

Children's Development of Mathematical Concepts - Grades 3 & 4

Since your children were young, they have been forming concepts -- including ideas about math. Now that they are in elementary school, their strong "math foundation" will play a part in their learning. Later in elementary school (third and fourth grade) children are learning the following math skills:

NUMBER SENSE AND OPERATIONS:

- ☐ reading, writing, and interpreting whole numbers up to 100,000, plus comparing and ordering numbers
- ☐ place value of larger numbers (e.g. knowing that 103,456 is one group of hundred-thousand, zero groups of ten-thousand, three groups of one thousand, four groups of one hundred, five groups of ten, and six ones)
- ☐ **expanded notation**, for example, $643 = 6 \times 100 + 4 \times 10 + 3$
- ☐ the understanding that a fraction represents a part of a **whole unit** or **collection**:



This circle -- which represents a whole unit -- is $\frac{2}{4}$ black and $\frac{2}{4}$ white or $\frac{1}{2}$ black and $\frac{1}{2}$ white.



*There are 4 black circles, and 4 white circles in this **collection**; $\frac{4}{8}$ (or $\frac{1}{2}$) of the circles are black and $\frac{4}{8}$ ($\frac{1}{2}$) of the circles are white.*

- ☐ how to show fractions on a number line, finding equivalent fractions (for example, $\frac{3}{4} = \frac{9}{12}$), figuring out the decimal equivalent of simple fractions (for example, $5\frac{1}{2} = 5.5$), as well as adding and subtracting simple fractions
- ☐ how to classify numbers, e.g. determining "odd" numbers (1, 3, 5...), "even" numbers (2, 4, 6...), or factors & multiples (for example, multiples of "4" are: 4, 8, 12, 16, 20)
- ☐ how to multiply and divide numbers, and what the inverse relationship between multiplication and division means, for example, $6 \times 6 = 36$ relates to $36/6 = 6$
- ☐ using and explaining properties of operations, such as $50 \times 10 = 10 \times 50$, or $(6 \times 5) \times 3 = 6 \times (5 \times 3)$
- ☐ using the correct operations (addition, subtraction, multiplication, or division) when problem solving
- ☐ dividing a three-digit whole number with a single digit divisor, and finding remainders
- ☐ multiplying up to 12×12 mentally, as well as adding and subtracting up to five-digit numbers on paper
- ☐ rounding numbers to the nearest 10, 100, 1000, 10,000 and 100,000
- ☐ understanding money up to \$1,000



PATTERNS, RELATIONSHIPS, AND ALGEBRA:

- ☐ creating and explaining **number patterns**, for example: 6, 60, 600, 6,000, 60,000, 600,000
- ☐ basic algebraic concepts, such as: if $D \times 2 = 12$, then the value of "D" is 6
- ☐ reading graphs, tables, charts, and number sentences
- ☐ figuring out unit pricing, e.g., five pears cost \$2.00, so one pear costs \$.40
- ☐ learning how to use scales on maps, e.g. one inch = 5 miles, so 10 inches = 50 miles



As they progress through elementary school, children's understanding of cause and effect relationships, as well as their problem solving abilities further develops. For example, they come to understand how changing one variable in a math problem will change the entire outcome.

| input | function | output |
|-------|---------------|--------|
| 5 | multiply by 2 | 10 |

| input | X | 5 | 6 | 7 | 8 |
|--------|---|----|----|----|----|
| output | y | 10 | 12 | 14 | 16 |

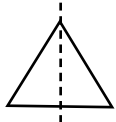
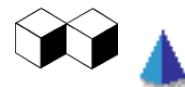
Your children may be using function tables, like this one to learn that changing variables in math problems will change their outcome. For example, if the input variable were changed to "7" the "output" would be "14."

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Children's Development of Mathematical Concepts - Grades 3 & 4 (continued)

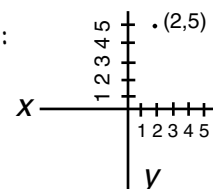
GEOMETRY AND SPATIAL RELATIONSHIPS:

- ☐ continue learning how to compare attributes (traits) of two- and three-dimensional shapes, such as number of sides, faces, corners, right angles, symmetry, etc. a shape has
- ☐ continue learning how to draw, compare, and classify two- and three-dimensional shapes
- ☐ identifying angles as right (90 degrees), acute (less than 90 degrees) or obtuse (greater than 90 degrees)
- ☐ describing (and drawing) intersecting, parallel, and perpendicular lines as well as continuing to practice drawing lines of symmetry in 2-D shapes; predicting what will happen when folding or combining two- and three-dimensional shapes



A shape is "symmetrical" when it can be sliced into two parts and each part is the same size and shape (like a mirror reflection).

- ☐ learning to use ordered pairs of letters, or numbers, to graph or locate points in quadrants:
- ☐ continuing to practice flipping, turning, and sliding shapes to determine if the two shapes are congruent (same size and shape)



MEASUREMENT AND TIME:



- ☐ continue learning how to measure objects by length, area, weight, volume using standard-units of measurement (both metric and English systems) such as inches, centimeters, meters, square feet, square inches, grams, pounds, liters, with appropriate tools, ruler, thermometer, scale, etc.
- ☐ developing a further understanding of temperature (Celsius and Fahrenheit)
- ☐ learning to do simple conversions using time, money, and other units of measurement, such as 2 hours = 120 minutes; 50 cents = .50 or 1/2 of a dollar; 2 yards = 6 feet, etc.
- ☐ becoming proficient at telling time to the minute on analog and digital clocks (a.m. & p.m.) and further developing an understanding of how to use and read calendars
- ☐ an understanding of **elapsed time**, for example, soccer practice is from 3 p.m.-5 p.m. or *two hours*
- ☐ estimating and finding the perimeter and area of shapes such as rectangles, triangles, and even irregular shapes using models, grids, or by measuring; solving problems by measuring

DATA ANALYSIS, STATISTICS, AND PROBABILITY:

- ☐ collecting and organizing data using observations, interviews, measurements, experiments, etc; organizing this data visually and using the data to solve problems or answer questions
- ☐ matching lists, tables, graphs, and other representations of data with real sets of data
- ☐ making predictions and drawing conclusions from tables, bar graphs, circle graphs, pictographs, line graphs, line plots, and tally marks
- ☐ learning simple probability problems such as, their chances of selecting a penny from a bag that contains five pennies and five nickels
- ☐ learning to count the number of **possible combinations** using objects from up to three sets, for example, how many different sandwiches one can create with three types of bread, three kinds of "sandwich filler" such as cold cuts, and two kinds of condiments, such as mayonnaise and mustard
- ☐ predicting and classifying outcomes of experiments as certain, likely, unlikely, or impossible.

AT THIS AGE, YOUR CHILDREN ARE PROBABLY LEARNING MANY OF THESE CONCEPTS USING HANDS-ON MATERIALS, SUCH AS BLOCKS, UNIFIX CUBES, COINS, PLAY MONEY, ETC.

SEE "HOME ACTIVITIES FOR MATH SKILLS DEVELOPMENT: GRADES 3 & 4" TO REINFORCE MATH WITH CHILDREN AT HOME!

Sources: The Massachusetts Mathematics Curriculum Framework (2000); Math Standards Links" by the University of Massachusetts School of Education at www.ccbitt.cs.umass.edu/SchoolofEducation/Preservice/standardsconnector/annframeworks/math/mathtarget.html; and Harcourt School Publishers Math Glossary at www.harcourtschool.com/glossary/math2/index3.html.

Home Activities for Math Skills Development: Grades 3 & 4

Parents can easily incorporate mini-math lessons into daily conversations with their children. Try these ideas at home to reinforce the math concepts your children are learning at school:

NUMBER SENSE AND OPERATIONS:

- ◆ Point out large numbers in the environment and encourage your children to read them. Newspapers, magazines, and Web sites are great places to find large numbers that contain up to six-digits, including money values.
- ◆ When you see a number in the environment, challenge your child to "round up" to the nearest 10, 100, 1,000, 10,000, or 100,000. For example, the number 886 could be "rounded up" to "890" (the nearest 10) or "900" (the nearest "hundred").
- ◆ When possible, demonstrate fractions around the home. When eating pizza, note, "The pizza is cut into eight slices, or *eighths*."
- ◆ Play games with classifications of numbers. For example, " What do these numbers have in common: 2, 4, 6, 8?" (they are even)
- ◆ Practice math facts in the car or at home. Use the math facts that your children are learning in school. For example, "What's 7×7 ? What's $49/7$?" When playing a game, challenge your children to answer two math facts correctly before they can take a turn.



MATH VOCABULARY:

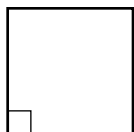
- ❖ Your elementary school child may be coming home with math homework containing some unfamiliar words; when we were children, our teachers used different math vocabulary! To learn "the lingo" of today's math, visit: www.harcourtschool.com/glossary/math2/index_temp.html. This Web site lists vocabulary used at various grade levels, along with definitions and examples.
- ❖ Use math vocabulary whenever possible, for example talk about how your street is *perpendicular* to another; point out *parallel* lines, or *angles* when you see them.
- ❖ Encourage your children to teach you new math words they learn at school.
- ❖ Read books to your children that contain mathematical themes and vocabulary. Ask your children's teacher, or the local librarian, for suggestions.

PATTERNS, RELATIONSHIPS, AND ALGEBRA:

- ❖ When at the grocery store, have your children help you figure out unit pricing. For example, if two pounds of bananas are \$1.50, how much is one pound or a half a pound?
- ❖ Before going on a car trip, look at a map together. Help your child figure out where you are, and your destination. Use the map's key to figure out the distance.

GEOMETRY AND SPATIAL RELATIONSHIPS:

- ❖ Try Origami, the Japanese art of paper folding with your children. Your local library or bookstore will have some books on the topic. This is a great way to practice finding lines of symmetry.
- ❖ Your children are learning all sorts of names for shapes that we as adults did not hear, or use, until later in our school careers. For example, **quadrilateral** (a closed, plane figure with straight lines that has four sides), **rhombus** (a quadrilateral with two pairs of parallel, equally-sized sides), or **trapezoid** (a quadrilateral with one pair of parallel sides) to name a few. Encourage your children to show you these shapes (using these more complex words) when out or around the home.

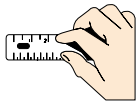


a square is also a quadrilateral, and is also a rhombus

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Home Activities for Math Skills Development: Grades 3 & 4(continued)

MEASUREMENT AND TIME:

- ❖ Periodically ask you children: "What time is it?" Have them tell you to the minute (e.g., 4:18) using an analog clock. Talk about time, including **elapsed time**. Ask, "How long was soccer practice?" or "For how long did you (watch TV/do homework/clean your room/etc.) today?"
-  ❖ Continue encouraging them to practice measuring. Have your children measure the height (and/or weight) of family members--especially growing children! Then have them track this growth on a chart. Practice converting units of measurement, such as inches into feet.
- ❖ Talk about measurements whenever applicable, for example at the fabric store ("yards" of fabric purchased), grocery store (money/unit pricing/weight of fruits & vegetables), gas station (compare gas prices and estimate, then calculate, how much the family would spend on lower grades of gas compared with higher grades of gas), etc.

PROBLEM SOLVING:

- ❖ The next time you are reading the newspaper, watching TV, or are out and about with your children and you spot any type of graph, ask your children what it means. Find "teachable moments" to talk about the graphs, charts and tables.
- ❖ Encourage them to come up with solutions to simple, everyday problems. For example, when planning for an extended family gathering, have them help you decide how much food to buy, and brainstorm other materials (paper cups/plates, beverages, etc.) you will need.
- ❖ Continue reading aloud to children. Many children's books have problem solving concepts woven into them, such as **predicting outcomes**, **cause and effect relationships**, and **logical thinking**.
- ❖ Mention statistics, probability, and simple data when applicable. For example, talk about batting averages of Red Sox players, the weather forecast (snow is *likely*; it will *probably* rain), winning the lottery (unfortunately, *unlikely*), etc.

PLAY COMMERCIAL GAMES THAT REINFORCE MATH CONCEPTS:

- ❖ Monopoly, Monopoly Junior, and Payday for concepts about **money**, including **budgeting** and **making change**
- ❖ Uno, Dominoes, or card tricks for **number pattern recognition**, **mental computation**, and **cause & effect relationships**
- ◆ Chinese Checkers, Checkers, Connect Four, and Battleship can help build **visual perceptual organization**. Children need visual perceptual organization skills to read and create charts and graphs accurately, as well as align columns in complex math problems, such as adding three- and four-digit numbers or doing long division.
- ◆ Clue Junior and Guess Who for enhancing **logical reasoning**, **planning**, and **cause and effect relationships**
- ◆ Tangrams for **geometry**, **patterns**, and **spatial relationships**
- ◆ Multi-piece puzzles (50+ pieces) for **spatial relationships** and **part-to-whole concepts**
- ◆ Children's puzzle or riddle books for **problem solving**.
- ◆ Have them keep score when playing a game. When applicable, encourage them to use tally marks, and/or add scores. Encourage them to be the "banker" when playing games that deal with money.



Sources: "Family Board Games Build Math Skills" by Julie Tiss, M.Ed. Washington Parent Magazine at www.washingtonparent.com/articles/9707/math.html; "Help Your Child to Learn to Develop an Understanding of Math Concepts," by Susan Jindrich at www.meddybemps.com; The Massachusetts Mathematics Curriculum Framework (2000); Math Standards Links" by the University of Massachusetts School of Education at www.ccbt.cs.umass.edu/SchoolofEducation/Preservice/standardsconnector/annframe-works/math/mathtarget.html; and Harcourt School Publishers Math Glossary at www.harcourtschool.com/glossary/math2/index3.html.