

MATHEMATICS - DRAFT

Introduction

A preschool classroom's physical and teaching environments should capitalize on children's natural, spontaneous interactions with math in the world around them by featuring a wide variety of ongoing mathematical opportunities. Possibilities for learning across all the math domains (identified in the Common Core State Standards for Mathematics as counting and cardinality, operations and algebraic thinking, number and operations in base ten, measurement and data, and geometry) should be available, daily, in classroom activity/interest areas, during small and large group teacher-child interactions, and out of doors.

While providing a wide array of opportunities for engaging with math, in conjunction with the Common Core State Standards, New Jersey's preschool standards for mathematics call attention to the fact that:

In early childhood, a priority is placed on developing children's sense of number as quantity,

emphasizing:

- number;
- spatial relations and measurement; and
- geometry;

and underscoring the importance of:

developing mathematical practice skills.

Mathematics Practice Skills in Preschool

The Common Core addresses mathematical process skills through eight standards for mathematical practice used for kindergarten through twelfth grade. Based, in part, on the National Council of Teachers of Mathematics *Curriculum Focal Points – for Prekindergarten through Grade Eight Mathematics* the eight practice standards describe the skills necessary for thinking mathematically.

Young children need ongoing opportunities to develop their mathematical thinking. In addition to daily opportunities for independent choice and exploration, preschool classroom time should be regularly allotted for in depth, small group math experiences that encourage children to interact, pursue problem solving strategies, and reflect. Teachers should facilitate a supportive learning environment by continuously observing, listening, and scaffolding children's mathematical thinking in everyday contexts. Teachers should also recognize and

plan short- and long-term projects based on the strong opportunities for mathematical thinking and problem solving that occurs when mathematics is combined with other curriculum content areas.

The preschool mathematics practices, aligned with the Common Core Mathematical Practice Standards (and found in the chart, below) do not stand alone. Rather they are to be taught within and across each of New Jersey’s preschool mathematics standards. The following chart describes the mathematical processes that should be occurring in preschool classrooms every day so that young children have ongoing opportunities to explore and develop their mathematical thinking.

Common Core Standards for Mathematical Practice	New Jersey Preschool Mathematical Practices
Make sense of problems and persevere in solving them.	<ul style="list-style-type: none"> • Teachers model for and work with children to think about, make plans, and follow through to solve a mathematical problem using objects or pictures. • Children informally experiment with math problem solving strategies using objects or pictures.
Reason abstractly and quantitatively.	<ul style="list-style-type: none"> • Teachers model for and work with children to solve number stories using objects or pictures (to ten). • Teachers introduce number symbols to describe number stories (to five). • Children draw pictures to begin to represent simple number stories (to five) and may begin to use number symbols in their drawings.
Construct viable arguments and critique the reasoning of others.	<ul style="list-style-type: none"> • Teachers use objects, drawings, and actions while modeling mathematical thinking. • Children begin to use objects, drawings, and actions to represent how they approached a mathematical problem.
Model with mathematics.	<ul style="list-style-type: none"> • Teachers point out math in everyday situations and model using math to solve everyday problems. • Children begin to use objects, pictures, words (and may begin to use number symbols [to five]) to solve simple everyday problems (to ten).
Use appropriate tools strategically.	<ul style="list-style-type: none"> • Teachers model and use tools (e.g., a clock, paper and pencil, dice, two- and three-dimensional geometric shapes) and standardized objects (e.g., Unifix® cubes, unit blocks).
Attend to precision.	<ul style="list-style-type: none"> • Teachers model and use mathematics vocabulary during classroom activities and routines. • Children begin to use mathematics vocabulary during classroom activities and routines.
Look for and make use of structure.	<ul style="list-style-type: none"> • Children use materials that give them experience with parts and wholes (e.g., filling egg cartons, combining shapes [tangrams, puzzles, pattern blocks], combining two groups to make one group [combining a group of plastic zoo animals with a group of plastic farm animals]).
Look for and express regularity in repeated reasoning.	<ul style="list-style-type: none"> • Teachers model for and work with children to develop simple patterns (e.g., ab, abb, abc) using objects, pictures, actions, and words. • Children identify, repeat, and extend simple patterns started by the teacher. • Children begin to intentionally make their own simple patterns using objects, pictures, actions, and/or words.

The Preschool Mathematics Standards

New Jersey's Preschool Standards for Teaching and Learning in Mathematics mirror the Common Core's goals for mathematics (sometimes referred to as 'big ideas') and the learning trajectories, or pathways that children will follow from preschool through grade 12 to reach these goals. The preschool standards are ordered according to the domains used in the Common Core State Standards for mathematics:

Preschool Standard	Preschool Standard Content	Common Core Domain Alignment
Standard 1	Standard 1 is about number sense: -children's understanding of numbers and quantities.	<i>Counting and Cardinality</i>
Standard 2	Standard 2 is about number sense: -children's understanding of number relationships and operations.	<i>Counting and Cardinality</i>
Standard 3	Standard 3 is about children's ability to: -compare, -order; and -begin to measure.	<i>Measurement and Data</i>
Standard 4	Standard 4 is about: -children's ability to identify and use shapes; and -children's understanding of position in space.	<i>Geometry</i>

In a high-quality preschool classroom, preschoolers are intentionally introduced to and engage in the 'big ideas' of mathematics. Teachers note children's interests and strengths in addition to assessing each child's prior experience and informal knowledge, effectively integrating differentiated math experiences into all aspects of children's daily routines and transitions.

With a comprehensive preschool curriculum as the vehicle, continuous (performance based) assessment of what each child in the class knows and is able to do translates into purposefully planned, standards based teaching practices. The teaching practices section of the preschool mathematics standards provides samples of activities and explorations for each of the learning outcomes.

There are four preschool mathematics standards:

Standard 4.1: Children begin to demonstrate an understanding of number and counting.

Standard 4.2: Children demonstrate an initial understanding of numerical operations.

Standard 4.3: Children begin to conceptualize measurable attributes of objects.

Standard 4.4: Children develop spatial and geometric sense.

Each of these four standards is further elaborated in the sections that follow. For each standard, effective preschool teaching practices are listed, followed by the preschool competencies that develop as a result of those practices.

Standard 4.1: Children begin to demonstrate an understanding of number and counting.

Preschool Teaching Practices

Preschool teachers will:

- Encourage and support individual attempts to learn to count numbers to 20 or higher.
- Include and refer by name to written numbers in the classroom environment during daily routines and in the context of large and small group experiences.
- Intentionally refer to the symbol and number name when discussing numbers (quantities) of objects.
- Provide manipulatives and materials (e.g., print and digital material, sand molds, tactile numeral cards, puzzles, counting books, hand-held devices such as tablets, interactive whiteboards) and activities (e.g. tracing numbers in sand, forming numbers with clay, recording data) that feature number names and number quantities.
- Provide a wide variety of writing materials for children to informally explore writing numbers along with meaningful contexts for children to write numbers on charts and graphs.
- Make materials and books that promote exploration of number quantities (e.g., collections of small objects, cash registers with money, number puzzles, counting books and games in print and digital formats, egg cartons and plastic eggs) accessible to children.
- Integrate purposeful counting experiences throughout the school day, indoors and outdoors (e.g., taking attendance, following the rule to stay three steps behind another person, climbing the ladder of the slide, pulling the paper towel holder lever twice. Play board games that involve arranging and counting objects and identifying small quantities of objects with small groups of children).
- Encourage children to compare numbers frequently through questions (e.g., “Are there more people riding in the bus or in the airplane?”) and graphing (e.g., favorite colors, pets).

- Foster one-to-one correspondence throughout the day (e.g., ask a child to put out just enough bowls and spoons for each stuffed animal seated at the table, ask a child to arrange just enough cars so that each garage space has one car in it).
- Model how to represent and describe data (e.g., display daily attendance on a graph and discuss “how many,” “more,” “less,” “fewer,” “equal to.”).
- Work with children in small groups to help them organize (classify) objects, describe their work, and represent the results (e.g., children use a series of graphs to represent the results of experiences in sorting buttons by various attributes – size, color, number of holes, etc.).

Preschool Learning Outcomes

Children will:

Preschool Number	Preschool Indicator	Kindergarten Number
4.1.1	Count to 20 by ones with minimal prompting.	
4.1.2	Recognize and name one-digit written numbers up to 10 with minimal prompting.	
4.1.3	Know that written numbers are symbols for number quantities and, with support, begin to write numbers from 0 to 10.	
4.1.4	Understand the relationship between numbers and quantities (i.e., the last word stated when counting tells “how many”): (a)Count quantities of objects up to 10, using one-to one- correspondence, and accurately count as many as 5 objects in a scattered configuration. (b)Arrange and count different kinds of objects to demonstrate understanding of the consistency of quantities (i.e., “5” is constant, whether it is a group of 5 people, 5 blocks or 5 pencils). (c)Instantly recognize, without counting, small quantities of up to 3 objects (i.e., subitize).	
4.1.5	Use one-to-one correspondence to solve problems by matching sets (e.g., getting just enough straws to distribute for each juice container on the table) and comparing amounts (e.g., counting the number of openings in a muffin tin, then collecting the number of cubes needed to fill the openings with one cube each).	

- 4.1.6 Compare groups of up to 5 objects (e.g., beginning to use terms such as “more,” “less,” “same”).

Standard 4.2: Children demonstrate an initial understanding of numerical operations.

Preschool Teaching Practices

Preschool teachers will:

- Model addition for children by using counting to combine numbers (e.g., “Maria has two blocks and Justin has three. There are five blocks altogether: 1, 2, 3, 4, 5.”).
- Model subtraction for children by using counting to separate quantities of objects (e.g., “There are five cars on the carpet: 1, 2, 3, 4, 5. I am putting two cars in the basket. There are three cars left on the carpet.”).
- Engage informally with children during center time to explore joining and taking apart small quantities of concrete objects.
- Provide opportunities for children to independently explore addition and subtraction (e.g., using small manipulatives with egg cartons, muffin tins and story mats; interacting with children using computer software and handheld device applications).
- Develop addition and subtraction stories with small groups of children using story mats and flannel board scenes with small quantities of objects and pictures/drawings.
- Use fingers, chalk, wipe-off markers and/or whiteboard technology to tell and draw addition and subtraction stories with small groups of children.
- Provide writing materials and/or handheld devices with appropriate applications in classroom centers so that children can choose to view, solve and create addition and subtraction stories.

Preschool Learning Outcomes

Children will:

Preschool Number	Preschool Indicator	Kindergarten Number
4.2.1	Represent addition and subtraction by manipulating up to 5 objects: (a) putting together and adding to (e.g., “3 blue pegs, 2 yellow pegs, 5 pegs altogether.”); and (b) taking apart and taking from (“I have four carrot sticks. I’m eating one. Now I have 3.”).	

- 4.2.2 Begin to represent simple word problem data in pictures and drawings.

Standard 4.3: Children begin to conceptualize measurable attributes of objects.

Preschool Teaching Practices

Preschool teachers will:

- Provide standard and nonstandard measurement materials both indoors and outdoors (e.g., unit blocks, inch cubes, rulers, cups, buckets, balance scales, water and sand tables).
- Invite children to compare and order objects according to measurable attributes (e.g., length, height, weight, area).
- Listen for and extend children’s conversations about long and short, longer and shorter, short and tall, shorter and taller, etc.
- Provide materials for children to sort, classify, order, and pattern (e.g., buttons, beads, colored craft sticks, bowls, trays).
- Use digital photography to record children’s work so that students can revisit, think more about, and discuss their strategies with adults and classmates.

Preschool Learning Outcomes

Children will:

Preschool Number	Preschool Indicator	Kindergarten Number
4.3.1	Sort, order, pattern, and classify objects by non-measurable (e.g., color, texture, type of material) and measurable attributes (e.g., length, capacity, height).	
4.3.2	Begin to use appropriate vocabulary to demonstrate awareness of the measurable attributes of length, area, weight, and capacity of everyday objects (e.g., long, short, tall, light, heavy, full).	
4.3.3	Compare (e.g., which container holds more) and order (e.g., shortest to longest) up to 5 objects according to measurable attributes.	

Standard 4.4: Children develop spatial and geometric sense.

Preschool Teaching Practices

Effective preschool teachers:

- Use positional words (e.g., over, under, behind, in front of) to describe the relative position of items and people, and encourage the children to use them (e.g., “Michael is sitting next to Ana.” “I see that you used yellow paint under the blue stripe on your painting.” “Are you in front of or behind me?” “The car is on the right.”).
- Dramatize stories that make use of positional words (e.g., *Rosie’s Walk* by Pat Hutchins).
- Use everyday experiences to foster understanding of spatial sense (e.g., talk about locations in the school, map the classroom by learning/interest area, invite children to use blocks to create simple scenes or locations [e.g., the park, the zoo] ask children to describe and/or draw how to get from the classroom block area to the easel).
- Provide materials that can be put together and taken apart indoors and outdoors that help children to develop spatial and geometric sense (e.g., puzzles of varying complexity, items to fill and empty, fit together and take apart, or arrange and shape; materials that move; tunnels to crawl through).
- Introduce vocabulary describing two- and three-dimensional shapes and constructions (e.g., circle, sphere, square, cube, triangle, rectangular prism, pyramid; side, point, angle) and use that vocabulary when interacting with children and materials in learning centers, small groups, and individual settings.
- Provide opportunities for children to compose and decompose pictures and designs with two-dimensional shapes (e.g., tangrams, in collage arrangements, two-dimensional manipulative shapes, computer and interactive whiteboard software, handheld device [such as a tablet] applications).
- Provide opportunities for children to compose and decompose with three-dimensional shapes (e.g., unit blocks, hollow blocks, three-dimensional manipulative shapes, boxes, balls, three-dimensional styrofoam shapes).
- Provide opportunities for children to talk about their two- and three-dimensional designs with other children and with adults.
- Provide opportunities for children to explore the attributes (differences and similarities) between two- and three-dimensional shapes (e.g., “It’s like a can.” “It has 3 sides and 3 points, so it’s a triangle.”) and constructions (e.g., faces of attribute blocks, balls, blocks of all shapes, boxes, beads).

Preschool Learning Outcomes

Children will:

Preschool Number	Preschool Indicator	Kindergarten Number
4.4.1	Respond to and use positional words (e.g., in, under, between, down, behind).	
4.4.2	Use accurate terms to name and describe some two-dimensional shapes and begin to use accurate terms to name and describe some three-dimensional shapes (e.g., circle, square, triangle, sphere, cylinder, cube, side point, angle).	
4.4.3	Manipulate, compare and discuss the attributes of: <ul style="list-style-type: none">(a) two-dimensional shapes (e.g., use two dimensional shapes to make designs, patterns and pictures by manipulating materials such as paper shapes, puzzle pieces, tangrams; construct shapes from materials such as straws; match identical shapes; sort shapes based on rules [something that makes them alike or different]; describe shapes by sides and/or angles; use pattern blocks to compose/decompose shapes when making and taking apart compositions of several shapes).(b) three-dimensional shapes by building with blocks and with other materials having height, width, and depth (e.g., unit blocks, hollow blocks, attribute blocks, boxes, empty food containers, plastic pipe).	