

# Grades K-2

## Mathematics CPS Curriculum Overview

The K-2 mathematics curriculum provides a foundation in counting, numeration and place value, and addition and subtraction. It also begins the process of sorting and representing data using simple graphs, as well as introducing students to the properties of basic geometric shapes and simple measurement tools. Most central to the K-2 mathematics curriculum is the concept of pattern. Students learn to recognize, describe, extend, and create a wide variety of patterns. It is this work with pattern that provides the foundation for mathematical thinking and reasoning. Students explore numerical patterns in the hundred chart, geometrical patterns with pattern and attribute blocks, and patterns in their environment.

Students are nurtured as problem-solvers in the primary grades. They are encouraged to talk and write about how they tried to solve a problem, as well as show their work with pictures, symbols, or numbers. They are also encouraged to listen to others share different strategies to solve the same problem. The mathematics experience of primary students will be rich in communication about different ways of thinking about the same problem. Students are encouraged to ask questions, make comparisons, and seek out patterns and relationships in their own work and that of their classmates. These mathematics problem-solving strategies are consistent with the strategies used to develop strong literacy skills.

By the end of second grade students should be comfortable with numbers to 1000, and be able to work with two digit numbers in addition and subtraction contexts. They should have a good spatial sense from sorting, classifying, and designing with basic geometric shapes as well as be able to use standard units for measuring length and weight. In addition, students should have developed good mental math skills for estimation. Most important, by the end of grade 2 a student should have a variety of strategies for problem solving and communicating their approach to solving a problem.

**Recommended Curriculum: The Investigations Curriculum [K-2] 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.**



## Mathematics Learning Expectations for Kindergarten

### I. PROBLEM SOLVING

During Kindergarten, children will develop the ability to:

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

They will be able to:

- Generate solutions
- Make comparisons

#### B. Formulate problems from everyday mathematical situations.

They will be able to:

- Notice situations in which a problem exists

#### C. Develop and apply strategies for problem solving.

They will be able to:

- Use manipulatives to solve problems
- Express a possible solution to a problem verbally
- Illustrate a possible solution

#### D. Verify and interpret results.

They will be able to:

- Talk about what happened when they tried to solve a problem

### II. STATISTICS AND PROBABILITY

During Kindergarten, children will develop the ability to:

#### A. Collect, organize and describe data.

They will be able to:

- Count, sort, and classify objects, persons and things

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

They will be able to:

- Use picture graphs with some consistency

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

They will be able to:

- Experience situations in which data can be collected

### III. MEASUREMENT

During Kindergarten, children will develop the ability to:

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

They will be able to:

- Identify an attribute by comparing objects

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

They will be able to:

- Measure, compare and order several objects using a non-standard unit (cubes, popsicle sticks) of length or weight

#### C. Make and use estimates of measurement.

They will be able to:

- Estimate lengths of objects using non-standard measurement units

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

They will be able to:

- Use conventional terms for time appropriately (yesterday, today, tomorrow)
- Use appropriate language to describe length (long, short, tall), weight (heavy, light) and volume (more, less, empty, full)
- Use appropriate language to compare distance (near, far) (long, short) and speed (fast, slow)
- Use the names of seasons, months and days of the week
- Read digital clocks to the hour

**IV. PATTERNS, RELATIONS and FUNCTIONS**

During Kindergarten, children will develop the ability to:

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

They will be able to:

- Identify, copy, describe, extend and create color, size, or type-of-object(dog, cat, dog, cat, dog, cat.....) patterns

**B. Represent and describe mathematical relationships.**

They will be able to:

- Notice patterns found in the real world
- Record patterns

**V. GEOMETRY AND SPATIAL SENSE**

During Kindergarten, students will develop the ability to:

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

They will be able to:

- Classify objects according to shape
- Find and name circles, squares, triangles and rectangles
- Notice 2-D and 3-D objects

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

They will be able to:

- Cover given shapes with other shapes

**C. Develop spatial sense.**

They will be able to:

- Understand directional words (up, down, forward, sideways, backward)
- Understand position and distance words (over, under, near, far)

**D. Relate geometric ideas to number and measurement ideas.**

They will be able to:

- Sort by shape or size

**E. Recognize and appreciate geometry in their world.**

They will be able to:

- Describe common shapes when given pictures and real world objects

**VI. FRACTIONS AND DECIMALS**

During Kindergarten, children will develop the ability to:

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

They will be able to:

- Identify shapes having two equal parts

**VII. NUMBER SENSE AND NUMERATION**

During Kindergarten, children will develop the ability to:

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

They will be able to:

- Represent numbers with concrete objects 0-10

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

They will be able to:

- Count forward 0-20
- Count backward 10-0
- Read and order numbers 0-20
- Count objects with one-to-one correspondence 0-9
- Write numbers 0-10
- Group objects by a given number 0-10

**C. Develop number sense.**

They will be able to:

- Identify numbers before, after and in-between 0-20
- Demonstrate a reasonable sense of numbers relevant to their everyday lives (class size, number of items in a jar)

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

They will be able to:

- Tell a story using numbers 0-6

**VIII. WHOLE NUMBER OPERATIONS**

During Kindergarten, 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 addition by joining sets of 0-9 concrete objects
- Model subtraction as take-away and comparison with 0-9 concrete objects

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

They will be able to:

- Listen to and discuss stories that have addition and subtraction problems

**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 addition and subtraction problems

**IX. WHOLE NUMBER COMPUTATION**

During Kindergarten, children will develop the ability to:

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

They will be able to:

- Add sums to 6 using concrete objects and pictures
- Subtract from numbers up to 6 using concrete objects and pictures
- Use "counting on" by 1 as a rote addition strategy for numbers 0-10 (choral recitation)
- Use "counting back" by 1 as a rote subtraction strategy for number 0-6 (choral recitation)
- Understand and use the terms "add" and "take away"

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

They will be able to:

- Understand and use the terms "predict" and "estimate"

**C. Use calculators in appropriate computational situations.**

They will be able to:

- Reproduce number 0-20 on a calculator

**X. ESTIMATION**

During Kindergarten, children will develop the ability to:

**A. Explore estimation strategies.**

They will be able to:

- Recognize opportunities to estimate

# 1

## Mathematics Learning Expectations for Grade 1

### I. PROBLEM SOLVING

During Grade 1, children will develop the ability to:

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

They will be able to:

- Generate solutions and elaborate on ideas
- Make comparisons and point out relationships

#### B. Formulate problems from everyday mathematical situations.

They will be able to:

- Describe situations in which a problem exists verbally

#### C. Develop and apply strategies for problem solving.

They will be able to:

- Break down tasks into simpler tasks
- Recognize more than one solution to a problem

#### D. Verify and interpret results.

They will be able to:

- Talk or write about how they tried to solve a problem
- Test possible solutions to a problem
- Show work with pictures and numbers

### II. STATISTICS AND PROBABILITY

During Grade 1, children will develop the ability to:

#### A. Collect, organize and describe data.

They will be able to:

- Identify and describe attributes of various materials
- Use an attribute as a basis for sorting and categorizing a variety of objects
- Describe data qualitatively and quantitatively

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

They will be able to:

- Use tally marks
- Read bar graphs and answer simple questions about the data
- Use concrete and pictorial representations of the same data
- Construct vertical bar graphs using concrete objects
- Present data to others in a way that communicates information clearly
- Explain and interpret results of surveys

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

They will be able to:

- Conduct surveys with classmates
- Develop strategies to guess someone else's sorting rule

#### D. Explore concepts of chance.

They will be able to:

- Use spinners and dice

### III. MEASUREMENT

During Grade 1, children will develop the ability to:

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

They will be able to:

- Describe an object in terms of its attribute

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

They will be able to:

- Understand the need for standard units of measurement
- Read the weight from a simple scale
- Measure, compare, order, equalize and record several objects using a non-standard unit of length or weight
- Learn to use a balance

**C. Make and use estimates of measurement.**

They will be able to:

- Estimate and determine length and weight of objects in non-standard units

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

They will be able to:

- Use measurement words to describe attributes in their world
- Identify measurement instruments (calendar, clock, rulers, scales, thermometers)
- Read digital and analog clocks to the half hour
- Use a calendar to find today's date
- Identify coins and their values

**IV. PATTERNS, RELATIONS and FUNCTIONS**

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

They will be able to:

- Identify, describe, extend, and create direction, orientation and patterns in number relationships with concrete objects or pictures

**B. Represent and describe mathematical relationships.**

They will be able to:

- Describe patterns found in the real world
- Predict components that are missing

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

They will be able to:

- Write number sentences

**V. GEOMETRY AND SPATIAL SENSE**

During Grade 1, students will develop the ability to:

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

They will be able to:

- Describe 2-D and 3-D objects
- Recognize and construct open and closed paths
- Draw a straight line
- Make circles, squares, triangles, and rectangles
- Describe circles, triangles, squares, using the attributes of numbers of sides and corners

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

They will be able to:

- Find objects with symmetry

**C. Develop spatial sense.**

They will be able to:

- Follow simple orientation directions for moving themselves and objects

#### **D. Relate geometric ideas to number and measurement ideas.**

They will be able to:

- Sort shapes using the attribute of numbers of sides and corners
- Estimate which container holds more

#### **E. Recognize and appreciate geometry in their world.**

They will be able to:

- Use geometric words to describe shapes in their world

### **VI. FRACTIONS AND DECIMALS**

During Grade 1, children will develop the ability to:

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

They will be able to:

- Notice fractions and decimals in everyday and mathematical situations
- Listen to stories about partitioning situations
- Notice a shape that shows one-half, one-third, one-fourth
- Notice halves, thirds and fourths

#### **B. Develop number sense for fractions and decimals.**

They will be able to:

- Order ( $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ ) fractions using concrete objects

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

#### **D. Apply fractions and decimals to problem situations.**

They will be able to:

- Use recipes that have simple fractions
- Listen to stories that use simple fractions

### **VII. NUMBER SENSE AND NUMERATION**

During Grade 1, 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 with concrete objects or pictures
- Represent numbers 0-50 with concrete objects

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

They will be able to:

- Count forward 0-100
- Count backward 100-0
- Read, write and order numbers 0-100
- Identify tens and ones in two-digit numbers
- Group by tens

#### **C. Develop number sense.**

They will be able to:

- Recognize a number as the sum of two other numbers 0-20

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

They will be able to:

- Write story problems for others to solve using numbers 0-20

### **VIII. WHOLE NUMBER OPERATIONS**

During Grade 1, 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 addition by joining sets of 0-20 with concrete objects
- Model subtraction as take-away, comparison and negation with 0-20 concrete objects
- Model addition with and without regrouping with concrete objects

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

They will be able to:

- Tell a story to match an addition sentence
- Tell a story to match a subtraction sentence

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

They will be able to:

- Tell and discuss stories that have addition and subtraction problems
- Write addition and subtraction sentences using numbers 0-20

**D. Develop operation sense.**

They will be able to:

- Relate addition and subtraction using families of facts up to 10
- Use the commutative property of addition

**IX. WHOLE NUMBER COMPUTATION**

During Grade 1, children will develop the ability to:

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

They will be able to:

- Add pairs of single-digit numbers up to  $9+9$ , in vertical and horizontal form and record sums using concrete objects, pictures or symbols
- Subtract up to  $18-9$ , in vertical and horizontal form and record the difference using concrete objects, pictures or symbols
- Count by tens (starting at zero)

- Add tens using concrete objects, pictures or symbols
- Add tens and ones without regrouping using concrete objects, pictures or symbols
- Subtract tens and ones without regrouping
- Add three numbers using concrete objects, or pictures

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

They will be able to:

- Use "counting on" by 1, 2, or 3 as a rote addition strategy (choral recitation)
- Use "counting back" by 1, 2, 3 as a rote subtraction strategy (choral recitation)
- Use "counting up" as a subtraction strategy
- Use "counting back" by 1, 2, or 3 as a rote subtraction strategy
- Use doubles as a rote addition strategy to ten
- Use "making 10" as a rote addition strategy for solving addition problems
- "Count on" by tens by rote

**C. Use calculators in appropriate computational situations.**

They will be able to:

- Reproduce numbers 50-100 on a calculator

**X. ESTIMATION**

During Grade 1, children will develop the ability to:

**A. Explore estimation strategies.**

They will be able to:

- Estimate the number of objects 0-100 in a set and explain their thinking

# 2

## Mathematics Learning Expectations for Grade 2

### I. PROBLEM SOLVING

During Grade 2, children will develop the ability to:

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

They will be able to:

- Explain problem solving strategy

#### B. Formulate problems from everyday mathematical situations.

They will be able to:

- Write situations in which a problem exists
- Formulate question for a given problem
- Formulate a problem for a given question

#### C. Develop and apply strategies for problem solving.

They will be able to:

- Use manipulatives or drawings to solve problems
- Identify one strategy by name (guess and check, make a list)
- Use numbers to explain strategy

#### D. Verify and interpret results.

They will be able to:

- Listen to others share different strategies to solve the same problem
- Write about what happens when they solve a problem
- Test and evaluate possible solutions

### II. STATISTICS AND PROBABILITY

During Grade 2, children will develop the ability to:

#### A. Collect, organize and describe data.

They will be able to:

- Find information in simple bar graphs and pictographs

- Collect data from surveys

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

They will be able to:

- Construct a bar graph on graph paper
- Construct a pictograph where each picture represents one unit
- Record data in tables or lists
- Realize that scale is uniform

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

They will be able to:

- Create problems that require data collection

**D. Explore concepts of chance.**

They will be able to:

- Make conjectures using spinners, dice and coins

### **III. MEASUREMENT**

During Grade 2, children will develop the ability to:

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

They will be able to:

- Compare objects in terms of their attributes

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

They will be able to:

- Use standard units of measurement
- Measure length to nearest inch or centimeter
- Read the weight from a simple scale to nearest ounce, pound, grams or kilograms
- Label and use metric and English rulers

**C. Make and use estimates of measurement.**

They will be able to:

- Establish lengths and weights of objects in standard units

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

They will be able to:

- Tell stories using measurement situations
- Read analog clock to the quarter hour
- Construct a clock

- Construct a calendar
- Read and write time in digital notation
- Make equivalent amounts for nickels and dimes represent in multiple ways, name the value and write amounts to \$.25
- Make change by "counting on" for amounts to \$.25

#### **IV. PATTERNS, RELATIONS and FUNCTIONS**

During Grade 2, children will develop the ability to:

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

They will be able to:

- Identify core of patterns and determine whether core repeats or core grows
- Build a pattern by repeating a unit square

##### **B. Represent and describe mathematical relationships.**

They will be able to:

- Recognize basic number facts as a number sequence of patterns
- Describe the relationship between parts and wholes in addition and subtraction

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

They will be able to:

- Solve equations when one of the components (sum, difference or addend 0-20) is replaced by a box

##### **D. Use patterns and relationships to analyze mathematical situations.**

They will be able to:

- Investigate ways to find missing components in number sentences

#### **V. GEOMETRY AND SPATIAL SENSE**

During Grade 2, students will develop the ability to:

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

They will be able to:

- Construct and describe common geometric figures
- Identify and construct 3-D objects
- Identify and describe solids, (cylinders, cubes, cones, pyramids)
- Identify triangles and quadrilaterals as classes of shapes

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

They will be able to:

- Discuss and record designs made from combining shapes

- Divide rectangles into equal parts
- Create symmetrical designs
- Identify lines of symmetry

**C. Develop spatial sense.**

They will be able to:

- Give simple orientation directions to others
- Identify, describe, and compare 2-D and 3-D figures presented in various orientations and in the environment
- Investigate mirror images of shapes

**D. Relate geometric ideas to number and measurement ideas.**

They will be able to:

- Compare capacities of differently shaped containers and estimate their volume using manipulatives
- Describe spatial and numerical relationships found among shapes

**E. Recognize and appreciate geometry in their world.**

They will be able to:

- Identify common geometric figures when given pictures, words, and real world objects (circle, cones, cubes)

**VI. FRACTIONS AND DECIMALS**

During Grade 2, children will develop the ability to:

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

They will be able to:

- Identify fractions and decimals in everyday and mathematical situations
- Recognize symbol  $1$  or  $1/2$
- $2$
- Identify a shape that shows one-half, one-third, one-fourth
- Identify halves, thirds and fourths

**B. Develop number sense for fractions and decimals.**

They will be able to:

- Order fractions using concrete objects

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

They will be able to:

- Recognize that if a fractional shape exactly covers another, the two are equivalent

**D. Apply fractions and decimals to problem situations.**

They will be able to:

- Tell a story using simple fractions
- Divide rectangles and circles into halves and fourths
- Divide a rectangular object into thirds
- Divide groups of objects into halves, thirds, fourths
- Use the symbol  $\frac{1}{2}$  or  $\frac{1}{22}$
- Explain thinking orally or pictorially

## **VII. NUMBER SENSE AND NUMERATION**

During Grade 2, 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 0-99

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

They will be able to:

- Read, write, and order numbers 0-999
- Group by hundreds 0-1000
- Regroup with concrete objects 0-100
- Regroup using grouping notation
- Count by 2's, 5's, and 10's
- Read and write ordinal numbers first to tenth

### **C. Develop number sense.**

They will be able to:

- Express a number in many ways 0-100 (4,  $2+2$ , IV, four,  $8-4$ , IIII)
- Recognize even and odd numbers
- Recognize Roman numerals I to XX

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

They will be able to:

- Write story problems for others to solve using numbers 0-100
- Notice number relationships in the context of time, money and measurement

## **VIII. WHOLE NUMBER OPERATIONS**

During Grade 2, 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 the addition of two- or three-digit numbers with or without regrouping with concrete objects
- Model the subtraction of one- or two-digit numbers from two-digit numbers with or without regrouping with concrete objects
- Model the subtraction of one-, two-, or three-digit numbers from three-digit numbers with or without regrouping with concrete objects

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

- They will be able to:
- Write and illustrate an addition/subtraction/multiplication sentence to match a story problem
- Write and illustrate a story to match an addition/subtraction/multiplication sentence
- Use the language of basic addition and subtraction operations (sum, difference)

**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 addition and subtraction problems that require joining, separating, equalizing and comparing situations
- Collect mathematical situations from everyday, sort them by operation
- Write addition and subtraction sentences using numbers 0-100 and symbols

**D. Develop operation sense.**

- They will be able to:
- Verbalize the relationship between addition and subtraction
- Use and explain the commutative property (reverse the order of two addends doesn't change the sum)

**IX. WHOLE NUMBER COMPUTATION**

During Grade 2, children will develop the ability to:

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

They will be able to:

- Solve basic addition facts fluently
- Use the basic addition facts to solve basic subtraction facts
- Combine, separate, and compare quantities to 100 using models such as number charts, base ten blocks, and coins
- Solve problems about equal groups of 2's, 5's, or 10's
- Add two-digit numbers with or without grouping
- Subtract one- or two-digit numbers from two-digit numbers with or without regrouping
- Make drawings to group objects by 1's, 2's, 3's, 4's, and 5's

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

They will be able to:

- Use estimation to check reasonableness of an answer
- Use a variety of strategies to add and subtract numbers to 100

**C. Use calculators in appropriate computational situations.**

They will be able to:

- Follow a story and keep track of the sums or differences using a calculator

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

They will be able to:

- Develop strategies appropriate to specific problems and determine whether the results are reasonable

**X. ESTIMATION**

During Grade 2, children will develop the ability to:

**A. Explore estimation strategies.**

They will be able to:

- Estimate the number of objects 0-300 in a set and tell how the estimate was obtained

**B. Recognize when an estimate is appropriate.**

They will be able to:

- Report a measurement as an approximation

**C. Determine reasonableness of results.**

They will be able to:

- Estimate reasonable results to addition and subtraction situations and explain how the answer was obtained

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

They will be able to:

- Describe and justify the reasonableness of an estimate

*This is the end of the Grades K-2 Mathematics Curriculum Overview, Cambridge Public Schools*