

O

octagon An 8-sided figure.

odd number A whole number that is not divisible by 2, such as 1, 3, 5, and so on. When an odd number is divided by 2, the remainder is 1. A whole number is either an odd number or an even number.

opposite of number A number that is the same distance from zero on the number line as the given number, but on the opposite side of zero. *See also* **additive inverses.**



operation Addition, subtraction, multiplication, division, raising to a power, and taking a root are mathematical operations.

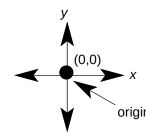
orders of magnitude Powers of ten.

order of operations Rules that tell the order in which operations should be done.

ordered number pair Two numbers in specific order used to locate a point on a coordinate grid. They are usually written inside parentheses: (2,3).

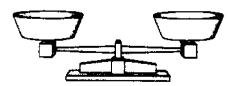
ordinal number A number used to express position or order in a series, such as first, third, tenth, and so on.

origin The point where the x-axis and y-axis intersect on a coordinate grid.

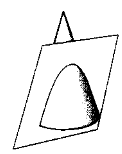


P

pan balance A device used to compare the weights of objects or to weigh objects.

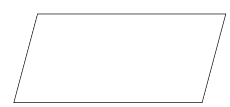


parabola The curve formed by the surface of a right circular cone when it is sliced by a plane that is parallel to a side of the one. A parabola can also be described as the curve from a line and a point that is not on that line.



parallel lines (segments, rays) Lines (segments, rays) that are the same distance apart and never meet.

parallelogram A quadrilateral that has two pairs of parallel sides. Pairs of opposite sides of a parallelogram are congruent.



part-to-part ratio A ratio that compares a part of the whole to another part of the whole. For example, the statement "There are 8 boys for every 12 girls" expresses a part-to-part ratio.

part-to-whole ratio A ratio that compares a part of the whole to the whole. For example, the statement "8 out of 20 students are boys" expresses a part-to-whole ratio. The statement "12 out of 20 students are girls" also expresses a part-to-whole ratio.

pattern A simple arrangement of objects so one can predict what will come next if arrangement is continued, such as head, toe, head, toe ? or blue, red, red, blue, red, ?

pentagon A 5-sided figure.

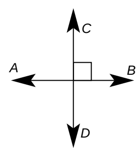
percent (%) Per hundred, or out of a hundred. For

P

example, “48% of the students are boys” means that out of every 100 students in the school 48 are boys.

perimeter The distance around a two-dimensional shape. A formula for the perimeter of a rectangle is P = 2 * (l + w), where l represents the length and w the width of the rectangle.

perpendicular Two rays, lines, or line segments that form right angles are said to be perpendicular to each other.



per-unit rate A rate that tells the quantity of items with a given unit for each item of a different unit. Two dollars per gallon, 12 miles per hour, and 4 words per minute are examples of per-unit rates.

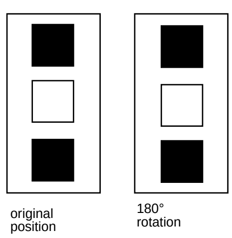
pi The ratio of the circumference of a circle to its diameter. Pi is the same for every circle, approximately 3.14. Also written as the Greek letter π.

place value Determines the value of a digit in a number, written in standard notation, determined by its position. Each place has a value ten times that of the place to its right and one-tenth the value of the place to its left.

plane A flat surface that extends forever.

point An exact location in space. Points are usually labeled with capital letters.

point symmetry The property of a figure that can be rotated 180° about a point in such a way that the resulting figure (the image) exactly matches the original figure (the preimage).



polygon A closed figure consisting of line segments (sides) connected endpoint to endpoint.

polyhedron A 3-dimensional shape, whose surfaces (faces) all are flat. Each face consists of a polygon and the interior of a polygon.

positive power of 10 *See* **power of 10.**

positive rational numbers Numbers greater than 0 that can be written as a fraction or a terminating or repeating decimal. For example, 7, 4/3, 8.125, and 5.111… are positive rational numbers.

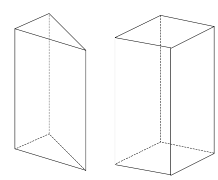
power Usually, a product of factors that are all the same. 5 * 5 * 5 (or 125) is called 5 to the third power, or the third power of 5, because 5 is a factor three times. 5 * 5 * 5 can also be written as 5^3. In general, a power of a number n is a number that can be represented in exponential notation as n^a, where a is any number.

power of 10 A whole number that can be written as a product using only 10 as a factor; also called a positive power of 10. For example, 100 is equal to 10 * 10 or 10^2. 100 is called ten squared, the second power of 10, or 10 to the second power. A negative power of 10 is a number that can be written as a product using only 0.1 or 10^{-1}, as a factor. 0.01 is equal to 0.1 * 0.1, or 10^{-2}. Other powers of 10 include 10^1, or 10, and 10^0, or 1.

prime factorization A number, expressed as a product of prime factors. For example, the prime factorization of 24 is 2 * 2 * 2 * 3 or 2^3 * 3.

prime number A whole number greater than 1 that has exactly two whole-number factors, 1 and itself. For example, 7 is a prime number because its only divisible by 1 and itself. The first five prime numbers are 2, 3, 5, 7, and 11. *See also* **composite number.**

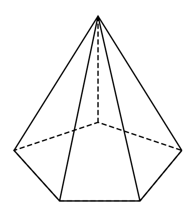
prism A polyhedron with two parallel faces (called bases) that are the same size and shape. Prisms are classified according to the shape of two parallel bases. The faces of a prism are always bounded by parallelograms, and are often rectangular.



probability A number from 0 to 1 that indicated the likelihood that something (an event) will happen. The closer a probability is to 1, the more likely it is that an event will happen.

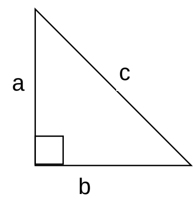
product *See* **multiplication.**

pyramid A polyhedron in which one face (the base) is a polygon and the other faces are formed by triangles with a common vertex (the apex). A pyramid is classified according to the shape of its base.



P

Pythagorean Theorem The following famous theorem: If the legs of a right triangle have the lengths *a* and *b* , and the hypotenuse has length *c*, then $a^2 + b^2 = c^2$.



Q

quadrangle A polygon with four angles.

quadrilateral A polygon with four sides.

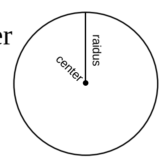
quadruple Four times the amount.

quintillion A digit followed by 18 whole number places. Quintillion written in number form is 1,000,000,000,000,000,000 or 10^{18}.

quotient The quotient is the result of the division. For example, in 28/7 = 4, 4 is the quotient. *See also* **division.**

R

radius A line segment from the center of a circle (or sphere) to any point on the circle (or sphere); also, the length of such a line segment.



random number A number that has the same chance of appearing as any other number.

random sampling Taking a sampling from the population in a manner that allows all members the same chance of being included.

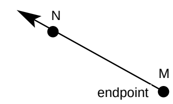
range The difference between the maximum and minimum in a set of data.

rate A comparison of two quantities with unlike units. For examples, a speed such as 55 miles per hour compares distance with time.

ratio A comparison of two quantities with like units. Ratios can be expressed with fractions, decimals, percent, or words; or they can be written with a colon between the two numbers being compared. For example, if a team wins 3 games out of 5 games played, the ratio of wins to total games is 3/5, 0.6, 60%, 3 to 5, or 3:5 (read "three to five").

rational number Any number that can be represented in the form *a*/*b* where *a* and *b* are integers and *b* is not 0. Also, any number that can be represented by a terminating decimal or repeating decimal. 2/3, -2/3 , 0.5, -0.5 and 0.333… are rational numbers.

ray A straight path that extends infinitely from a point, called its endpoint.

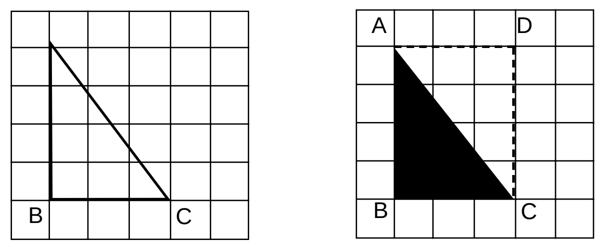


real number Any **rational** or **irrational number.**

reciprocal *See* **multiplicative inverses.**

rectangle A parallelogram with four right angles.

rectangular method A method for finding area, in which rectangles are used to surround a figure or parts of a figure. All the areas that are calculated are either areas of rectangles or of trianglular halves of rectangular regions.



The area of rectangle ABCD is 3 units * 4 units = 12 square units. The area of triangle ABC is one half the area of the rectangle, or 6 square units.

rectangular prism A prism whose faces are all rectangles.

rectangular pyramid A pyramid, the base of which is a rectangle.

reference frame A system of numbers, letters, or words to show quantities with reference to a zero point. Examples of reference frames are number lines, time lines, calendars, thermometers, maps, and coordinate systems.

reflection A "flipping" motion of a picture or object so that its image is the opposite of the original (preimage).

reflex angle An angle whose measure is between 180° and 360°.

regular polygon A convex polygon in which all the sides are the same length and all the angles have the same measures.

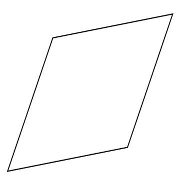
R

regular polyhedron A polyhedron with faces that are all congruent regular polygons. There are regular polyhedrons:
tetrahedron: 4 faces, each formed by an equilateral triangle
cube: 6 faces, each formed by a square
octahedron: 8 faces, each formed by an equilateral triangle
dodecahedron: 12 faces, each formed by a regular pentagon
icosahedron: 20 faces, each formed by an equilateral triangle.

relation symbol A symbol used to express the association between two quantities. The symbols used in number sequences are: = for equal to; ≠ for is not equal to; < for is less than; > for is greater than; ≤ for is less than or equal to; ≥ for is greater than or equal to.

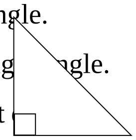
remainder *See* **division.**

rhombus A parallelogram whose sides are all the same length. The angles are usually not right angles, but they my be right angles.



right angle A square corner; a 90° angle.

right triangle A triangle that has a right angle.



rotation A turn around a center point

rotation symmetry Property of a figure that can be rotated around a point in such a way that the resulting figure (the image) exactly matches the original figure (the preimage). The rotation must be more than 0 degrees, but less than 360 degrees. If a figure has rotation symmetry, its order of rotation symmetry is the number of different ways it can be rotated to match itself exactly. “No rotation” is counted as one of the ways.

rote counting Reciting numbers in order from memory.

rounding Replacing a number with a nearby number that is easier to work with or better reflects the precision of the data. 12,964 rounded to the nearest thousand is 13,000.

rule table A table for displaying the input, output, and rule of problems in the “What’s My Rule” routine.

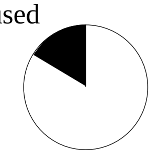
S

sample A subset of a population used to represent the whole population.

scale drawing An accurate picture of an object in which all parts are drawn to the same scale. If an actual object measures 33 by 22 yards, a scale drawing of it might measure 33 by 22 millimeters.

scientific notation A system for representing numbers in which a number is written as the product of a power of 10 and a number that is at least 1 but less than 10. Scientific notation allows writing big and small numbers with only a few symbols. For example, 4,000,000 in scientific notation is $4 \text{ x } 10^6$. 0.00001 in scientific notation is $1 \text{ x } 10^{-5}$.

sector A region bound by an arc and two radii of a circle. The word *wedge* is sometimes used instead of sector.



semicircle *See* **circle.**

Sieve of Erathosthenes A method credited to the mathematician Erathosthenes (about 200 B.C.) for identifying prime numbers.

similar figures Figures that are exactly the same shape but not necessarily the same size.

simplest form A fraction in which the numerator and the denominator have no common factor except 1 and the numerator is less than the denominator. Also, a mixed number in which the fraction is in simplest form.

simplify an expression To rewrite the expression by removing parentheses and combining like terms. For example, $7y + 4 + 5 + 3y$ can be simplified as $10y + 9$; $3(2y + 5) - y$ can be simplified as $5y + 15$.

skip counting Counting by a specific multiple, such as skip counting by 2s from 2, would be 2, 4, 6, 8,…

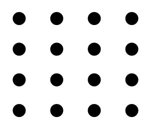
speed A rate that compares distance traveled with the time taken to travel that distance.

S

sphere The set of all points in space that are a given distance (the radius of the sphere) from a given point (the center of the sphere). A ball is shaped like a sphere, as is Earth.

square A rectangle whose sides are all the same length.

square array A rectangular array with the same number of rows as columns. For example, 16 objects will form a square array with 4 objects in each row and 4 objects in each column.



square number A number that is the product of a whole number multiplied by itself; a whole number to the second power. 25 is a square number, because 25 = 5 * 5. A square number can be represented by a square array.

square of a number The product of a number multiplied by itself, symbolized by a raised 2. For example, $3.5^2 = 3.5 * 3.5 = 12.25$

square root of a number The square root of a number *n* is a number which, when multiplied by itself, results in the number *n*. For example, 4 is a square root of 16, because 4 * 4 = 16. The other square root of 16 is -4 because -4 * (-4) = 16.

square unit A unit used in area measurement.

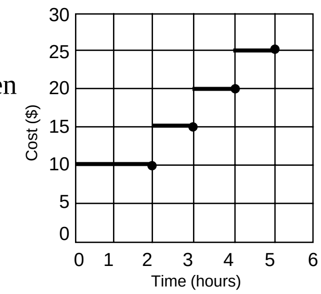
standard notation The most familiar way of representing whole numbers, integers, and decimals by writing digits in specified places.

standard unit A uniform unit of measure.

stem-and-leaf plot A display of data in which digits with larger place values are named as stems, and digits with smaller place values are named as leaves.

Stems 10's	Leaves 1's
2	4 4 5 6 7 7 8
3	1 1 2 2 6 6 6
4	1 1 3 5 8
5	0 2

step graph A graph that looks like steps. Particularly useful when the horizontal axis represents time.



straightedge A tool, such as a ruler, used to draw a straight line.

subtraction A mathematical operation based on "taking away" or comparing ("How much more?"). The number being subtracted is called the **subtrahend**; the number it is subtracted from is called the minuend; the result of the subtraction is called the **difference.** In 45 - 12 = 33, 45 is the minuend, 12 is the subtrahend, and 33 is the difference. Addition "undoes" subtraction. 45 - 12 = 33, and 45 = 12 + 33.

subtrahend The number being subtracted is called the subtrahend. In 45 - 12 = 33, 45 is the minuend, 12 is the subtrahend. *See also* **subtraction.**

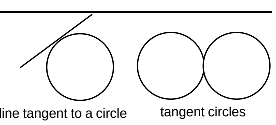
sum The result of adding two or more numbers.

supplementary angles Two angles whose measures total 180°.

symmetry The matching of two halves of a shape.

T

tangent Intersecting at exactly one point.



template A sheet of plastic with geometric shapes cut out, used to draw patterns and designs.

term In an algebraic expression or equation, a number or a product of a number and one or more variables. For example, the terms of the expression $5y + 3k - 8$ are $5y$, $3k$, and 8. A variable term is a term that contains at least one variable. For example, in the equation $4b - 8 = b + 5$, $4b$ and b are variable terms. A constant term is a term that does not contain a variable. For example, in the equation $4b - 8 = b + 5$, 8 and 5 are constant terms.

tessellation An arrangement of closed shapes that covers a surface completely without overlaps or gaps.

T

tetrahedron *See* **regular polyhedron.**

theorem A mathematical statement that can be proved to be true (or, sometimes, a statement that is proposed and needs to be proved). For example, the Pythagorean Theorem states that if the legs of a right triangle have length of a and b , and the hypotenuse has length c , then $a^2 + b^2 = c^2$.

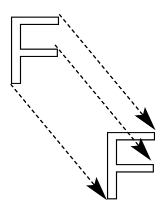
three dimensional (3-D) Objects that are not completely within a single flat surface; objects with thickness as well as length and width.

tile A shape used in a tessellation. If only one shape is repeated in a tessellation, the tessellation is called a same-tile tessellation.

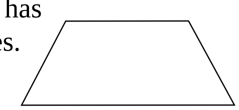
tiling Covering a surface with uniform shapes so there are no gaps or overlaps, except possibly gaps around the edges.

top-heavy fraction A fraction that names a number greater than or equal to 1; a fraction whose numerator is equal to or greater than its denominator. Examples of top-heavy fractions are 7/5, 5/5, 9/7, and 16/4. Also called **improper fraction.**

translation The motion of "sliding" an object or picture along a straight line



trapezoid A quadrilateral that has exactly one pair of parallel sides. No two sides need be the same length.



triangle A polygon with three sides. An **equilateral triangle** has three sides of the same length. An **isosceles triangle** has two sides of the same length. A **scalene triangle** has no sides of the same length

triangular prism A prism whose base is a triangle.

triangular pyramid A pyramid in which the base is a triangle.

U

unit ONE of something.

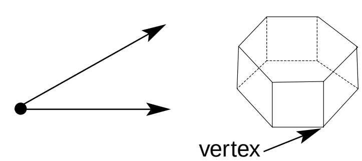
unit box Rectangular box displayed alongside a set of numbers or problems. It contains the unit or label for the numbers in use.

unit marks The equidistant marks that represent numbers on thermometers, rulers, and other scales of measurement.

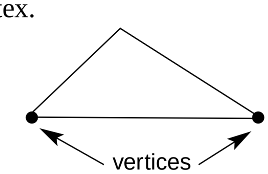
V

variable A letter or other symbol that represents a number. A variable need not represent one specific number; it can stand for many different values.

vertex The point at which the rays of an angle, two sides of a polygon, or the edges of a polyhedron meet.



vertices Plural of vertex.



volume The measure of the amount of space occupied by a 3-dimensional shape.

W

whole The entire object, collection of objects, or quantity being considered; the ONE, the unit, 100%.

whole number Any of the numbers 0, 1, 2, 3, 4, and so on.

X

x-by-y array An arrangement having x rows of y per row, representing x sets of y objects in each set.

Math games are an important part of the *Everyday Mathematics* program.

They are designed to help your child practice his/her basic facts and computation skills and to develop increasingly sophisticated solution strategies. These games also lay the foundation for more increasingly difficult concepts.

Games build fact and operation skills, while reinforcing calculator skills, money exchange, logic, geometric awareness, probability and chance experiences. Since most games involve generating numbers randomly, they can be played again and again without repeating the same problem. Rules can be altered to allow players to progress from easy to more challenging versions. Games can be played competitively or modified to be cooperative activities.

Games are fun and can be played by families to provide additional practice in an interesting way. Some games can be played by students across a variety of grade levels. Examples of some games that can be played at home are included on the following pages. The suggested grade levels are in parentheses.

Random-Number Generators

Many games involve generating numbers randomly. Several methods are possible.

The Everything Math Deck: This deck of cards is really two decks in one: a whole number deck and a fraction deck using the back side of the cards. There are four cards each for the numbers 0-10, and one card each for the numbers 11-20. You can limit the range of numbers to be generated by removing some of the cards from the deck. These cards are used in many classrooms.

Standard playing cards: Use the 2-10 cards as they are and use the aces to represent the number 1. Write the number 0 on the queens' face cards, the numbers 11 through 18 on the remaining face cards (kings, jacks), and 19 and 20 on the jokers.

Dice: Use a regular die to generate numbers up to 6. A polyhedral die (die that has 8, 10, 12, etc. sides) can be used to extend the range of numbers to be generated.

Egg cartons: Label each cup with a number. For example, you might label the cups 0-11. Place one or more pennies or other small objects inside the carton, close the lid, shake the carton and open the carton to see in which cups the objects landed.

Disappearing Train (K)

Concept: Number operations (+ and -)

Players: 2 or more

Materials: Blank die (or cube) with the sides marked -1, -2, -3, -1, -2, +3 At least 24 cubes, pennies, or other small objects to make trains.

Directions: Explain the (-) and (+) signs on the cube: the minus sign before a number means “take away” (or subtract) that many objects and the plus sign before the one number means “put together” or add that many objects.

Players make trains of cubes (or blocks, bottle caps, buttons, etc.) equal in number. They take turns rolling the die (or cube) and removing (or adding) as many cars from their train as the number on the cube indicates.

The game ends when the first train disappears. Players must roll the exact number needed to make the train disappear. If one car is left, the player needs to roll a -1 to finish.

Option: A non-competitive version of this game might be to work together on one train, (alternating turns rolling the die) to make it disappear.

One and Only (K)

Concept: Numeration; Counting

Players: 3-5

Materials: Number Cards (1-10) Allow one set of ten cards for each player.

Directions: Mix up a deck of number cards and pull out one card. The unpaired card is the “One and Only.” (Adults may remember “Old Maid” as a similar game.)

Deal out all the cards. Players look at their hands and put down any pairs. The first player then draws a card from the person on the right. All subsequent pairs are laid down. The next player (to the right of the first player) then gets to pick a card from the person on his or her right, and so on. The game ends when one player puts down all his or her cards.. The player who has the “odd” card at the end of the game is the “One and Only.”

Penny- Nickel Exchange (K-1)

Concept: Number Sense; Money

Players: 2 or more (in pairs)

Materials: 1 die (or number cube with 1-6 on it) for each pair of players; 40 pennies and 8 nickels for each pair of players

Directions: Partners make a bank of 40 pennies and 8 nickels, using real money. Players take turns rolling the die and collecting the number of pennies from the bank that matches the number rolled on the die. As players acquire 5 or more pennies, they say “Exchange” and turn in their 5 pennies for a nickel. The game ends when the bank is out of nickels. The partner with more nickels at the end wins.

Option 1: Children play with a larger bank and two dice. This allows them to exchange coins more rapidly. At the end of any turn, each player should have fewer than five pennies.

Option 2: Penny-Nickel-Dime Exchange: Use 1 die; 40 pennies, 8 nickels and 4 dimes for each partnership. Players take turns rolling the die and collecting the number of pennies from the bank that matches the number rolled on the die. Students first “exchange” 5 pennies for a nickel, and later exchange 2 nickels (or 5 pennies and 1 nickel) for a dime. The game ends when no more exchanges can be made.

Students may add up their coin amounts to determine a winner or the objective may be to play the game until **each** partner has 60¢.

Beat the Calculator (1-5)

Concept: Number Operations; Basic Facts

Players: 3

Materials: 1 deck of number cards 1-10 (4 of each for a total of 40 cards)

Directions: One player is the "caller," a second player is the "calculator," and the third player is the "brain."

Shuffle the deck of cards and place it face down on the playing surface.

The caller turns over the top two cards from the deck. These are the numbers to be added (or multiplied). The calculator finds the sum with a calculator, while the brain solve its without a calculator. The caller decides who got the answer first. Players trade roles every 10 turns or so.

Option: To extend the facts, the caller attaches a 0 to either one of the numbers or both. For example, if the caller turns over a 4 and a 6, he or she may make up one of the following problems: 4*60, 40*6, or 40*60

Broken Calculator (1-6)

Concept: Numeration

Players: 2

Materials: Calculators

Directions: Partners pretend that one of the number keys is broken. One partner says a number, and the other tries to display it on the calculator without using the "broken" key.

For example, if the 8 key is "broken," the player can display the number 18 by pressing 9 [+] 7 [+] 2, 9 [*] 2, 72 [-] 50 [-] 2 [-] 2, etc.

Scoring: A player's score is the number of keys entered to obtain the goal. Scores for five rounds are totaled, and the player with the lowest total wins.

Two-Fisted Pennies Game (1-2)

Concept: Number Operations; Basic Facts

Players: 2 or more

Materials: 10 pennies per player (or more)

Directions: Children count out 10 pennies, then split them between their two hands. (Help children identify their left hand and right hand.)

Ask children to share their amounts. For example: my left hand has 1 and my right hand has 9; left hand 3 and right hand 7; left hand 4 and right hand 6; left hand 5 and right hand 5. The various splits for any given number can be recorded.

Partners can continue to play using a different total number of pennies. For example, 9 pennies, 12 pennies, 20 pennies.

Option 1: Partners take turns grabbing a part of a pile of 10 (or 20, etc.) pennies. The other partner takes the remainder of the pile. Both players count their pennies, secretly. The partner making the grab uses the count to say how many pennies must be in the partner's hand. (I have 2, you must have 8.) The eventual result is many addition names for 10, etc.

Option 2: Use dimes instead of pennies. Have children tell the value of the money in each hand.

Pick-a-Coin (2-3)

Concept: Money; Basic Facts

Players: 2 or 3

Materials: A regular die or number cube
A recording sheet per player (see example below)
Calculator

Directions: Players take turns. At each turn, a player rolls a die five times. After each roll, he/she records the number that comes up on the die in any one of the empty cells for that turn on his/her own record sheet. Then they use their calculators to find the total amount and record it in the table.

For example, player 1 rolls a 1, 2, 3, 4, and 5 and records this:

Player 1 P	N	D	Q	$1	Total
1st turn 1	3	4	2	5	$6.06
2nd turn					$___._
3rd turn					$___._
4th turn					$___._
Total					$___._

After four turns, players use their calculators to find the grand total. The player with the highest total wins.

Making Change Game (2-4)

Concept: Money; Basic Facts

Players: 2 or 3

Materials: 2 dice; a $1 bill, 6 quarters, 2 dimes, and 2 nickels for each player

Directions: There is no money in the bank at the beginning of the game. Players take turns depositing money into the bank. To determine the amount that they are to deposit, they roll the dice and multiply the total number of dots on the dice by 5 cents.

At the beginning of the game, they will be able to count out the exact amount. Later, they make change from the money in the bank if they don't have the exact amount. The first player without enough money to put in the bank wins.

Option 1: Use two different-colored dice to represent nickels and dimes. Each player starts with three $1 bills in addition to the coins.

Option 2: Use three different-colored dice to represent nickels and dimes and quarters. Each player starts with six $1 bills in addition to the coins.

Collection Game (2-4)

Concept: Numeration; Money; Place Value

Players: 2 or 3

Materials: Play money: 12 $1 bills; 12 $10 bills; and 1 $100 bill for each player
2 dice
Place-Value Mat (see following sample)

Directions: Players put all their money in the bank. At each turn, they roll the dice, take from the bank the amount they roll, and place the money on the game mat. Whenever possible, they trade ten $1 bills for a $10 bill or ten $10 bills for a $100 bill. The first player to trade for a $100 bill wins. Most games last 12-18 rounds.

Place-Value Mat

One Hundred Dollars $100	Ten Dollars $10	One Dollar $1

Take-Apart Game (2-4)

Concept: Numeration; Money

Players: 2 or 3

Materials: Play money: 12 $1 bills; 12 $10 bills; and 1 $100 bill for each player
2 dice

Directions: Each player begins with a $100 bill and the rest of the money goes in the bank. At each turn, players roll the dice and put the amount they roll into the bank. They exchange a bill of a higher denomination for bills of the next lower denomination, as needed. The first player with less than $12 wins.

Option 1: Set larger or smaller goals.

Option 2: Generate larger numbers (which shorten the number of rounds to reach a given goal) using 2 polyhedral dice or 3 regular dice.

Option 3: Use dollar bills, dimes, and pennies instead of $100, $10, and $1 bills.

Top-It Games (K-6)

Number Top-It (K)

Concept: Numeration

Players: 2

Materials: Deck of 40 cards: 4 each in a selected range of 10 (for example, 0-9)

Directions: A player shuffles the cards and deals out the whole deck between them. The players place their stacks face down before them.

Each turns over his or her top card and reads the number aloud. Whoever turns over the larger number keeps both cards. If the cards match, they are put aside and the next cards are turned over until someone wins the round and takes all the cards for that round. When all the cards from both stacks have been used up, play ends.

Players may toss a penny to determine whether the player with the most or least cards wins.

Addition Top-It (1-3)

Concept: Number Operations; Basic Facts

Players: 2 or 3

Materials: Deck of cards: 4 each 0-10 and 1 each 11-20

Directions: A player shuffles the cards and places the deck number-side down on the playing surface. Each player turns over two cards and calls out their sum. The player with the largest sum wins the round and takes all the cards.

In case of a tie for the largest sum, each tied player turns over two more cards and calls out their sum. The player with the largest sum takes all the cards of both plays.

Play ends when not enough cards are left for each player to have another turn. The player with the most cards wins. Or players may toss a penny to determine whether the player with the most or the fewest cards wins.

Option 1: Use a set of double-nine dominoes instead of a set of number cards. Place the dominoes face down on the playing surface. Each player turns over a domino and calls out the sum of the dots on the two halves. The winner of a round takes all the dominoes in play.

Option 2: To practice addition with three addends, use three cards or three dice.

Subtraction Top-It (1-3)

Concept: Number Operations; Basic Facts

Players: 2 or 3

Materials: Deck of cards: 4 each 0-10 and 1 each 11-20

Directions: This game is played the same way as Addition Top-It. Use the cards to generate subtraction problems. The player with the largest (or smallest) difference wins the round.

Multiplication Top-It (3-6)

Concept: Number Operations; Basic Facts

Players: 2-4

Materials: Deck of cards: 4 each 0-10

Directions: This game is played just like Addition Top-It only multiplication problems are generated from the 2 cards. The player with the largest product wins the round.

Name that Number (2-6)

Concept: Number Operations; Basic Facts

Players: 2 or 3

Materials: Deck of cards: 4 each 0-10, 1 each of 11-20

Directions: Shuffle the deck of cards and deal 5 cards to each player. Turn over the top card. This is the **target** number for the round.

Players try to name the target number by adding, subtracting, multiplying, or dividing the numbers on as many of their cards as possible. A card may only be used once. They write their solutions on a sheet of paper or slate. Then the players set aside the cards they used to name the target number and replace them with new cards from the top of the deck. They put the target number on the bottom of the deck and turn over the top card. This is the new target number.

Play continues until there are not enough cards left in the deck to replace the players' cards. The player who sets aside more cards wins the game.

Sample turn:

Player's numbers: 7, 5, 8, 2, 10
Target number: 16

Some possible solutions:
7 * 2 = 14 ➞ 14 +10 =24 ➞ 24 - 8 = 16
(four cards used)
8/2 = 4 ➞ 4 + 10 = 14 ➞ 14 + 7 = 21
➞ 21 - 5 = 16

(all five cards used)

Subtraction Pole Vault (4-5)

Concept: Number Operations; Basic Facts

Players: 1 or more

Materials: Deck of cards: 4 each of 0-9
Scratch paper or slate to record results
Calculator to check answers

Directions: Shuffle the cards and place the deck face down on the playing surface. Each player starts at 250. They take turns doing the following:

1. Turn over the top 2 cards and make a 2-digit number. (There are 2 possible numbers.) Subtract this number from 250 on scratch paper. Check the answer on a calculator.
2. Turn over the next 2 cards and make another 2-digit number. Subtract it from the result in step 1. Check the answer on a calculator.
3. Do this 3 more times: (Take 2 cards, make a 2-digit number, subtract it from the last result and check the answer on a calculator.)

The object is to get as close to 0 as possible, without going below 0. The closer to 0, the higher the pole-vault jump. If a result is below 0, the player knocks off the bar; the jump does not count.

Sample jump:

Turn 1: Draw 4 and 5.
Subtract 45 (or 54).
250 - 45 = 205

Turn 2: Draw 0 and 6.
Subtract 60 (or 6).
205 - 60 =145

Turn 3: Draw 4 and 1.
Subtract 41 (or 14).
145 - 41 =104

Turn 4: Draw 3 and 2.
Subtract 23 (or 32).
104 - 23 = 81

Turn 5 Draw 6 and 9.
Subtract 69 (or 96)
81 - 69 = 12

Option 1: Players start by subtracting from 1000 and the target number could be -10 rather than 0.

Baseball Multiplication (3-6)

Concept: Number Operations; Basic Facts

Players: 2

Materials: 2 regular dice, 4 pennies
Multiplication table or a calculator

Directions: Take turns being the "pitcher" and the "batter"

1. Draw a diamond and label "home plate," "first base," "second base," and "third base."
2. Make a score sheet that looks like the following:

Innings	1	2	3	4	5	6	Total
Team 1 outs							
runs							
Team 2 outs							
runs							

3. At the start of the inning, the batter puts a penny on home plate.
4. The pitcher rolls the 2 dice. The batter multiplies the 2 numbers that come up and tells the answer. The pitcher checks the answer in a multiplication table or on a calculator.
5. The batter looks up the product in the Hitting Table. If it is a hit, the batter moves all pennies on base as follows:

Single	1 base
Double	2 bases
Triple	3 bases
Home Run	4 bases or across home plate

6. A run is scored each time a penny crosses home plate. If a play is not a hit, it is an out.
7. A player remains the batter for 3 outs. Then players switch roles. The inning is over when both players have made 3 outs.
8. After making the third out, a batter records the number of runs scored in that inning on the scoreboard.
9. The player who has more runs at the end of 4 innings wins the game. If the game is tied at the end of 4 innings, play continues into extra innings until one player wins.
10. If, at the end of the first half of the last inning, the second player is ahead, there is no need to play the second half of the inning. The player who is ahead wins.

Hitting Tables

1 to 6 Facts
1 to 9 Out
10 to 19 Single (1 base)
20 to 29 Double (2 bases)
30 to 35 Triple (3 bases)
36 Home Run (4 bases)

1 to 10 Facts
1 to 21 Out
22 to 45 Single
46 to 70 Double
71 to 89 Triple
90 to 100 Home Run

1 to 12 Facts
1 to 24 Out
25 to 49 Single
50 to 64 Double
65 to 79 Triple
80 to 144 Home Run

Option 1: 1 to 10 Facts Game
Use a number card deck with 4 each of the numbers 1 to 10 instead of dice. At each turn, draw 2 cards from the deck and find the product of the numbers. Use the 1 to 10 Facts Hitting Table to find out how to move the pennies.

Option 2: 1 to 12 Facts Game
At each turn, roll 4 regular dice. Separate them into 2 pairs. Add the numbers in each pair and multiply the sums.

For example, suppose you roll a 2, 3, 5, and 6. You could separate them as follows:

2 + 3 = 5	2 + 5 = 7	2 + 6 = 8
5 + 6 = 11	3 + 6 = 9	3 + 5 = 8
5 * 11 = 55	7 * 9 = 63	8 * 8 = 64

How you pair the numbers can make a difference in whether you make a base or an out.

High-Number Toss (4 - 6)

Concept: Numeration; Comparing Decimals

Players: 2

Materials: Number cards, 4 each of the numbers 0 through 9

Directions: Begin by making a score card. See the example below:

Shuffle the cards and place the deck face down on the playing surface. Each player has a score card on which to record his or her results.

In each round:

- Player A draws the top card from the deck and writes that number on any one of the three blanks on the score card.
  It need not be the first blank —it can be any one of them.

- Player B draws the next card from the deck and writes the number on one of his or her blanks.

- Players take turns doing this two more times. The player with the larger number wins the round.

Scoring: The winner's score for a round is the difference between the two players' scores. The loser scores 0 for the round.

Example:
Player A: 0. 6 5 4 Player B: 0. 7 5 3

Player B has the larger number and wins the round. Since 0.753 - 0.654 = 0.099, Player B scores 0.099 points and Player A scores 0 points for the round.

Players take turns starting a round. At the end of 4 rounds, they find their total scores. The player with the larger total score wins the game.

Game 1	
Round 1	**Score**
0._____ _____ _____	__________
Round 2	**Score**
0._____ _____ _____	__________
Round 3	**Score**
0._____ _____ _____	__________
Round 4	**Score**
0._____ _____ _____	__________
Total:	__________

Doggone Decimal (6)

Concept: Estimation; Numeration

Players: 2

Materials: 1 deck of cards with 4 each of the numbers 0 through 9.
2 counters or coins per player (to use as decimal points)
4 index cards labeled 0.1, 1, 10, or 100
Calculator

Directions: One player shuffles the number cards and deals 4 cards face down to each player. The other player shuffles the index cards, places them face down, and turns over the top card. The number that appears (0.1, 1, 10, or 100) is the Target Number.

1. Using 4 number cards and 2 decimal-point counters, each player forms two numbers, each with two digits and a decimal point:
   - Each player tries to form numbers whose product is as close as possible to the Target Number.
   - The decimal point can go anywhere in a number.
2. Players compute the product of their numbers using a calculator to verify the correct answer.
3. The player whose product is closer to the Target Number wins all 8 number cards.
4. Four new number cards are dealt to each player, and a new Target Number is turned over.
5. The game ends when all four Target Numbers have been turned over.
6. The player with the most number cards wins the game. In the case of a tie, one tie-breaking round is played.

Example:

- The index card turned over is 10, so the Target Number is 10.
- Briana is dealt 1, 4, 8, and 8. She forms the numbers 8.8 and 1.4.
- Evelyn is dealt 2, 3, 6, and 9. She forms the numbers 6.9 and 3.2.
- Briana's products is 12.32 and Evelyn's is 22.08.
- Briana's product is closer to 10. She wins the round and the cards.

Fraction Action, Fraction Friction (5 - 6)

Concept: Number Sense, Estimation;

Players: 2 or 3

Materials: calculator

Make one set of 16 *Fraction Action, Fraction Friction* cards. The suggested set includes a card for each of the following fractions (for several fractions there are 2 cards): 1/2, 1/3, 2/3, 1/4, 3/4, 1/6, 1/6, 5/6, 1/12, 1/12, 5/12, 5/12, 7/12, 7/12, 11/12, 11/12.

Directions: Shuffle the Fraction Action, Fraction Friction cards. Deal one card to each player. The player with the fraction closest to 1/2 begins the game. Players take turns. At each turn:

1. The player takes a card from the top of the pile and places it face up on the playing surface.
2. At each turn, the player must announce one of the following:
   "Action!"
   This means that the player wants an additional card. The player believes that the sum of the cards is not close enough to 2 to win the hand and that with an additional card, there is a good chance that the sum of the cards will not go over 2.

   "Friction!"
   This means that the player does not want an additional card. The player believes that the sum of the cards is close enough to 2 to win the hand and that with an additional card, there is a good chance that the sum of the cards will go over 2.

Play continues until all players have announced, "Friction!" or have a set of cards whose sum is greater than 2. The player whose sum is closest to 2 without going over is the winner of the hand. Players may check each other's sums on their calculators.

Reshuffle the cards and begin again. The winner of the game is the first player to win 5 hands.

These mathematics-related titles are organized by mathematics topics. Some titles may appear more than once.

Algebra and Uses of Variables

Corduroy
Don Freeman
New York: Viking Press, 1968

Numblers
Suse MacDonald
New York: Dial Books, 1988

Eye Spy: A Mysterious Alphabet
Linda Bourke
San Francisco: Chronicle Books, 1991

Puzzlers
Suse MacDonald
New York: Dial Books, 1989

Exploring Data and Chance

Caps for Sale
Esther Slobodkina
New York: Harper Collins, 1940

Cloudy with a Chance of Meatballs
Judi Barrett
New York: Atheneum, 1978

Harriet's Halloween Candy
Nancy Carlson
New York: Puffin Books, 1994

Moira's Birthday
Robert Munsch
Toronto: Annick Press, 1989

Purple, Green and Yellow
Robert Munsch
Toronto: Annick Press, 1992

Geometry and Spatial Sense

A Cloak for a Dreamer
Aileen Friedman
New York: Scholastic, 1994

Color Zoo
Lois Ehlert
New York: Harper Collins Publishers, 1989

Grandfather Tang's Story
Ann Tompert
New York: Crown Publishers, 1990

Geometry and Spatial Sense (cont.)

The Greedy Triangle
Marilyn Burns
New York: Scholastic, 1994

Linus the Magician
Rosalie Barker
California: Harbor House Publishers, 1993

Sea Shapes
Suse MacDonald
San Diego: Gulliver Books, 1994

The Secret Birthday Message
Eric Carle
New York: Harper Trophy, 1972

The Shape of Things
Dayle Ann Dodds
Massachusetts: Candlewick Press, 1996

Shapes
Keith Faulkner
New York: Barnes and Noble, 1994

Shape Space
Cathryn Falwell
New York: Clarion Books, 1992

Shapes, Shapes, Shapes
Tana Hoban
New York: Greenwillow Books, 1986

Space Race
Bob Barner
New York: Bantam Doubleday, 1995

What Am I?
N. N. Charles
New York: The Blue Sky Press, 1994

Measures and Measurement

Alexander, Who Used to Be Rich Last Sunday
Judith Viorst
New York: Atheneum, 1978

The Baker's Dozen
Aaron Shepard
New York: Atheneum Publishers, 1995

Benny's Pennies
Pat Brisson
New York: Bantam Doubleday, 1993

These mathematics-related titles are organized by mathematics topics. Some titles may appear more than once.

Measures and Measurement (cont.)

A Chair for My Mother
Vera Williams
New York: Scholastic, 1982

A Flower Grows
Ken Robbins
New York: Dial Books, 1990

The Go-Around Dollar
Barbara Johnston Adams
New York: Four Winds Press, 1992

How Big Is a Foot?
Rolf Myller
New York: Bantam Doubleday, 1990

How the 2nd Grade Got $8205.50
Nathan Zimelman
Illinois: Albert Whitman and Co., 1992

If You Made a Million
David Schwartz
New York: Lothrop, Lee & Shepard Books, 1989

Inch by Inch
Leo Lionni
New York: Scholastic, 1960

Mr. Archimedes' Bath
Pamela Allen
New York: Harper Collins Publishers, 1994

Pancakes, Pancakes
Eric Carle
New York: Scholastic, 1990

Papa, Please Get the Moon for Me
Eric Carle
New York: Scholastic, 1986

Picking Peas for a Penny
Angela Shelf Medearis
New York: Scholastic, 1990

Super, Super, Super Words!
Bruce McMillan
New York: Lothrop, Lee & Shepard Books, 1989

Numeration and Order

Amazing Anthony Ant
Lorna and Graham Philpo
New York: Random House, 1994

Numeration and Order (cont.)

Anno's Counting Book
Mitsumasa Anno
New York: Harper & Row, 1977

Anno's Counting House
Mitsumasa Anno
New York: Philomel, 1982

Counting on Calico
Phyllis Tildes
Massachusetts: Charlesbridge Publishing, 1994

Count Your Way Through Japan
Jim Haskins
Minnesota: Carolrhoda Books, Inc., 1987

Count Your Way Through Korea
Jim Haskins
Minnesota: Carolrhoda Books, Inc., 1989

The Crayon Counting Book
Pam Munoz Ryan
Massachusetts: Charlesbridge Publishing, 1996

Eating Fractions
Bruce McMillan
New York: Scholastic, 1991

Fish Eyes
Lois Ehlert
New York: Harcourt Brace, 1990

Fraction Action
Loreen Leedy
New York: Holiday House, 1994

Fraction Fun
David A. Adler
New York: Holiday House, 1996

How Many Bugs in a Box?
David A. Carter
New York: Scholastic, 1994

How Many How Many How Many
Ray Walton
Massachusetts: Candlewick, 1993

How Much Is a Million?
David Schwartz
New York: Lothrop, Lee & Shepard Books, 1985

These mathematics-related titles are organized by mathematics topics. Some titles may appear more than once.

Numeration and Order (cont.)

I Spy Two Eyes: Numbers in Art
Lucy Micklethwait
New York: Greenwillow Books, 1993

Moira's Birthday
Robert Munsch
Toronto: Annick Press, 1987

Moja Means One
Tom Feelings
New York: Dial Books, 1971

Mouse Count
Ellen Stoll Walsh
New York: Voyager Books, 1991

My First Number Book
Marie Heinst
New York: Dorling-Kindersley, 1992

Notorious Number
Paul Giganti Jr.
California: Teaching Resource Center, 1993

Numbers at Play: A Counting Book
Charles Sullivan
New York: Rizzoli International Publications, 1992

Out for the Count
Catherine Cave
New York: Simon and Schuster, 1991

17 Kings and 42 Elephants
Margaret Mahy
New York: Dial Books, 1987

Ten Black Dots
Donald Crews
New York: Scholastic, 1986

Ten, Nine, Eight
Molly Bang
New York: Mulberry Books, 1983

The Right Number of Elephants
Jeff Sheppard
New York: Scholastic, 1990

The 329th Friend
Marjorie W. Sharmat
New York: Four Winds Press, 1992

Numeration and Order (cont.)

Two Ways to Count to Ten
Ruby Dee
New York: Henry Holt and Co., 1990

12 Ways to Get to 11
Eve Merriam
New York: Simon and Schuster, 1993

Operations

Anno's Mysterious Multiplying Jar
Masaichiro Anno
New York: Philomel Books, 1983

Bunches and Bunches of Bunnies
Louise Mathews
New York: Scholastic, 1978

The King's Chessboard
David Birch
New York: Dial Books, 1988

One Hundred Hungry Ants
Elinor J. Pinczes
Boston: Houghton Mifflin Company, 1993

The M & M's Counting Book
Barbara McGrath
Massachusetts: Charlesbridge, 1994

Number One, Number Fun
Kay Chorao
New York: Holiday House, 1995

A Remainder of One
Elinor J. Pinczes
Boston: Houghton Mifflin Company, 1995

Sea Squares
Joy N. Hulme
New York: Hyperion Paperbacks, 1991

Patterns, Functions and Sequences

The Amazing Book of Shapes
Lydia Sharman
New York: Dorling-Kindersley, 1994

The Boy and the Quilt
Shirley Kurtz
Pennsylvania: Good Books, 1991

These mathematics-related titles are organized by mathematics topics. Some titles may appear more than once.

Patterns, Functions and Sequences (cont.)

The Patchwork Quilt
Valerie Flournoy
New York: Scholastic, 1985

Eight Hands, Round: A Patchwork Alphabet
Ann Whitford Paul
New York: Harper Collins Publishers, 1991

Patterns
Ivan Bulloch
New York: Thompson Learning, 1994

Sam Johnson and the Blue Ribbon Quilt
Lisa Campbell Ernst
New York: Lothrop, Lee, & Shepard Books, 1983

Ten Little Rabbits
Virginia Grossman
San Francisco: Chronicle Books, 1995

Reference Frames

Chicken Soup with Rice
Maurice Sendak
New York: Scholastic, 1962

Clocks and More Clocks
Pat Hutchins
New York: Aladdin Book, 1994

My First Book of Time
Claire Llewellyn
New York: Dorling-Kindersley, 1992

P. Bear's New Year's Party
Paul Owens Lewis
Oregon: Beyond Words Publishing, 1989

Pigs on a Blanket
Amy Axelrod
New York: Simon and Schuster, 1996

Seven Blind Mice
Ed Young
New York: Scholastic, 1993

Three Days on a River Canoe
Vera B. Williams
New York: Scholastic, 1981

These mathematics-related titles are organized by mathematics topics. Some titles may appear more than once.

Algebra and Uses of Variables

A Grain of Rice
Helena Clare Pittman
New York: Hastings House, 1986

The Rajah's Rice
David Barry, Contributor
New York: W.H. Freeman & Co., 1985

Exploring Data and Chance

Calculation and Chance
Laura and Taylor Buller
New York: Marshal Cavendish Corp., 1990

Do You Wanna Bet?
Jean Cushman
New York: Clarion Books, 1991

How to Get Fabulously Rich
Thomas Rockwell
New York: Franklin Watts, 1990

Jumanji
Chris Van Allsburg
Boston: Houghton Mifflin Co., 1981

Socrates and the Three Little Pigs
Tuyosi Mori
New York: Philomel Books, 1986

What Do You Mean by "Average"?
Elizabeth James
New York: Lothrop, Lee & Shepard Books, 1978

Geometry and Spatial Sense

The Boy with Square Eyes
Juliet Snape
New York: Prentice-Hall Books, 1987

A Cloak for the Dreamer
Aileen Friedman
New York: Scholastic, 1994

Grandfather Tang's Story
Ann Tompert
New York: Crown Publishers, 1990

Julia Morgan, Architect of Dreams
Ginger Wadsworth
Minneapolis: Lerner, 1990

Geometry and Spatial Sense (cont.)

Paper John
David Small
New York: Farrar, Straus, & Giroux, 1987

The Greedy Triangle
Marilyn Burns
New York: Scholastic, Inc., 1994

Round Trip
Ann Jonas
New York: Greenwillow Books, 1983

Shape: The Purpose of Forms
Eric Laithwaite
New York: Franklin Watts, 1986

Measures and Measurement

Alexander, Who Used to Be Rich Last Sunday
Judith Viorst
New York: Atheneum, 1978

Anno's Flea Market
Mitsumasa Anno
New York: Philomel Books, 1984

A Chair for My Mother
Vera Williams
New York: Scholastic, 1982

The Go-Around Dollar
Barbara Johnston Adams
New York: Four Winds Press, 1992

The Hundred Penny Box
Sharon Bell Mathis
New York: Puffin, 1986

If You Made a Million
David M. Schwartz
New York: Lothrop Lee & Shepard Books, 1989

Is a Blue Whale the Biggest Thing There Is?
Robert E. Wells
Illinois: Albert Whitman and Co., 1993

The Librarian Who Measured the Earth
Kathryn Lasky
New York: Little, Brown, and Co., 1994

The Magic School Bus Inside the Earth
Joanna Cole
New York: Scholastic, 1987

These mathematics-related titles are organized by mathematics topics. Some titles may appear more than once.

Measures and Measurement (cont.)

Math Curse
Jon Scieszka
New York: Viking, 1995

The Money Tree
Sarah Stewart
New York: Farrar, Straus, Giroux, 1991

Pigs Will Be Pigs
Amy Axelrod
New York: Four Winds Press, 1994

What's Cooking, Jenny Archer?
Ellen Conford
Boston: Little, Brown, 1989

What's Smaller Than a Pygmy Shrew?
Robert E. Wells
Illinois Albert Whiteman and Co., 1993

Numeration and Order

Fraction Action
Loreen Leedy
New York: Holiday House, 1994

How Much Is a Million?
David M. Schwartz
New York: Lothrop, Lee & Shepard Books, 1985

Roman Numerals I to MM
Arthur Geisert
New York: Houghton Mifflin, 1996

Operations

Anno's Mysterious Multiplying Jar
Masaichiro Anno
New York: Philomel Books, 1983

Bunches and Bunches of Bunnies
Louise Mathews
New York; Scholastic, 1978

The King's Chessboard
David Birch
New York: Dial Books, 1988

One Hundred Hungry Ants
Elinor J. Pinczes
Boston: Houghton Mifflin Company, 1993

Operations (cont.)

A Remainder of One
Elinor J. Pinczes
Boston: Houghton Mifflin Company, 1995

Sea Squares
Joy N. Hulme
New York: Hyperion Paperbacks, 1991

2 x 2 = Boo!
Loreen Leedy
New York: Holiday House, 1994

Patterns, Functions and Frames

Eight Hands Round
Ann Whitford Paul
New York: Harper Collins Publishers, 1991

Esio Trot
Roald Dahl
New York: Viking, 1990

A Million Fish…More or Less
Patricia C. McKissack
New York: Random House, 1991

Patterns in the Wild
National Wildlife Federation
Washington, D.C.: National Wildlife Federation

The Quilt-Block History of Pioneer Days
Mary Cobb
Connecticut: The Millbrook Press, 1995

The Seasons Sewn
Michael McCurdy, Contributor
New York: Harcourt Brace, 1996

Visual Magic
Dr. David Thomson
New York: Dial Books, 1991

Reference Frames

All in a Day
Mitsumasa Anno
New York: Philomel Books, 1986

Around the World in Eighty Days
Jules Verne
New York: William Morrow, 1988

These mathematics-related titles are organized by mathematics topics. Some titles may appear more than once.

Reference Frames (cont.)

Diary of a Church Mouse
Graham Oakley
New York: Atheneum, 1987

Pigs on a Blanket
Amy Axelrod
New York: Simon and Schuster, 1996

Somewhere Today
Bert Kitchen
Massachusetts: Candlewick Press, 1994

Time for Horatio
Penelope Colville Paine
California: Advocacy Press, 1990

Following are some suggestions that will enable you to share in your child's experiences in learning mathematics and help you to create an environment in your home that provides encouragement for your child.

- Ask your child to explain the concepts and relationships he/she is studying. Be concerned with the process as well as the end result. Explaining thoughts often helps children to clarify their thinking and their understanding.
- When your child has a question, try not to tell him/her how to solve the problem. Rather, ask questions that will help the child to think about the problem in a different way, thus helping the child to reach a solution.
- Encourage your child to draw diagrams, models, or sketches to help understand or explain a concept or problem.
- Provide a special time and place for study that will not be disrupted by other household activities.
- Play math games with your child. Some appropriate grade level games are included in this manual. You might also ask your child to teach you a game that he/she learned at school.
- Show interest in your child's experiences in math class. Ask the child to tell about his/her class activities.
- Encourage your child to form study groups with other classmates to work on assignments. By discussing their views and approaches, students provide each other with rich insights about problems and concepts.
- Engage your child in home activities that use a variety of mathematical skills. Encourage your child to use appropriate games and puzzles and to make estimations and talk about math ideas at mealtime, while traveling, while shopping, etc.
- Make triangle flash cards with your child and encourage him/her to memorize the facts. It is important that your child has mastered basic addition/subtraction facts by the end of second grade and multiplication/division facts by the end of fourth grade.
- Take advantage of opportunities to visit your child's math class.

…each time one prematurely teaches a child something he could have discovered for himself, that child is kept from inventing it and consequently from understanding it completely.

—Jean Piaget

Anchorage School District
Educating students for success in life.

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