

Children's Development of Mathematical Concepts: Ages 0-4 (Infants, Toddlers, & Preschoolers)

Babies and young children use their senses to learn about the world. They form concepts about language long before learning to speak, and form **mathematical concepts** long before learning to add or subtract. At this young age, mathematical concepts are those basic skills that will lay the foundation for future learning in math. For example:

SIZE: Babies notice that they are "small" and mom is "big" before they know what those words mean.

CAUSE & EFFECT RELATIONSHIPS: Infants become aware of how their actions impact their surroundings, for example, they become aware that if they shake a rattle, it will make noise.

CLASSIFYING: Classifying is putting objects into sets based on common traits. Even babies start classifying objects in simple ways. For example, they come to realize which of their toys make noise, and which ones do not.

PREDICTING: Predicting involves guessing what will happen, based on previous experiences. For example, when kids hear the water running in the tub, they may "predict" that bath time is near.

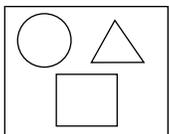
AS CHILDREN MATURE AND THEIR LANGUAGE SKILLS DEVELOP, THEIR UNDERSTANDING OF MATHEMATICAL CONCEPTS ALSO DEVELOPS. FOR EXAMPLE:

ROTE COUNTING: Rote counting is based on memorization of number order. Toddlers learn to count (usually up to 5 or 10) before they know what the numbers mean and often skip, or repeat, numbers.

MEANINGFUL COUNTING: Young children come to understand the use of numbers through exploration. They learn that counting can be used for objects, such as how many raisins they have for snack, and can successfully count a small number of items. Assigning a number to an object is the developmental milestone known as **one-to-one correspondence**. They will also notice if someone has "more" raisins than they have and will begin to recognize written numbers.

IDENTIFYING SHAPES: Toddlers and preschoolers can recognize simple geometric shapes, such as circles, squares, etc. They may announce that their cracker is a *circle*.

MAKING CAUSE & EFFECT PREDICTIONS: As children develop, they become more aware of how their actions impact their surroundings. Toddlers know that when they hit a block tower they built, it will topple. Older toddlers and preschoolers may be able to "predict" what a story will be about by looking at the picture on the cover.



SPATIAL RELATIONSHIPS: Toddlers & preschoolers come to understand the relationship between shapes or objects. When they work on puzzles, their concept of "part-to-whole" relationships develops. They start using "positional" words to explain spatial relationships, such as, "The dog is *under* the table," or, "I'm sitting *in front of* you."

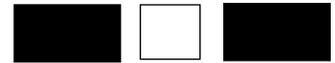


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SERIATION/ORDERING: Seriation is putting objects in a particular order, such as size; for example, lining crayons up in order from shortest to longest.

SEQUENCING AND PATTERNING: A repeated sequence is a pattern. Young children notice and experiment with patterns. For example, when stacking blocks, they may stack them in a black - white - black sequence. Two- and three-year-olds can usually sequence up to three items.



MATCHING: Matching involves finding objects that are alike, or the same. Young children may match blocks, or household items, such as plates. Once children can match, they can learn how to compare, then physically classify (sort) items.

COMPARING & CLASSIFYING: Comparing involves identifying similarities and differences among objects. As children develop, they start to use comparative language, such as, "My cup is the biggest!" Once children can compare objects, they learn how to sort, or "classify" them by one characteristic, such as color or size. For example, three- and four-year olds are able to create a set by putting all the "blue blocks" in a pile. Four- and five-year-olds can usually compare objects that are familiar to them, even if those objects are not in sight.

TIME: Young children do not understand abstract ideas about time, for example, "The drive to grandma's house is two hours," and they can not understand clocks. However, they do have basic ideas about time, such as they eat breakfast in the morning and go to bed after dinner.

MEASURING: Young children do not understand what "12 inches" means, but they can grasp that mommy is taller than grandma.

IS ALL THIS REALLY MATH?

These concepts may not seem "mathematical," but they are! Learning math requires good observation skills -- which children are developing from birth as they explore and play. In the world of mathematics there are patterns, geometric shapes (circles, squares, etc.), comparisons (greater than, less than, equal to), and classifications or sets (numbers divisible by two, prime numbers, etc.). Understanding fractions later on in elementary school requires an understanding of part-to-whole relationships. See "Home Activities for Math Skills Development: Infants, Toddlers, and Preschoolers" for ideas on how to encourage children's math skills development.

Sources: "Family Board Games Build Math Skills" by Julie Tiss, M.Ed. Washington Parent Magazine at www.washingtonparent.com/articles/9707/math.htm; "Help Your Child Learn to Develop an Understanding of Math Concepts," by Susan Jindrich at www.meddybemps.com; "Making the Most of Math in the Early Childhood Program" by Dan Weigle and Sally Martin of the University of Nevada Cooperative Extension at <http://www.unce.unr.edu/publications/FS01/FS0103.doc>; and "Stages of Math Development" at <http://www.cem.msu.edu/~leej/development-math.html>.

Home Activities for Math Skills Development: Infants, Toddlers, and Preschoolers

There are many easy activities parents can integrate into one-on-one time with children that will encourage their development of **mathematical concepts**, starting when they are babies:

LANGUAGE: Adults should surround children with language and incorporate simple **math vocabulary** in everyday conversations. At this age, **math vocabulary** can mean:

- ✓ The names of **shapes**: circle, square, oval, rectangle, etc.
 - ✓ **Numbers**: start with simple numbers, such as 0-10
 - ✓ Words that show **spatial relationships**: under, on, above, below, in front of, etc.
 - ✓ **Directional words**: straight, left, right, high, low, near, far, etc.
 - ✓ **Comparative words**: more than, less than, taller, bigger, fewer, smallest, etc.
 - ✓ **Descriptive words**: light/heavy; empty/full; hot/cold; etc.
 - ✓ **Time**: before, after, then, etc.
 - ✓ **Other math words**: pair, group/set, names of coins, words to describe measurements, etc.
- ◆ Sentences such as, "I am putting the bottle *on* the table", "I have *fewer* cookies than you", "You are *bigger* than your doll" or, "You have *two* ears", reinforce **math vocabulary**.
- ◆ Let children see you "hide" an object, then challenge them to "find" it. Ask, "Is it *behind* the door?" Call attention to shapes, colors, and patterns in books, the home, and outside.
- ◆ Sing songs about numbers, such as "One, Two, Buckle My Shoe" or "Five Monkeys Jumping on the Bed."
- ◆ Use simple language that emphasizes time, such as "After dinner, we will read a book, *then* go to bed." Not only will this help young children develop a sense of time, but knowing what will happen next eases transition times for them.

OBSERVATIONS: Point out objects in the environment to your infant, toddler, or preschooler. Say, "Look at the cars!" or "Can you smell the flowers?" As children get older, point out written words and numbers as well. For example, say, "That sign has a *three* and a *five* together, which stands for '35'."

Toys: Simple toys such as **nesting cups** (a set of cups ranging in size that fit inside each other) and **sorters** (blocks of different shapes that fit into canisters with openings that match the shapes) help babies and toddlers form concepts about size, shape, and other attributes.



READING: Children learn vocabulary when adults read to them. Books written for infants and young children often introduce shapes, colors, and numbers. Classics such as The Three Little Pigs, The Three Billy Goats Gruff, Little Red Riding Hood, and Goldilocks and the Three Bears all emphasize comparative language. Ask your children to make predictions before reading a story by saying, "What do you think this book will be about?"

COUNTING: In addition to teaching children how to rote count, show them how to count objects. Set out items, such as toys, and have them touch each one as they count. Begin with small sets of two or three objects. Increase the number of objects as they become more skilled at counting. (Line the objects up so they do not count the same object twice.) Also, let them see you counting; when putting dishes away after dinner, count the number of clean forks out loud. Ask, "How many carrots do you think are on your plate?" See if they'll count to find out!

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Home Activities for Math Skills Development: Infants, Toddlers, and Preschoolers (continued)

WHEN CHILDREN LEARN TO MATCH, COMPARE, & SORT OBJECTS, THEIR KNOWLEDGE OF RELATIONSHIPS FURTHER DEVELOPS. AN UNDERSTANDING OF RELATIONSHIPS GIVES CHILDREN A STRONG FOUNDATION FOR FUTURE LEARNING IN MATH. TRY THESE ACTIVITIES DURING PLAYTIME:



MATCHING & COMPARING: When folding laundry, have your toddler or preschooler try to match the socks. Then ask, "Which socks are (mommy's/daddy's/yours)?" When playing with blocks, choose one and have your child try to find another block that looks just like it. Let children hear you compare objects, for example say, "This tree is taller than that one."

SERiation/ORDERING: Say to your older toddler or preschooler, "Can you help me put your (stuffed animals/blocks) in order from *smallest* to *largest*?" Start with one object, then ask, "Which one is the next largest?" **On-line seriation activity:** Visit www.meddybemps.com/9.692.html to put animals in order from smallest to largest with your child.

SEQUENCING: Make a simple pattern with two or three blocks and challenge your toddler or preschooler to match the sequence. Use stringing beads with older toddlers and preschoolers to create repeating sequences (patterns). See if they can copy what you have done. **On-line patterning activity:** Visit www.meddybemps.com/9.693.html to put birds in a pattern with your child.

CLASSIFYING & SORTING OBJECTS: Encourage older toddlers & preschoolers to sort objects by one attribute. Say, "Can you put all of the *yellow* cars in a pile?" Or, "Can you show me your *soft* toys?" Have your toddlers and preschoolers help you clean up after playing with toys. Say, "Let's put all of the blocks in the box." Preschoolers can practice sorting objects such as beads, buttons, seeds, etc. **On-line sorting activity:** Visit www.meddybemps.com/deepblue/sortingfish.html to sort big and little fish with your children.



PUZZLES: Children can develop an understanding of relationships between shapes, including part-to-whole relationships, by using puzzles. Puzzles with sturdy cut-outs that toddlers can fit into a board are especially effective. Provide simple puzzles for young children to try.

MEASURING: Let toddlers help you prepare snacks or simple meals. Though they will not understand the concept of what a "teaspoon" is, if they have experiences with different measuring tools, they will likely grasp that a "teaspoon" of sugar is a "little sugar" whereas a "cup" of sugar is lot. Play games with measuring. Say, "How many blocks *long* is your foot? Let's see!" Use the objects to measure their feet, then say, "Your foot is (two) blocks long!"



FREE PLAY: Starting from when they are babies, children learn much about the world during free play. Provide a variety of materials for them to explore. For example, when in the bathtub, give them toys that allow them to pour (bucket/cup), squeeze (sponges/droppers), etc. This is how they will test cause and effect relationships and form other mathematical ideas!

NOTE: Remember, young children are also learning to assert themselves and to be independent. Also, just like adults, they may want to be left in peace to play on their own without "distractions." If children are not interested in an activity you initiate, try it again another day.☆

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