PBS TeacherLine New York
Understanding Numbers and Operations: Addition and Subtraction
Grades Pre K – 3

New York State Learning Standards: Mathematics, Science, and Technology - Standard 3

Students will:
- understand the concepts of and become proficient with the skills of mathematics;
- communicate and reason mathematically;
- become problem solvers by using appropriate tools and strategies;

through the integrated study of number sense and operations, algebra, geometry, measurement, and statistics and probability.

<u>Number Sense and Operations Strand</u>

Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.

Number Systems

PK.N.1 Count the items in a collection and know the last counting word tells how many items are in the collection (1 to 10)
PK.N.2 Count out (produce) a collection of a specified size 1 to 10
PK.N.3 Verbally count by 1's to 10
PK.N.4 Explore the different representations of a group of objects
PK.N.5 Draw pictures or other informal symbols to represent a spoken number up to 5
PK.N.6 Draw pictures or other informal symbols to represent how many in a collection up to 5
PK.N.7 Recognize numerals (0-5)
PK.N.8 Use and understand the terms first and last

K.N.1 Count the items in a collection and know the last counting word tells how many items are in the collection (1 to 10)
K.N.2 Count out (produce) a collection of a specified size 1 to 10
K.N.3 Numerically label a data set of 1 to 5
K.N.4 Verbally count by 1's to 20
K.N.5 Verbally count backwards from 10
K.N.6 Represent collections with a finger pattern up to 10
K.N.7 Draw pictures or other informal symbols to represent a spoken number up to 10
K.N.8 Draw pictures or other informal symbols to represent how many in a collection up to 10
K.N.9 Write numbers 1-10 to represent a collection
K.N.10 Visually determine how many more or less, and then using the verbal counting sequence, match and count 1-10

1.N.1 Count the items in a collection and know the last counting word tells how many items are in the collection (1 to 100)
1.N.2 Count out (produce) a collection of a specified size (10 to 100 items), using groups of ten
1.N.3 Quickly see and label with a number, collections of 1 to 10
1.N.4 Count by 1's to 100
1.N.5 Skip count by 10's to 100
1.N.6 Skip count by 5's to 50
1.N.7 Skip count by 2's to 20

1.N.8 Verbally count from a number other than one by 1's

1.N.9 Count backwards from 20 by 1's

1.N.10 Draw pictures or other informal symbols to represent a spoken number up to 20

1.N.11 Identify that spacing of the same number of objects does not affect the quantity (conservation)

1.N.12 Arrange objects in size order (increasing and decreasing)

1.N.13 Write numbers to 100

1.N.14 Read the number words *one, two, three…ten*

1.N.15 Explore and use place value

1.N.16 Compare and order whole numbers up to 100

1.N.17 Develop an initial understanding of the base ten system: 10 ones = 1 ten, 10 tens = 1 hundred

1.N.18 Use a variety of strategies to compose and decompose one-digit numbers

1.N.19 Understand the commutative property of addition

1.N.20 Name the number before and the number after a given number, and name the number(s) between two given numbers up to 100 (with and without the use of a number line or a hundreds chart)

1.N.21 Use before, after, or between to order numbers to 100 (with or without the use of a number line)

1.N.22 Use the words higher, lower, greater, and less to compare two numbers

2.N.1 Skip count to 100 by 2's, 5's, 10's

2.N.2 Count back from 100 by 1's, 5's, 10's using a number chart

2.N.3 Skip count by 3's to 36 for multiplication readiness

2.N.4 Skip count by 4's to 48 for multiplication readiness

2.N.5 Compare and order numbers to 100

2.N.6 Develop an understanding of the base ten system: 10 ones = 1 ten, 10 tens = 1 hundred, 10 hundreds = 1 thousand

2.N.7 Use a variety of strategies to compose and decompose two-digit numbers

2.N.8 Understand and use the commutative property of addition

2.N.9 Name the number before and the number after a given number, and name the number(s) between two given numbers up to 100 (with and without the use of a number line or a hundreds chart)

2.N.10 Use and understand verbal ordinal terms

2.N.11 Read written ordinal terms (first through ninth) and use them to represent ordinal relations

2.N.12 Use zero as the identity element for addition

2.N.13 Recognize the meaning of zero in the place value system (0-100)

3.N.1 Skip count by 25's, 50's, 100's to 1,000

3.N.2 Read and write whole numbers to 1,000

3.N.3 Compare and order numbers to 1,000

3.N.4 Understand the place value structure of the base ten number system: 10 ones = 1 ten, 10 tens = 1 hundred, 10 hundreds = 1 thousand

3.N.5 Use a variety of strategies to compose and decompose three-digit numbers

3.N.6 Use and explain the commutative property of addition and multiplication

3.N.9 Understand and use the associative property of addition

3.N.10 Develop an understanding of fractions as part of a whole unit and as parts of a collection

Number Theory

2.N.14 Use concrete materials to justify a number as odd or even

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Students will understand meanings of operations and procedures, and how they relate to one another.

Operations

PK.N.9 Develop addition and subtraction readiness with sums up to 4 and subtraction involving one to four items, using manipulatives

K.N.12 Solve and create addition and subtraction verbal word problems (use counting-based strategies, such as counting on and to ten)
K.N.13 Determine sums and differences by various means

1.N.24 Develop and use strategies to solve addition and subtraction word problems
1.N.25 Represent addition and subtraction word problems and their solutions as number sentences
1.N.26 Create problem situations that represent a given number sentence
1.N.27 Use a variety of strategies to solve addition and subtraction problems with one- and two-digit numbers without regrouping
1.N.28 Demonstrate fluency and apply addition and subtraction facts to and including 10
1.N.29 Understand that different parts can be added to get the same whole

2.N.15 Determine sums and differences of number sentences by various means (i.e., families, related facts, inverse operations, addition doubles, and doubles plus one)
2.N.16 Use a variety of strategies to solve addition and subtraction problems using one- and two-digit numbers with and without regrouping
2.N.17 Demonstrate fluency and apply addition and subtraction facts up to and including 18
2.N.18 Use doubling to add 2-digit numbers
2.N.19 Use compensation to add 2-digit numbers
2.N.20 Develop readiness for multiplication by using repeated addition
2.N.21 Develop readiness for division by using repeated subtraction, dividing objects into groups (fair share)

3.N.18 Use a variety of strategies to add and subtract 3-digit numbers (with and without regrouping)

Students will compute accurately and make reasonable estimates.

Estimation

1.N.30 Estimate the number in a collection to 50 and then compare by counting the actual items in the collection

2.N.22 Estimate the number in a collection to 100 and then compare by counting the actual items in the collection

3.N.25 Estimate numbers up to 500
3.N.26 Recognize real world situations in which an estimate (rounding) is more appropriate
3.N.27 Check reasonableness of an answer by using estimation

Algebra Strand

Students will perform algebraic procedures accurately.

Equations and Inequalities

2.A.1 Use the symbols <, >, = (with and without the use of a number line) to compare whole numbers up to 100

3.A.1 Use the symbols <, >, = (with and without the use of a number line) to compare whole numbers and unit fractions (½, ½, ¼, $^1/_5$, $^1/_6$, and $^1/_{10}$)

Students will recognize, use, and represent algebraically patterns, relations, and functions.

Patterns, Functions, and Relations

PK.A.1 Duplicate simple patterns using concrete objects

K.A.1 Use a variety of manipulatives to create patterns using attributes of color, size, or shape

1.A.1 Determine and discuss patterns in arithmetic (what comes next in a repeating pattern, using numbers or objects)

2.A.2 Describe and extend increasing or decreasing (+,-) sequences and patterns (numbers or objects up to 100)

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Shapes

K.G.1 Describe characteristics and relationships of geometric objects

Students will identify and justify geometric relationships, formally and informally*.*

Geometric Relationships

K.G.2 Sort groups of objects by size and size order (increasing and decreasing)

Students will apply transformations and symmetry to analyze problem solving situations.

Transformational Geometry

K.G.3 Explore vertical and horizontal orientation of objects
K.G.4 Manipulate two- and three-dimensional shapes to explore symmetry

Students will apply coordinate geometry to analyze problem solving situations.

Coordinate Geometry

K.G.5 Understand and use ideas such as over, under, above, below, on, beside, next to, and between

Measurement Strand

Students will determine what can be measured and how, using appropriate methods and formulas.

Units of Measurement

K.M.1 Name, discuss, and compare attributes of length (longer than, shorter than)
K.M.2 Compare the length of two objects by representing each length with string or a paper strip

1.M.2 Use non-standard units (including finger lengths, paper clips, students' feet and paces) to measure both vertical and horizontal lengths

2.M.3 Compare and order objects according to the attribute of length
2.M.4 Recognize mass as a qualitative measure (i.e., Which is heavier? Which is lighter?)
2.M.5 Compare and order objects, using lighter than and heavier than

Students will use units to give meaning to measurements.

Units

2.M.8 Identify equivalent combinations to make one dollar
2.M.9 Tell time to the half hour and five minutes using both digital and analog clocks

Students will develop strategies for estimating measurements.

Estimation

2.M.10 Select and use standard (customary) and non-standard units to estimate measurements

Statistics and Probability Strand

Students will collect, organize, display, and analyze data.

Collection of Data

3.S.1 Formulate questions about themselves and their surroundings

Problem Solving Strand

Students will build new mathematical knowledge through problem solving.

PK.PS.1 Explore, examine, and make observations about a social problem or mathematical situation
PK.PS.2 Interpret information correctly, identify the problem, and generate possible solutions

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3.PS.1 Explore, examine, and make observations about a social problem or mathematical situation
3.PS.2 Understand that some ways of representing a problem are more helpful than others
3.PS.3 Interpret information correctly, identify the problem, and generate possible solutions

Students will solve problems that arise in mathematics and in other contexts.

PK.PS.3 Act out or model with manipulatives activities involving mathematical content from literature and/or story telling
PK.PS.4 Formulate problems and solutions from everyday situations (i.e., as counting the number of children in the class or using the calendar to teach counting)

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2.PS.4 Formulate problems and solutions from everyday situations (i.e., counting the number of children in the class, using the calendar to teach counting).

3.PS.4 Act out or model with manipulatives activities involving mathematical content from literature
3.PS.5 Formulate problems and solutions from everyday situations
3.PS.6 Translate from a picture/diagram to a numeric expression
3.PS.7 Represent problem situations in oral, written, concrete, pictorial, and graphical forms
3.PS.8 Select an appropriate representation of a problem

Students will apply and adapt a variety of appropriate strategies to solve problems.

PK.PS.5 Use informal counting strategies to find solutions
PK.PS.6 Experience teacher-directed questioning process to understand problems
PK.PS.7 Compare and discuss ideas for solving a problem with teacher and/or students to justify their thinking
PK.PS.8 Use manipulatives (i.e., tiles, blocks) to model the action in problems
PK.PS.9 Use drawings/pictures to model the action in problems

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2.PS.9 Use drawings/pictures to model the action in problems

3.PS.9 Use trial and error to solve problems
3.PS.10 Use process of elimination to solve problems
3.PS.11 Make pictures/diagrams of problems
3.PS.12 Use physical objects to model problems
3.PS.13 Work in collaboration with others to solve problems
3.PS.14 Make organized lists to solve numerical problems
3.PS.15 Make charts to solve numerical problems
3.PS.16 Analyze problems by identifying relationships
3.PS.17 Analyze problems by identifying relevant versus irrelevant information
3.PS.18 Analyze problems by observing patterns
3.PS.19 State a problem in their own words

Students will monitor and reflect on the process of mathematical problem solving.

PK.PS.10 Explain to others how a problem was solved, giving strategies

K.PS.10 Explain to others how a problem was solved, giving strategies

1.PS.10 Explain to others how a problem was solved, giving strategies and justifications

2.PS.10 Explain to others how a problem was solved, giving strategies and justifications

3.PS.20 Determine what information is needed to solve a problem
3.PS.21 Discuss with peers to understand a problem situation
3.PS.22 Discuss the efficiency of different representations of a problem
3.PS.23 Verify results of a problem

3.PS.24 Recognize invalid approaches
3.PS.25 Determine whether a solution is reasonable in the context of the original problem

<u>Reasoning and Proof Strand</u>

Students will recognize reasoning and proof as fundamental aspects of mathematics.

PK.RP.1 Understand that mathematical statements can be true or false

K.RP.1 Understand that mathematical statements can be true or false

1.RP.1 Understand that mathematical statements can be true or false
1.RP.2 Recognize that mathematical ideas need to be supported by evidence

2.RP.1 Understand that mathematical statements can be true or false
2.RP.2 Recognize that mathematical ideas need to be supported by evidence

3.RP.1 Use representations to support mathematical ideas
3.RP.2 Determine whether a mathematical statement is true or false and explain why

Students will make and investigate mathematical conjectures.

PK.RP.2 Investigate the use of knowledgeable guessing as a mathematical tool
PK.RP.3 Explore guesses, using a variety of objects and manipulatives

K.RP.2 Investigate the use of knowledgeable guessing as a mathematical tool
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1.RP.3 Investigate the use of knowledgeable guessing as a mathematical tool
1.RP.4 Explore guesses, using a variety of objects and manipulatives

2.RP.3 Investigate the use of knowledgeable guessing as a mathematical tool
2.RP.4 Explore guesses, using a variety of objects and manipulatives

3.RP.3 Investigate the use of knowledgeable guessing by generalizing mathematical ideas
3.RP.4 Make conjectures from a variety of representations

Students will develop and evaluate mathematical arguments and proofs.

PK.RP.4 Listen to claims other students make

K.RP.4 Listen to claims other students make

1.RP.5 Justify general claims, using manipulatives
1.RP.6 Develop and explain an argument verbally or with objects
1.RP.7 Listen to and discuss claims other students make

2.RP.5 Justify general claims, using manipulatives
2.RP.6 Develop and explain an argument verbally or with objects
2.RP.7 Listen to and discuss claims other students make

3.RP.5 Justify general claims or conjectures, using manipulatives, models, and expressions

3.RP.6 Develop and explain an argument using oral, written, concrete, pictorial, and/or graphical forms

3.RP.7 Discuss, listen, and make comments that support or reject claims made by other students

Students will select and use various types of reasoning and methods of proof.

2.RP.8 Use trial and error strategies to verify claims

Communication Strand

Students will organize and consolidate their mathematical thinking through communication.

PK.CM.1 Understand how to organize their thought processes with teacher guidance

K.CM.1 Understand how to organize their thought processes with teacher guidance

1.CM.1 Understand how to organize their thought processes with teacher guidance
1.CM.2 Verbally support their reasoning and answer

2.CM.1 Understand how to organize their thought processes
2.CM.2 Verbally support their reasoning and answer

3.CM.1 Understand and explain how to organize their thought process
3.CM.2 Verbally explain their rationale for strategy selection
3.CM.3 Provide reasoning both in written and verbal form

Students will communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

PK.CM.2 Share mathematical ideas through the manipulation of objects, drawings, pictures, and verbal explanations

K.CM.2 Share mathematical ideas through the manipulation of objects, drawings, pictures, and verbal explanations

1.CM.3 Share mathematical ideas through the manipulation of objects, drawings, pictures, charts, and symbols in both written and verbal explanations

2.CM.3 Share mathematical ideas through the manipulation of objects, drawings, pictures, charts, and symbols in both written and verbal explanations

3.CM.4 Organize and accurately label work
3.CM.5 Share organized mathematical ideas through the manipulation of objects, drawings, pictures, charts, graphs, tables, diagrams, models, symbols, and expressions in written and verbal form
3.CM.6 Answer clarifying questions from others

Students will analyze and evaluate the mathematical thinking and strategies of others.

PK.CM.3 Listen to solutions shared by other students

PK.CM.4 Formulate mathematically relevant questions with teacher guidance

K.CM.3 Listen to solutions shared by other students
K.CM.4 Formulate mathematically relevant questions with teacher guidance

1.CM.4 Listen to solutions shared by other students
1.CM.5 Formulate mathematically relevant questions

2.CM.4 Listen to solutions shared by other students
2.CM.5 Formulate mathematically relevant questions

3.CM.7 Listen for understanding of mathematical solutions shared by other students
3.CM.8 Consider strategies used and solutions found in relation to their own work

Students will use the language of mathematics to express mathematical ideas precisely.

PK.CM.5 Use appropriate mathematical terms, vocabulary, and language

K.CM.5 Use appropriate mathematical terms, vocabulary, and language

1.CM.6 Use appropriate mathematical terms, vocabulary, and language

2.CM.6 Use appropriate mathematical terms, vocabulary, and language

3.CM.9 Increase their use of mathematical vocabulary and language when communicating with others
3.CM.10 Describe objects, relationships, solutions and rationale using appropriate vocabulary
3.CM.11 Decode and comprehend mathematical visuals and symbols to construct meaning

Connections Strand

Students will recognize and apply mathematics in contexts outside of mathematics.

PK.CN.1 Recognize the presence of mathematics in their daily lives
PK.CN.2 Use counting strategies to solve problems in their daily lives
PK.CN.3 Recognize and apply mathematics to objects and pictures

K.CN.1 Recognize the presence of mathematics in their daily lives
K.CN.2 Use counting strategies to solve problems in their daily lives
K.CN.3 Recognize and apply mathematics to objects and pictures

Students will recognize and use connections among mathematical ideas.

2.CN.1 Recognize the connections of patterns in their everyday experiences to mathematical ideas
2.CN.2 Understand and use the connections between numbers and the quantities they represent to solve problems
2.CN.3 Compare the similarities and differences of mathematical ideas

3.CN.1 Recognize, understand, and make connections in their everyday experiences to mathematical ideas

3.CN.2 Compare and contrast mathematical ideas
3.CN.3 Connect and apply mathematical information to solve problems

Students will understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

1.CN.4 Understand how models of situations involving objects, pictures, and symbols relate to mathematical ideas
1.CN.5 Understand meanings of operations and how they relate to one another
1.CN.6 Understand how mathematical models represent quantitative relationships

2.CN.4 Understand how models of situations involving objects, pictures, and symbols relate to mathematical ideas
2.CN.5 Understand meanings of operations and how they relate to one another
2.CN.6 Understand how mathematical models represent quantitative relationships

3.CN.4 Understand multiple representations and how they are related
3.CN.5 Model situations with objects and representations and be able to make observations

Students will recognize and apply mathematics in contexts outside of mathematics.

1.CN.7 Recognize the presence of mathematics in their daily lives
1.CN.8 Recognize and apply mathematics to solve problems
1.CN.9 Recognize and apply mathematics to objects, pictures, and symbols

2.CN.7 Recognize the presence of mathematics in their daily lives
2.CN.8 Recognize and apply mathematics to solve problems
2.CN.9 Recognize and apply mathematics to objects, pictures and symbols

3.CN.6 Recognize the presence of mathematics in their daily lives
3.CN.7 Apply mathematics to solve problems that develop outside of mathematics
3.CN.8 Recognize and apply mathematics to other disciplines

Representation Strand

Students will create and use representations to organize, record, and communicate mathematical ideas.

PK.R.1 Use multiple representations, including verbal language, acting out or modeling a situation, and drawing pictures as representations
PK.R.2 Use standard and nonstandard representations

K.R.1 Use multiple representations, including verbal language, acting out or modeling a situation, and drawing pictures as representations
K.R.2 Use standard and nonstandard representations

1.R.1 Use multiple representations including verbal and written language, acting out or modeling a situation, drawings, and/or symbols as representations
1.R.2 Share mental images of mathematical ideas and understandings
1.R.3 Use standard and nonstandard representations

2.R.1 Use multiple representations, including verbal and written language, acting out or modeling a situation, drawings, and/or symbols as representations
2.R.2 Share mental images of mathematical ideas and understandings
2.R.3 Use standard and nonstandard representations

3.R.1 Use verbal and written language, physical models, drawing charts, graphs, tables, symbols, and equations as representations
3.R.2 Share mental images of mathematical ideas and understandings
3.R.3 Recognize and use external mathematical representations
3.R.4 Use standard and nonstandard representations with accuracy and detail

Students will select, apply, and translate among mathematical representations to solve problems.

1.R.4 Connect mathematical representations with problem solving

2.R.4 Connect mathematical representations with problem solving

3.R.5 Understand similarities and differences in representations.
3.R.6 Connect mathematical representations with problem solving
3.R.7 Construct effective representations to solve problems

Students will use representations to model and interpret physical, social, and mathematical phenomena.

PK.R.3 Use objects to show and understand physical phenomena (i.e., guess the number of cookies in a package)
PK.R.4 Use objects to show and understand social phenomena (i.e., count and represent sharing cookies between friends)
PK.R.5 Use objects to show and understand mathematical phenomena (i.e., draw pictures to show a story problem, show number value using fingers on your hand)

K.R.3 Use objects to show and understand physical phenomena (i.e., guess the number of cookies in a package)
K.R.4 Use objects to show and understand social phenomena (i.e., count and represent sharing cookies between friends)
K.R.5 Use objects to show and understand mathematical phenomena (i.e., draw pictures to show a story problem, show number value using fingers on your hand)

1.R.5 Use mathematics to show and understand physical phenomena (i.e., estimate and represent the number of apples in a tree)
1.R.6 Use mathematics to show and understand social phenomena (i.e., count and represent sharing cookies between friends)
1.R.7 Use mathematics to show and understand mathematical phenomena (i.e., draw pictures to show a story problem, show number value using fingers on your hand)

2.R.5 Use mathematics to show and understand physical phenomena (i.e., estimate and represent the number of apples in a tree)
2.R.6 Use mathematics to show and understand social phenomena (i.e., count and represent sharing cookies between friends)
2.R.7 Use mathematics to show and understand mathematical phenomena (i.e., draw pictures to show a story problem or show number value using fingers on your hand)

3.R.8 Use mathematics to show and understand physical phenomena (i.e., estimate and represent the number of apples in a tree)

3.R.9 Use mathematics to show and understand social phenomena (i.e., determine the number of buses required for a field trip)

3.R.10 Use mathematics to show and understand mathematical phenomena (i.e., use a multiplication grid to solve odd and even number problems)