

Grades 3-5

Mathematics

CPS Curriculum Overview

The grade 3-5 mathematics curriculum provides a foundation in the concepts of multiplication and division and begins work in fractions, decimals, and percents. Work with data is extended to include finding landmarks in the data, including the measures for central tendency and using more complex graphs. Two- and three-dimensional geometry is explored with an emphasis on building strong spatial visualization skills, including developing the concept of area. Students continue to develop pattern recognition skills in visual and numeric contexts.

Problem-solving skills are extended so that students are routinely exposed to multiple strategies for solving the same problem. The grade 3-4 mathematics learning environment encourages collaborative work as well as rich discourse about students' thinking and reasoning. Students extend their communication skills in mathematics by learning how to present an argument to their peers as well as how to summarize their thinking through writing.

By the end of grade 5 students should be comfortable with numbers to 1,000,000, know their multiplication tables to 12, and be able to multiply two and three digit numbers. They should understand the concept of division and have strategies for dividing by one- and two-digit divisors. Students should also develop comfort with representing numbers less than one in multiple ways using fractions, decimals, and percents. Students should also have developed comfort with basic concepts of probability. Most important, by the end of grade 5 students should be able to write a clear summary explaining their approach to a problem and justifying their reasoning.

Recommended Curriculum: The Investigations Curriculum [3-5] developed by TERC are the CPS adopted materials at these grade levels. Teachers are encouraged to use supplementary materials and make adaptations where they deem necessary.

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Mathematics Learning Expectations for Grade 3

I. PROBLEM SOLVING

During Grade 3, children will develop the ability to:

A. Use problem solving approaches to investigate and understand mathematical content.

They will be able to:

- Read problems accurately and identify necessary information to solve problem
- Solve problems that involve estimation

B. Formulate problems from everyday mathematical situations.

They will be able to:

- Write problems for others to solve
- Given a mathematical situation, generate a word problem

C. Develop and apply strategies for problem solving.

They will be able to:

- Identify and use multiple strategies
- Explain the solution verbally and in writing using numbers and words
- Develop their own efficient way to solve problems

D. Verify and interpret results.

They will be able to:

- Apply strategies shared by others
- Find another way to solve the same problem

II. STATISTICS AND PROBABILITY

During Grade 3, children will develop the ability to:

A. Collect, organize and describe data.

They will be able to:

- Find information in pictographs, pie graphs, line plot, list, table and bar graphs where each picture represents two or more objects
- Create labels for graphs

B. Construct, read, and interpret displays of data.

They will be able to:

- Construct a pictograph where each picture represents two or more objects both vertically and horizontally
- Create and compare pictorial and symbolic graphs that have uniform scales both vertically and horizontally
- Construct a line plot

C. Formulate and solve problems that involve collecting and analyzing data.

They will be able to:

- Make predictions as to outcome before collecting data
- Create and use one or two question in-class surveys and represent their findings with pictorial graphs
- Collect data using research

D. Explore concepts of chance.

They will be able to:

- Recognize impossible, possible and certain situations
- Make predictions from data presented in graphs

E. Use appropriate probability terms.

They will be able to:

- Use the word likely, unlikely, possible, impossible appropriately

III. MEASUREMENT

During Grade 3, children will develop the ability to:

A. Understand the attributes of length, capacity, weight, area, volume, time, and temperature.

They will be able to:

- Define and give an example of length, weight, time, area and temperature

B. Develop the process of measuring and concepts related to units of measurement.

They will be able to:

- Understand the relationship between the size of a unit and the numbers of units required
- Measure, compare, order, equalize and record several objects using standard units of measurement
- Measure volume using measuring cups and fractions of a cup
- Read a Fahrenheit and Celsius thermometer to nearest degree

C. Make and use estimates of measurement.

They will be able to:

- Tell time accurately
- Know temperature benchmarks, (body temperature, room temperature, freezing point of water)
- Establish benchmarks liquid capacity (cups, pints, half-gallons, gallons, one and two liters)
- Establish benchmarks for length (inches, feet, and yards, cm, meters)
- Know benchmarks for passage of time - timelines
- Make equivalent amounts for each coin

D. Make and use the language of measurements in problem solving and everyday situations.

They will be able to:

- Solve story problems using measurement situations
- Tell time accurately to the minute
- Read a thermometer
- Read a calendar and give appropriate number dates for two weeks from today, tomorrow and yesterday
- Represent in multiple ways, name, value of, and write amounts to \$1.00
- Make change by "counting on" for amounts to \$1.00

IV. PATTERNS, RELATIONS and FUNCTIONS

During Grade 3, children will develop the ability to:

A. Recognize, describe, extend and create a wide variety of patterns.

They will be able to:

- Identify and generalize shape and number patterns
- Construct symmetrical patterns
- Create patterns where core repeats
- Create patterns where core grows

B. Represent and describe mathematical relationships.

They will be able to:

- Organize data in a pattern
- Identify number patterns on the 100 chart
- Use a given fact ($6 + 7 = 13$) to understand that $16 + 7 = 23$
- Describe the characteristics of odd and even numbers and how they behave when combined
- Describe the relationship between skip counting and grouping

C. Explore the use of variable and open sentences to express relationships.

They will be able to:

- Identify rules and complete tables

D. Use patterns and relationships to analyze mathematical situations.

They will be able to:

- Describe ways to find missing components in number sentences
- Solve problems with missing components

V. GEOMETRY AND SPATIAL SENSE

During Grade 3, students will develop the ability to:

A. Describe, model, draw, and classify shapes.

They will be able to:

- Perform geometric transformations (flips, slides, turns) with concrete objects
- Identify and describe solids; cylinders, cubes, cones
- Identify an angle in a figure
- Identify triangles and quadrilaterals using sides and angles

B. Investigate and predict the results of combining, subdividing, and changing shapes.

They will be able to:

- Discuss and record designs made from combining or subdividing shapes

C. Develop spatial sense.

They will be able to:

- Locate points on the intersection of grid lines
- Describe location of an object in relation to another (right, left, north, south)

D. Relate geometric ideas to number and measurement ideas.

They will be able to:

- Divide geometric shapes into equal parts
- Make arrays for multiplication facts

E. Recognize and appreciate geometry in their world.

They will be able to:

- Describe common geometric figures when given real world objects

VI. FRACTIONS AND DECIMALS

During Grade 3, children will develop the ability to:

A. Develop concepts of fractions, mixed numbers, and decimals.

They will be able to:

- Notice the relationship between fractions and division
- Find a fractional part of a group or whole by dividing
- Use conventional fractional words and notation
- Identify a decimal point on a calculator and in print denoting money
- Read mixed numbers

B. Develop number sense for fractions and decimals.

They will be able to:

- Order fractions with like denominators using pictures
- Understand that the relationships that occur between 0 and 1 occur between any consecutive whole numbers

C. Use models to relate fractions to decimals and to find equivalent fractions.

They will be able to:

- Identify equivalent fractions to tenths using pictures and models
- Relate notation for common fractions with notation for decimals on the calculator ($1/10 = 10 \frac{1}{4} = .25$)
- Notice relationships among halves, fourths, and eighths and then thirds and sixths, understanding as the denominator increases and the amount decreases

D. Apply fractions and decimals to problem situations.

They will be able to:

- Identify situations in which fractions and decimals are used in the real world (weights, batting averages and stopwatches)
- Read, write, and use common fractions and decimals
- Explain thinking orally, pictorially, and/or in writing

VII. NUMBER SENSE AND NUMERATION

During Grade 3, children will develop the ability to:

A. Construct number meaning through real world experiences and use of physical materials.

They will be able to:

- Solve addition and subtraction problems using symbols 0-999
- Solve multiplication and division problems using concrete objects, pictures, and/or numbers

B. Understand our numeration system by relating counting, grouping, and place value concepts.

They will be able to:

- Read, write, and order numbers 0-9,999
- Count by 7's, 8's, 9's, 10's, and 11's to 100
- Be able to understand place value of numbers up to 9,999
- Read and write ordinal numbers from first to twentieth
- Add 10's and 100's to numbers 0-999

C. Develop number sense.

They will be able to:

- Express a number in many ways 0-999
- Round numbers to nearest tens and hundredths
- Recognize "landmarks" numbers
- Count forward and backward from a given number 0-999
- Recognize even and odd numbers

D. Interpret the multiple uses of numbers in the real world.

They will be able to:

- Use ordinal numbers to twentieth appropriately
- Write story problems using addition, subtraction, and/or multiplication
- Identify number relationships in the context of time, money, and linear measure

VIII. WHOLE NUMBER OPERATIONS

During Grade 3, children will develop the ability to:

A. Develop meaning for the operations by modeling and discussing a rich variety of problem situations.

They will be able to:

- Model basic multiplication facts with concrete objects or pictures (or arrays)
- Model basic division facts with concrete objects or pictures
- Understand the relationship between addition and multiplication
- Understand the relationship between addition and subtraction

B. Relate the mathematical language and symbolism of operations to problem situations and informal language.

They will be able to:

- Write a (number) sentence to match a story problem (all operations)
- Write and illustrate a story to match a number sentence (all operations)
- Use the language of addition, subtraction and multiplication
- Write related addition and subtraction sentences
- Find factors of a number using tiles or graph paper

C. Recognize that a wide variety of problem structures can be represented by a single operation.

They will be able to:

- Listen to and discuss stories that have multiplication and division problems

- Represent stories that have addition and subtraction problems that require joining, separating, equalizing and comparing

D. Develop operation sense.

They will be able to:

- Verbalize the relationship between repeated addition and multiplication
- Verbalize the relationship between repeated subtraction and division

IX. WHOLE NUMBER COMPUTATION

During Grade 3, children will develop the ability to:

A. Model, explain, and develop reasonable proficiency with basic facts and algorithms.

They will be able to:

- Recall basic addition facts
- Solve basic subtraction facts fluently
- Solve basic multiplication facts with products less than 50 fluently
- Add and subtract 10 to any number
- Add more than two double digit numbers
- Combine, separate, and compare quantities to 1,000 efficiently
- Subtract one-, two-, and three-digit numbers from four-digit numbers
- Multiply two-digit numbers by a single digit number using concrete objects
- Partition difficult problems to solve more easily
- Use models such as arrays, number charts, coins, and skip counting to solve multiplication problems with products to 50 and division problems with dividends to 50

B. Use a variety of mental computation and estimation techniques.

They will be able to:

- Use a variety of strategies to add and subtract numbers to 1,000 (using regrouping where needed)
- Use skip counting strategies for multiplying

C. Use calculators in appropriate computational situations.

They will be able to:

- Use calculators to explore number relationships

D. Select and use computation techniques appropriate to specific problems and determine whether the results are reasonable.

They will be able to:

- Decide whether an exact answer or an estimate is needed

X. ESTIMATION

During Grade 3, children will develop the ability to:

A. Explore estimation strategies.

They will be able to:

- Give a reasonable estimate using "landmark" numbers for numbers up to 1,000
- Use strategies to combine and compare quantities

B. Recognize when an estimate is appropriate.

They will be able to:

- Identify real world applications when estimates are made

C. Determine reasonableness of results.

They will be able to:

- Use landmark numbers (multiples of 10 and 100) in comparing or combining quantities

D. Apply estimation in working with quantities, measurement, computation, and problem solving.

They will be able to:

- Describe and justify the reasonableness of an estimation for numbers up to 1,000
- Solve problems that involve estimation

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Mathematics Learning Expectations for Grade 4

I. PROBLEM SOLVING

During Grade 4, children will develop the ability to:

A. Use problem solving approaches to investigate and understand mathematical content.

They will be able to:

- Solve problems that are without well-defined answers
- Test many alternative approaches
- Generalize solutions to other problems

B. Formulate problems from everyday mathematical situations.

They will be able to:

- Write multi-step problems for others to solve
- Teach another student how to solve a problem

C. Develop and apply strategies for problem solving.

They will be able to:

- Write and carry out a plan to solve a problem
- Draw upon a repertoire of problem solving strategies to solve a problem
- Discuss why some strategies are appropriate for certain problems

D. Verify and interpret results.

They will be able to:

- Check the solution and revise their problem solving plan, if necessary
- Find another way to solve the same problem

II. STATISTICS AND PROBABILITY

During Grade 4, children will develop the ability to:

A. Collect, organize and describe data.

They will be able to:

- Identify the appropriate graph (bar, line, or pictograph) to represent data
- Create appropriate survey questions to gather data
- Organize non-numerical data into appropriate categories
- Use the medians to compare two sets of numerical data

B. Construct, read, and interpret displays of data.

They will be able to:

- Create the appropriate graph (bar, line or pictograph) to represent data
- Analyze information represented on graphs
- Order data
- Tell what is typical of a set of data
- Write a story that matches the line graph of a plant's growth

C. Formulate and solve problems that involve collecting and analyzing data.

They will be able to:

- Identify data needed to solve a problem
- Formulate problems based on data presented in tables, charts and graphs

D. Explore concepts of chance.

They will be able to:

- Recognize likely and unlikely situations
- Make and describe predictions from data presented in graphs
- Show and record all arrangements of up to three different objects

E. Use appropriate probability terms.

They will be able to:

- Use probability words in appropriate situations (always, sometimes, never, likely, unlikely)

III. MEASUREMENT

During Grade 4, children will develop the ability to:

A. Understand the attributes of length, capacity, weight, area, volume, time, and temperature.

They will be able to:

- Define and give an example of capacity, area, volume

B. Develop the process of measuring and concepts related to units of measurement.

They will be able to:

- Measure liquids in liters and milliliters and know when each is appropriate
- Collect, graph and analyze plant growth data
- Understand the relationship between the size of a unit and the number of units required
- Measure lengths in half inches, quarter inches and centimeters
- Measure distances on maps using scale

C. Make and use estimates of measurement.

They will be able to:

- Use established benchmarks to estimate length, capacity, weight, and temperatures

- Estimate local distances in miles and tenths of miles

D. Make and use the language of measurements in problem solving and everyday situations.

They will be able to:

- Create their own measurement problems from everyday situations
- Solve measurement problems and explain their thinking
- Represent in multiple ways, name, value of and write amounts to \$10.00
- Make change by "counting on" for amounts to \$10.00

IV. PATTERNS, RELATIONS and FUNCTIONS

During Grade 4, children will develop the ability to:

A. Recognize, describe, extend and create a wide variety of patterns.

They will be able to:

- Distinguish between geometric patterns and non-pattern designs
- Extend numerical patterns

B. Represent and describe mathematical relationships.

They will be able to:

- Identify number patterns on a multiplication chart
- Use factors of 100 to understand the structure of 1000

C. Explore the use of variable and open sentences to express relationships.

They will be able to:

- Search for relationships that follow a rule

D. Use patterns and relationships to analyze mathematical situations.

They will be able to:

- Demonstrate through hands-on activities an understanding of maintaining balances in number sentences
- Explain the use of variables in number sentences

V. GEOMETRY AND SPATIAL SENSE

During Grade 4, students will develop the ability to:

A. Describe, model, draw, and classify shapes.

They will be able to:

- Perform geometric transformations (flips, slides, turns) with concrete objects and drawings
- Describe an angle
- Compare angles of different sizes

B. Investigate and predict the results of combining, subdividing, and changing shapes.

They will be able to:

- Predict the results of combining, subdividing or changing shapes with some accuracy
- Create symmetrical designs

C. Develop spatial sense.

They will be able to:

- Use positive and negative numbers to name and locate points on a grid
- Identify, describe and compare 2-D and 3-D figures presented in various orientations
- Draw 2-D representations of 3-D objects
- Construct 3-D cube configurations from 2-D drawings

D. Relate geometric ideas to number and measurement ideas.

They will be able to:

- Build rectangles to identify prime and composite numbers
- Use geometric arrays as models of multiplication

E. Recognize and appreciate geometry in their world.

They will be able to:

- Articulate the correlation of shape to function

VI. FRACTIONS AND DECIMALS

During Grade 4, children will develop the ability to:

A. Develop concepts of fractions, mixed numbers, and decimals.

They will be able to:

- Verbalize the relationship between fractions and division
- Explain that fractional parts represent equal areas of a whole
- Write mixed numbers
- Add and subtract tenths and hundredths
- Read and write decimals less than 1 to tenths and hundredths
- Read and write decimals greater than 1

B. Develop number sense for fractions and decimals.

They will be able to:

- Express a common fraction in many ways ($\frac{1}{2}$; $\frac{2}{4}$; .5)
- Tell if a fraction is closer to 0, $\frac{1}{2}$, or 1
- Order decimals using pictures
- Demonstrate the relationship between halves, fourths and eighths
- Demonstrate the relationship between thirds, sixths and twelfths
- Match common fraction and decimal equivalents

C. Use models to relate fractions to decimals and to find equivalent fractions.

They will be able to:

- Order fractions with like and unlike denominators using pictures and models
- Add and subtract fractions with like denominators using pictures and models
- Model decimals using pictures and models
- Add decimals using pictures and models
- Subtract decimals using pictures and models

D. Apply fractions and decimals to problem situations.

They will be able to:

- Use fractions and decimals to solve problems

VII. NUMBER SENSE AND NUMERATION

During Grade 4, children will develop the ability to:

A. Construct number meaning through real world experiences and use of physical materials.

They will be able to:

- Solve multiplication and division problems using pictures or symbols

B. Understand our numeration system by relating counting, grouping, and place value concepts.

They will be able to:

- Read, write, order numbers to 99,999
- Write numbers in compact and expanded notation to 99,999

C. Develop number sense.

They will be able to:

- Estimate sums, differences, and products by rounding
- Round numbers to nearest ten, hundred or thousand
- Express a number in many ways 0-9,999
- Use "landmark" numbers

D. Interpret the multiple uses of numbers in the real world.

They will be able to:

- Write story problems using addition, subtraction, multiplication and/or division
- Use real data and explain the use of numbers
- Use number relationships in the context of time, money and measurement

VIII. WHOLE NUMBER OPERATIONS

During Grade 4, children will develop the ability to:

A. Develop meaning for the operations by modeling and discussing a rich variety of problem situations.

They will be able to:

- Understand and apply the relationships of operations to solve problems ($3+3$ or 2×3)
- Model basic multiplication and division facts with pictures

B. Relate the mathematical language and symbolism of operations to problem situations and informal language.

They will be able to:

- Verbalize the effects of an operation on a pair of numbers
- Write stories that have multiplication and division situations
- Use the language of the four basic operations (addend, sum, difference, factor, multiple, product, quotient)

C. Recognize that a wide variety of problem structures can be represented by a single operation.

They will be able to:

- Represent and solve multiplication problems that combine "equal groups," "relate to arrays" (times as many) and "combination" situations (three blouses, four skirts, how many outfits?)

D. Develop operation sense.

They will be able to:

- Recognize that the same problem can be solved using different operations
- Verbalize the relationship between multiplication and division
- Recognize that the divisor cannot be 0

IX. WHOLE NUMBER COMPUTATION

During Grade 4, children will develop the ability to:

A. Model, explain, and develop reasonable proficiency with basic facts and algorithms.

They will be able to:

- Recall basic subtraction facts
- Recall basic multiplication facts 0-12
- Use the basic multiplication facts to solve basic division facts
- Add and subtract by multiples of 10 and 100
- Add more than two three-digit numbers
- Combine, separate, and compare quantities to 10,000 efficiently
- Partition difficult problems into parts involving multiples of 10, 100, 1000
- Multiply two-digit numbers by one-digit numbers
- Multiply two-digit numbers by two-digit numbers
- Divide two-digit numbers by one-digit numbers with and without remainders
- Use models such as arrays, number charts, coins, and skip counting to solve multiplication problems with products to 500 and division problems with dividends to 500

B. Use a variety of mental computation and estimation techniques.

They will be able to:

- Use mental math strategies to add, subtract, multiply, and divide
- Estimate sums and differences

C. Use calculators in appropriate computational situations.

They will be able to:

- Add and subtract very large numbers on a calculator
- Multiply and divide very large numbers on a calculator

D. Select and use computation techniques appropriate to specific problems and determine whether the results are reasonable.

They will be able to:

- Determine how they will complete a computation problem (paper-and-pencil, calculator, mental math or estimation)

X. ESTIMATION

During Grade 4, children will develop the ability to:

A. Explore estimation strategies.

They will be able to:

- Give a reasonable estimate using "landmark" numbers up to 10,000
- Reorder numbers for more efficient mental arithmetic

B. Recognize when an estimate is appropriate.

They will be able to:

- Identify the need to use exact numbers and estimates in different contexts

C. Determine reasonableness of results.

They will be able to:

- Identify acceptable intervals for good estimates

D. Apply estimation in working with quantities, measurement, computation, and problem solving.

They will be able to:

- Describe and justify the reasonableness of an estimation for numbers up to 10,000
- Use estimation to check solutions to determine reasonableness of solutions

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Mathematics Learning Expectations for Grade 5

I. PROBLEM SOLVING

A. Students will develop the ability to use problem-solving approaches to investigate and understand mathematical content.

They will be able to:

- Make a table, draw a picture, and use an organized list to solve the same mathematics problem
- Decide which operation or operations (+, -, \times , \div) will be used to solve a mathematics problem

B. Students will develop the ability to formulate problems from situations within and outside mathematics.

They will be able to:

- Create mathematics problems that arise from social studies and science curricula
- Create mathematics problems from the mathematics topic currently under study
- Use tables, graphs, and stories to represent the same event

C. Students will develop and apply a variety of strategies to solve problems, with emphasis on multi-step and non-routine problems.

They will be able to:

- Select an appropriate algorithm to use in a given problem situation
- Decide whether to use mental arithmetic, paper and pencil, or technology

- Use relationships between multiplication and division to help solve problems

D. Students will develop the ability to verify and interpret results with respect to the original problem situation.

They will be able to:

- Test the validity of student-generated hypotheses by working backwards to check a solution.
- Use estimation to determine reasonableness of results

E. Students will develop the ability to generalize solutions and strategies to new problem situations.

They will be able to:

- Determine which problem situations best match certain problem-solving strategies
- Select a strategy for solving a familiar problem in a new context

F. Students will develop the ability to acquire confidence in using mathematics meaningfully.

They will be able to:

- Actively participate in cooperative group problem-solving situations where teacher input is minimal
- Apply computational skills to more difficult problems, including both numeric and situational problems

II. NUMBER RELATIONSHIPS

A. Students will develop the ability to understand, represent, and use numbers in a variety of equivalent

forms (integer, fraction, decimal, percent, exponential and scientific notation) in real-world and mathematical problem situations.

They will be able to:

- Use a protractor to measure angles of incidence and reflection and note equivalence
- Make and read line, bar, or circle graphs, e.g., for use with expenditures, weather data, sports data
- Read and infer general information from keys, indices, tables, graphs, as found in almanacs and atlases
- Compare the data from a sample to the data in a larger population using fractions, decimals, and percents

B. Students will develop number sense for whole numbers, fractions, decimals, integers, and rational numbers.

They will be able to:

- Show understanding of place value by reading numbers less than 999,999
- Read, write, and pictorially represent fractions (e.g. by using regions or pieces)
- Write equivalent fractions
- Compare to see which are equivalent fractions
- Draw pictorial representations of equivalent fractions using regions or pieces
- Develop strategies for using known factor pairs to find equivalent factor pairs
- Demonstrate familiarity with factor pairs of 1000
- Develop a sense of the magnitude of 10,000
- Find pairs of 3-digit numbers that sum to 1000 or near 1000
- Understand relationships among place values up to the thousands place
- Develop a sense of the size of 1,000,000

C. Students will develop the ability to understand and apply ratios, proportions and percents in a wide variety of situations.

They will be able to:

- Recognize and use percentages in grading and on tests, e.g., 100%, 50%, 25%, 20%, 0%
- Express the relationship between two values in ratio form
- Write ratios in three formats: standard (a:b), fractional (a/b), and percent ($([a/b] \times 100)$)
- Use fractions and percentages to understand categorical and numerical data

D. Students will develop the ability to investigate relationships among fractions, decimals and percents

They will be able to:

- Use a calculator or a grid to convert scores on class work to decimals, and then to percentages
- Name as a fraction the pictorial representation of parts of a whole
- Use money to understand fractions, decimals, percentages
- one quarter = $1/4 = .25 = 25\%$
- one half = $1/2 = .50 = 50\%$
- three quarters = $3/4 = .75 = 75\%$

E. Students will develop the ability to represent numerical relationships in one- and two-dimensional graphs.

They will be able to:

- Use manipulatives such as string, maps, etc. to calculate distance
- Use a time line to see the relationship between then and now
- Draw pictures using ordered pairs in a coordinate system

- Make tables and graphs to display number patterns

III. SYSTEMS AND NUMBER THEORY

A. Students will develop the ability to understand and appreciate the need for numbers beyond the whole numbers.

They will be able to:

- Use simple fractions and decimal fractions to represent parts of a whole

B. Students will develop and use order relations for whole numbers, fractions, decimals, integers, and rational numbers.

They will be able to:

- Order whole numbers less than 1 million as well as fractions and decimal fractions as small as hundredths

C. Students will develop the ability to extend their understanding of whole number operations to fractions, decimals, integers, and rational numbers

They will be able to:

- Perform addition and subtraction with fractions
- Add and subtract decimal fractions

D. Students will develop the ability to understand how the basic arithmetic operations are related to one another.

They will be able to:

- Solve problems in which basic operations can be interchanged, i.e., addend + addend = sum, sum - addend = addend; factor x factor = product, product ÷ factor = factor
- Validate solutions to problems using a related operation
- Use relationships between multiplication and division to help solve problems

E. Students will develop and apply number theory concepts, e.g., primes, factors, and multiples) in real-world and mathematical problem situations.

They will be able to:

- Understand the role of powers of ten in our number system
- Identify a prime number less than 100
- Find all the factors of any number less than 100, using a calculator
- Describe numbers and number relationships with mathematical terms such as factor, multiple, prime and square
- Represent factor pairs as dimensions in a rectangular array
- Reason about number characteristics such as factor, multiple, prime and square
- Demonstrate familiarity with skip-counting patterns (25, 50, 75...)

IV. COMPUTATION AND ESTIMATION

A. Students will develop the ability to compute with whole numbers, fractions, decimals, integers, and rational numbers.

They will be able to:

- Use an efficient algorithm for multiplication (up to 2-digit numbers) and division of whole numbers with one-digit divisors
- Develop, record, and compare strategies for solving multiplication and division problems
- Multiply common fractions by a whole number, and add and subtract mixed numbers with like denominators
- Add and subtract decimals using correct placement of the decimal point

B. Students will develop, analyze, and explain procedures for computation and techniques for estimation.

They will be able to:

- Set up and explain the algorithms for multiplication (up to 2-digit numbers), and division of whole numbers with one-digit divisors
- Estimate the range of a product and quotient
- Round off to estimate
- Work left to right to estimate
- Use multiples of 10 to estimate
- Compare relationship between fractions and equivalent decimals by using illustrations

C. Students will develop, analyze, and explain methods for solving proportions.

They will be able to:

- Use concrete materials such as fraction bars to demonstrate proportional relationships

D. Students will select and use an appropriate method for computing from among mental arithmetic, paper-and-pencil, calculator, and computer methods.

They will be able to:

- Develop, explain, and compare strategies for finding exact answers or estimates to multiplication and division problems
- Decide if an exact answer is required, or if an estimate is sufficient, when given a problem situation
- Decide which tool is most efficient -- mental arithmetic, paper and pencil, calculator, or computer, once the above determination is made

E. Students will use computation, estimation, and proportions to solve problems.

They will be able to:

- Apply operations using whole numbers and fractions in problem-solving contexts

F. Students will use estimation to check the reasonableness of results.

They will be able to:

- Validate answers by checking actual solutions against estimates

V. PATTERNS AND FUNCTIONS

A. Students will describe, extend, analyze, and create a wide variety of patterns.

They will be able to:

- Recognize landmark numbers to 10,000
- Find and create patterns across the topics
- Recognize patterns in an arithmetic sequence
- Use the language of speed and motion to describe number patterns (distance, rate, and time)

B. Students will describe and represent relationships with tables, graphs, and rules.

They will be able to:

- Generate data
- Represent data in bar and line graphs and in tables
- Make tables and graphs to display number patterns
- Represent motion with number tables, graphs, and verbal descriptions
- Explore the relationships among time, distance, and speed

C. Students will analyze functional relationships to explain how a change in one quantity results in a change in another.

They will be able to:

- Explain how change in variables affects patterns
- Build designs that change in a regular way

- Build designs that grow according to number patterns
- Connect slope in a graph with rate of change
- Compare relative motions

D. Students will use patterns and functions to represent and solve problems.

They will be able to:

- Use and understand landmark numbers, as well as patterns in multiples and factors to solve problems

VI. ALGEBRA

A. Students will understand the concepts of variable, expression, and equation.

They will be able to:

- Identify a variable and express it in a number sentence or expression
- Write a rule for an arithmetic sequence, identifying the input number as a variable

B. Students will represent situations and number patterns with tables, graphs, verbal rules, and equations and explore the interrelationships of these representations.

They will be able to:

- Identify a pattern and represent it mathematically in an equation
- Construct a table showing how the numbers in a pattern are determined
- Explore relationships among distance, time, and speed
- Explore ways that speed, time, and distance can be represented with tables, graphs, stories, and informal representations

C. Students will analyze tables and graphs to identify properties and relationships.

They will be able to:

- Read a table and/or graph and find relationships within the data
- Interpret intervals in a table as reflecting speed
- Interpret steepness in a distance/time graph as reflecting speed
- Associate tables, graphs, and stories of the same event

D. Students will develop confidence in solving linear equations using concrete, informal and formal methods.

They will be able to:

- Create and solve linear equations using real-life examples and mathematical notation
- Describe with diagrams, block arrangements or symbols the changes in an arithmetic sequence
- Find the nth term in a series by stating a "rule" for this sequence

E. Students will investigate inequalities and non-linear equations informally.

They will be able to:

- not applicable

F. Students will apply algebraic methods to solve a variety of real-world and mathematical problems.

They will be able to:

- Explore irregular increase and decrease in step size and total

VII. STATISTICS

A. Students will systematically collect, organize, and describe data on paper and electronically.

They will be able to:

- Gather data from measurements, scale drawings, and random samples
- Collect and collate data from survey questions

- Collect and examine data that involve more than one variable
- Use line plots to represent data sets
- Compare two data sets
- Find medians and other fractional parts of data sets
- Make statements based on the data
- Look for associations and develop theories based on data

B. Students will construct, read, and interpret tables, charts, and graphs.

They will be able to:

- Read a line graph
- Read vertical and horizontal bar graphs
- Make hypotheses based on comparisons of two data sets
- Make representations of numerical and categorical variables
- Make recommendations based on interpretation of the data

C. Students will make inferences and convincing arguments that are based on data analysis.

They will be able to:

- Describe data in their own words
- Enter and analyze data in a computer database

D. Students will evaluate arguments that are based on data analysis.

They will be able to:

- Identify graphs with errors or misrepresentations (i.e. bar vs. line graph, and bars truncated to distort data)

E. Students will develop an appreciation for statistical methods as powerful means for decision-making.

They will be able to:

- Use data to describe the world around us in numerical terms
- Investigate and communicate data about trends in areas such as music, movies, fashion and sports
- Use data characteristics to compare a sample with a larger population

VIII. PROBABILITY

A. Students will model situations by devising and carrying out experiments or simulations to determine probabilities.

They will be able to:

- Find the theoretical probability of equally-likely events
- Conduct a probability experiment (such as flipping a coin 50 times)
- Determine the probability of rolling a given number with different polyhedra dice
- Analyze group data in terms of general features such as center and spread

B. Students will model situations by constructing a sample space to determine probabilities.

They will be able to:

- Divide the area of a rectangle into fractional parts to model a probability problem (i.e. coin flipping 50 times)
- Record results of probability experiments on line plots
- Compare line plots by examining general features

C. Students will appreciate the power of using a probability model by comparing experimental results with mathematical expectations.

They will be able to:

- Use a probability line to predict how often an event will happen in a given number of trials

- Compare the results of an experiment with its theoretical probability

D. Students will make predictions that are based on experimental or theoretical probabilities.

They will be able to:

- Use data from real-life problems such as weather forecasts to make decisions as to proper clothing, chances for having outdoor events, etc.
- Infer a theoretical probability from looking at a spinner divided into sectors
- Compute an expected number from a probability
- Predict and analyze features of distributions, including center and variability

E. Students will develop an appreciation for the pervasive use of probability in the real world.

They will be able to:

- Recognize ways people depend on probability to make decisions (i.e. stocking clothing sizes in a store, determining length of traffic lights, deciding when certain TV shows will be aired, selecting what types of commercials are appropriate for which programs and times)
- Understand that fairness of a game means an equal probability of winning or losing
- Apply knowledge of probability to design a fair game
- Distinguish between games of chance and games of skill

IX. GEOMETRY

A. Students will identify, describe, compare and classify geometric figures.

They will be able to:

- Distinguish between polygons and shapes that are not polygons
- Recognize polygons by the number of sides
- Draw polygons
- Describe a cube or rectangular prism in terms of its attributes, i.e., perpendicularity, parallelism, number of faces, number of edges or sides

B. Students will visualize and represent geometric figures with special attention to developing spatial sense.

They will be able to:

- Identify the attributes of a drawing of a square, rectangle, cube, rectangular prism, or triangle
- Make a construction of a square, rectangle, triangle, cube or rectangular prism, using manipulatives
- Make a drawing of a square, rectangle, triangle, cube, or rectangular prism, with paper/pencil or computer
- Use the computer commands to write a procedure for drawing a polygon (Geo-Logo)
- Use the computer commands to write a procedure for drawing geometric figures with specific properties (Geo-Logo)
- Distinguish between turns and angles
- See the relationships between turns and angles

C. Students will explore transformations of geometric figures.

They will be able to:

- Find lines of symmetry for triangles, squares, rectangles
- Identify the midpoint of sides of triangles, squares, rectangles
- Locate points on a coordinate grid

D. Students will represent and solve problems using geometric models.

They will be able to:

- Use fraction manipulatives to add, subtract and multiply fractions
- Use area model to solve multiplication problems involving fractions

E. Students will develop the ability to understand and apply geometric properties and relationships.

They will be able to:

- Use paper/pencil, straws, sticks, rods, or computer construction to demonstrate that within a triangle, the largest side is opposite the largest angle

F. Students will develop an appreciation of geometry as a means of describing the physical world.

They will be able to:

- Examine flowers, butterflies, faces, patterns in art, or letter/number patterns such as palindromes to determine line of symmetry
- Determine the relationship between the number of cubes that fill a rectangular box and the dimensions of the box

X. MEASUREMENT

A. Students will extend their understanding of the process of measurement.

They will be able to:

- Find benchmarks for foot, meter, minute, pound, kilogram, liter and cup
- Use the appropriate system of measurement in a real-life problem situation (i.e., length, area, or volume)
- Use cubes to determine volume of rectangular containers
- Identify units as either metric or U.S. standard

B. Students will estimate, make, and use measurements to describe and compare phenomena..

They will be able to:

- Use tools to measure length, weight, liquid, quantity, and duration of time
- Assign a standard measurement to a given shape (i.e. angle, polygon, rectangular prism).
- Compare unit sizes and explain which is larger: cubic inch or cubic centimeter? cubic inch or cubic foot?
- Compare the relative sizes of U.S. standard and metric measures of weight and liquid quantity
- Measure weight with a balance scale and weights (both metric and U.S. standard
- Measure liquid quantity with a liter measure marked in milliliters

C. Students will select appropriate units and tools to measure to the degree of accuracy required in a particular situation.

They will be able to:

- Use standard and metric rulers to measure lengths to the nearest sixteenth of an inch and to the nearest millimeter
- Use a trundle wheel to measure lengths to the nearest foot or meter
- Determine the most appropriate unit of measurement for specific contexts (i.e. would you measure the volume of a wastebasket in cubic centimeters or cubic meters?)
- Use a protractor to assign a standard measurement to a given angle
- Use a protractor to construct a standard angle measurement

D. Students will understand the structure and use of systems of measurement.

They will be able to:

- Use a thermometer to measure temperature changes above and below zero in Fahrenheit and Celsius temperatures
- On a number line, draw arrows to represent changes in temperature
- Develop vocabulary for units of time
- Develop benchmarks for minutes and for years
- Decide on, construct, and visualize appropriate units of volume for measuring a large-scale space, such as a classroom

E. Students will extend their understanding of the concepts of perimeter, area, volume, angle measure, capacity, and weight and mass.

They will be able to:

- Estimate and calculate the volume of prisms in standard and metric units
- Find the perimeter and area of irregular polygons composed of multiple rectangles
- Develop a sense of volume as the amount of space something takes up or the amount a container can hold
- Develop meaningful methods for determining the number of volume units that fit in a solid shape -- that is, methods that can be visualized, explained, and justified

F. Students will develop the concepts of rates and other derived and indirect measurements.

They will be able to:

- Use measurement conversions (minutes to hours to days) in the problem-solving process

G. Students will develop formulas and procedures for determining measures to solve problems.

They will be able to:

- Develop formulas for area, perimeter, and volume of rectangular prisms, and apply these formulas to real-life problems such as the area of the parts of boxes, the capacity of boxes, or the total wall space of rooms.
- Determine methods for using standard units of volume to measure non-rectangular solids

This is the end of the Grades 3-5 Mathematics Curriculum Overview, Cambridge P