

PBS TeacherLine New York Developing Algebraic Thinking Grades K – 2

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.

Number Sense and Operations Strand

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

Number Systems

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

1.N.15 Explore and use place value

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

1.N.19 Understand the commutative property of addition

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.12 Use zero as the identity element for addition

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

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

Operations

K.N.12 Solve and create addition and subtraction verbal word problems (use counting-based strategies, such as counting on and to ten)

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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.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)

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

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

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

Patterns, Functions, and Relations

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

K.A.2 Recognize, describe, extend, and create patterns that repeat (i.e., ABABAB or ABAABAAAB)

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)

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Statistics and Probability Strand

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

Collection of Data

K.S.1 Gather data in response to questions posed by the teacher and students

Organization and Display of Data

K.S.3 Sort and organize objects by two attributes (i.e., color, size, or shape)

K.S.4 Represent data using manipulatives

1.S.4 Display data in bar graphs using concrete objects with intervals of one

1.S.5 Use Venn diagrams to sort and describe data

Analysis of Data

K.S.5 Identify more, less, and same amounts from pictographs or concrete models

1.S.6 Interpret data in terms of the words: most, least, greater than, less than, or equal to

1.S.7 Answer simple questions related to data displayed in pictographs (i.e., category with most, how many more in a category compared to another, how many all together in two categories)

Students will make predictions that are based upon data analysis.

Predictions from Data

1.S.8 Discuss conclusions and make predictions in terms of the words likely and unlikely

1.S.9 Construct a question that can be answered by using information from a graph

Problem Solving Strand

Students will build new mathematical knowledge through problem solving.

K.PS.1 Explore, examine, and make observations about a social problem or mathematical situation

K.PS.2 Interpret information correctly, identify the problem, and generate possible solutions

1.PS.1 Explore, examine, and make observations about a social problem or mathematical situation

1.PS.2 Interpret information correctly, identify the problem, and generate possible solutions

2.PS.1 Explore, examine, and make observations about a social problem or mathematical situation

2.PS.2 Interpret information correctly, identify the problem, and generate possible solutions

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

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K.PS.3 Act out or model with manipulatives activities involving mathematical content from literature and/or story telling

K.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).

1.PS.3 Act out or model with manipulatives activities involving mathematical content from literature and/or story telling

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

2.PS.3 Act out or model with manipulatives activities involving mathematical content from literature and/or story telling

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).

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

K.PS.5 Use informal counting strategies to find solutions

K.PS.6 Experience teacher-directed questioning process to understand problems

K.PS.7 Compare and discuss ideas for solving a problem with teacher and/or students to justify their thinking

K.PS.8 Use manipulatives (i.e., tiles, blocks) to model the action in problems

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

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2.PS.5 Use informal counting strategies to find solutions

2.PS.6 Experience teacher-directed questioning process to understand problems

2.PS.7 Compare and discuss ideas for solving a problem with teacher and/or students to justify their thinking

2.PS.8 Use manipulatives (i.e., tiles, blocks) to model the action in problems

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

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

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

Reasoning and Proof Strand

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

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

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- 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

Students will make and investigate mathematical conjectures.

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

- 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

Students will develop and evaluate mathematical arguments and proofs.

- 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

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.

- 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

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

- 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

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

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

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

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

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

Connections Strand

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

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

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

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

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- 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

Representation Strand

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

- 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

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

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

- 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)

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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)