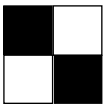
Children's Development of Mathematical Concepts -- Grades 5 & 6

In fifth and sixth grade, children will continue building upon the strong math foundation they have been forming throughout elementary school. At this age, they will start to use logical reasoning and to think about numbers and mathematical concepts abstractly. Here are some of the concepts your children will be learning at this stage:

NUMBER SENSE AND OPERATIONS

- ❒ positive integer (whole number) exponents, for example $10^2 = 10 \times 10 = 100$
- ❒ place value of very large to small numbers (billions, thousandths)
- ❒ represent larger numbers in expanded notation. For example, 6,574 is (6 X 1000) + (5 X 100) + (7 X 10) + 4
- ❒ represent fractions as **parts of a whole collection**, **part of a unit**, **location on a number line**, and **ratio of whole numbers;** learn to find equivalent fractions (1/2 = 2/4 or 3/12 = 9/36), mixed numbers (5/2 = 2 1/2), decimals (1/2 = .5), and percents (1/2 = 50%); learn to add, subtract, and multiply fractions, then simplify them (2/6 X 2/6 = 4/36, or 1/9)

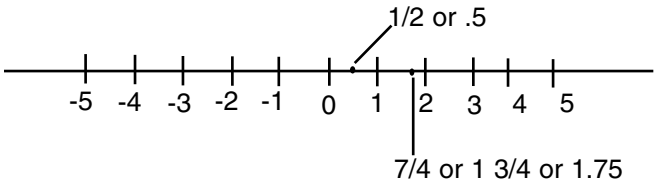
Fractions as part of a collection: 2 squares are light, and two are dark, or 1/2 are light, 1/2 are dark. As a ratio, it would be written 2:2 (or 1:1).



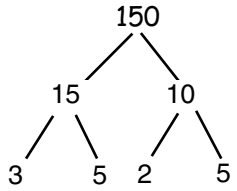
Fractions as part of a unit: This square is 1/2 dark and 1/2 light.

- ❒ compare the order of both positive and negative integers, fractions, mixed numbers, decimals and percents plus find and demonstrate these numbers on a number line; use the number line to demonstrate the addition and subtraction of integers (except subtracting negative integers)

number line



- ❒ divisibility rules for 2, 3, 4, 5, 6, 9, and 10, for example: even numbers are divisible by 2; whole numbers ending in "0" or "5" are evenly divisible by 5 (e.g. 20/5 = 4; 105/5 = 21); when a number's digits add up to 9, the number is divisible by 9 ("36" consists of a 3 and 6, and since 3 + 6 = 9, 36 is also divisible by 9)
- ❒ factoring numbers (prime factorization), finding the greatest common factor, and least common multiple of two or more numbers



This factor tree (left) shows that 150 = 3 X 5 X 2 X 5.

Multiples of 4 and 9

4 4 8 12 16 20 24 28 32 36

9 9 18 27 36 45

The least common multiple is the smallest number, other than zero, that is a common multiple of two or more numbers. The least common multiple of 4 and 9 is 36.

The greatest common factor (GCF) is the largest factor that two or more numbers have in common:

Factors of 12: 1, 2, 3, 4, 6, 12 **Factors of 30:** 1, 2, 3, 5, 6, 10, 15, 30 **GCF of 12 & 30 is 6.**

- ❒ how to select the correct operation (addition, subtraction, multiplication, division) to solve problems
- ❒ apply the correct "order of operations" when solving a problem: PEMA -- **P**arentheses, **E**xponents, **M**ultiplication, **A**ddition, for example, 2(5+3) + 4 = 2(8) + 4 = 16 + 4= **20**
- ❒ understand inverse relationship between addition and subtraction, plus multiplication and division, e.g., if 3 X 4 = 12, then 12/3 = 4
- ❒ strengthen ability to add, subtract, multiple, and divide whole numbers and positive decimals
- ❒ estimate results of computations with whole numbers, positive fractions, mixed numbers, decimals, and percents

PATTERNS, RELATIONSHIPS, & ALGEBRA

- ❒ understand symbolic, arithmetic, and geometric patterns or progressions, such as: 2, 4, 8, 16, 32, __, 128
- ❒ replace variables with given values: 2 (Z) + 3 = ___ when Z = 10 (answer: 23)
- ❒ use properties of equality to solve problems, for example, if X + 9 = 18, then 18-X = 9, so X=9
- ❒ show real situations and mathematical relationships using models, tables, and graphs; solve equations using these models, as well as with paper and pencil
- ❒ create and interpret graphs that represent relationships between two variables in daily situations
- ❒ identify and describe relationships between two variables with a constant or a non-constant rate of change

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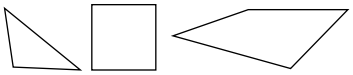
Children's Development of Mathematical Concepts -- Grades 5 & 6

GEOMETRY & SPATIAL RELATIONSHIPS

❒ identify polygons (closed plane figures that are formed by three or more line segments) based on their properties such as angles, perpendicular or parallel lines, and congruence of sides

POLYGONS:



❒ identify 3-dimensional shapes based on their properties, such as edges and faces
❒ identify relationships among points, lines, and planes (intersecting, parallel, perpendicular)
❒ graph points and identify coordinates of points in all 4 quadrants on a coordinate plane
❒ find the distance between two points on horizontal and vertical number lines
❒ continue practicing transformations on two-dimensional shapes, such as translations, rotations, and reflections; use these transformations to determine if two shapes are the same size & shape (congruent)
❒ find if two shapes are congruent by measuring sides and/or angles
❒ identify line and rotational symmetry
❒ match three-dimensional objects to their two-dimensional representations

three-dimensional shapes

CUBE  SPHERE 

PRISM (a solid figure that has two congruent polygon-shaped bases and other faces that are all rectangles) 

 CONE (a solid figure that has a circular base and one vertex)

PYRAMID 

MEASUREMENT

❒ use formulas to find perimeter and area of a shape; learn that shapes with the same number of sides, but different appearances could have the same area; learn to find the area of circles and more complex shapes
❒ identify, measure, describe, classify, and construct angles, triangles, and quadrilaterals
❒ solve problems involving proportional relationships and units of measurement, such as scale models, maps, & speed
❒ find the volume and surface area of a rectangular prism
❒ find the sum of angles in simple polygons up to 8 sides (octagon) with and without measuring the angles

DATA ANALYSIS, STATISTICS, & PROBABILITY

❒ describe and compare data sets using concepts such as median, mean, mode, maximum, minimum, and range
❒ understand and construct stem and leaf plots, line plots, and circle graphs

The "stem" of the stem and leaf plot represents the tens digits.

Class Math Test Scores

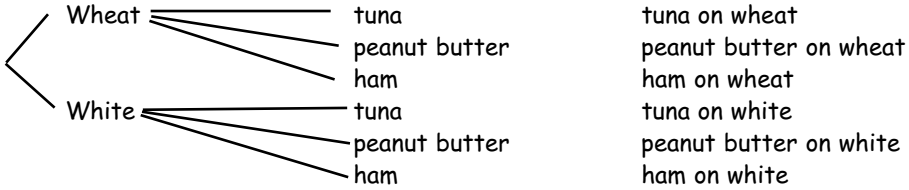
stem	leaf
5	9
6	3 6 6 7
7	1 4 8 8 9
8	0 0 3 8
9	2 4 9

The "leaf" of the stem and leaf plot represents the units (ones) digits.

Key: 5|9 = 59
So, the math scores for this class of 17 students are: 59, 63, 66, 66, 67, 71, 74, 78, 78, 79, 80, 80, 83, 88, 92, 94, 99.

❒ use tree diagrams, lists, and models to show possible or actual outcomes of trials, then analyze the outcomes

A **tree diagram** demonstrates all possible outcomes for an event. For example, if someone has two kinds of bread and three sandwich fillers, there are six possible "outcomes" or sandwiches that can be made:



❒ predict and test outcomes of experiments such as tossing a coin (heads vs. tails) or rolling a die; use ratios to show the probability of an event

SEE "HOME ACTIVITIES FOR MATH SKILLS DEVELOPMENT -- GRADES 5 & 6" TO REINFORCE MATH WITH YOUR CHILDREN AT HOME!

Sources: *The Massachusetts Mathematics Curriculum Framework (2000); "Math Standards Links" by the University of Massachusetts School of Education at www.ccbit.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 5 & 6

Parents can easily incorporate mini-math lessons into daily activities and conversations with their children. There are also many fun, interactive Web sites devoted to helping children learn math. Don't have a computer at home? Not to worry, your local library likely will. Try these online and non-computer based activities at home to reinforce the math concepts your children are learning at school:

NUMBER SENSE & OPERATIONS

☆ Reinforce fractions at home. For guidance on using fractions to make and double a recipe with kids visit **www.mathsurf.com/parent/mathathome/5a.html.** Recipes for banana bread and strawberry bars are on this site. There is also an activity on finding averages, percents, and interest (same URL, except change "**5a.html**" to "**6a.html**").

☆ Have them calculate a percentage of their allowance each week to save.

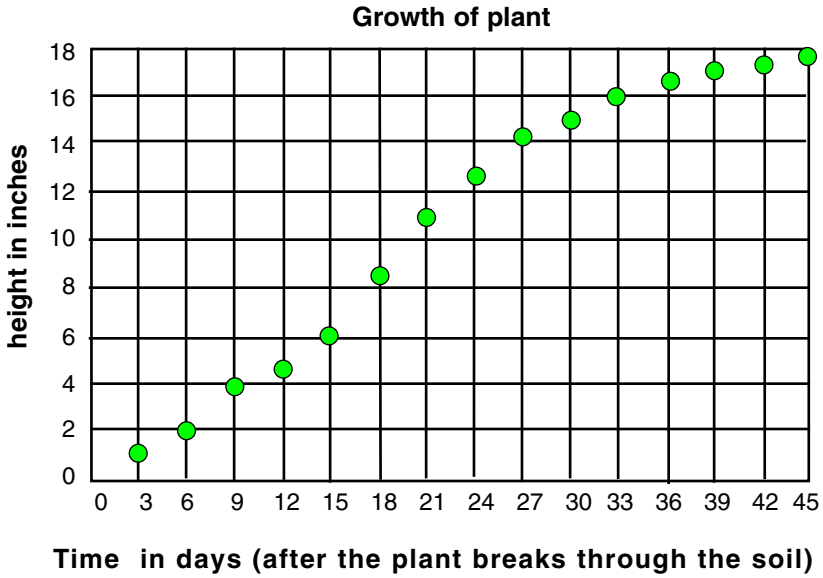
☆ Encourage estimation and mental math. When at the supermarket, challenge them to estimate the amount of the total bill. Then, encourage them to round prices up or down in their head; for example, an item that costs $1.05 can be rounded down to $1. This may help them mentally add the items. Have them revise their estimate based on their "mental math." See how close they were. If paying with cash, let children count the money.

☆ This Web site, **www.math.rice.edu/~lanius/Lessons/index.html**, has many fun, math activities to try, including practicing fractions using online pattern blocks.

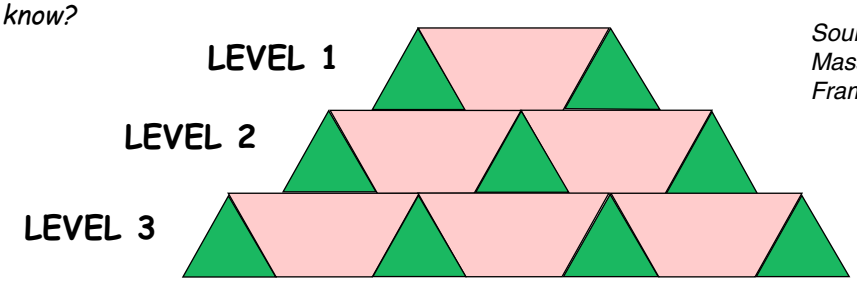
PATTERNS, RELATIONSHIPS, & ALGEBRA

☆ Fifth and sixth graders are learning to create and read graphs that represent real situations. Together, make graphs that your child can relate to; for example, chart the growth of a plant in the home or garden, the growth of a new pet (weight of a kitten as s/he matures), or the change in temperature over time. Talk about the conditions that contribute to the changes, such as a many sunny days, the amount of food the pet eats, or the changing of the season. This activity also gives your children practice in measuring.

Source: Plant Growth Chart (right) was adapted from the Massachusetts Mathematics Curriculum Framework, 2000, page 26.



☆ Fifth and sixth graders work with numeric and **geometric patterns** in school. They may be asked to answer a questions like this: *If the pattern below continues, how many triangles are needed to build to level 9? How do you know?*



Source: Example adapted from the Massachusetts Mathematics Curriculum Framework, 2000, page 26.

☆ Helping your children with patterns, including tessellations (repeating patterns of interlocking shapes), will reinforce what they are learning in school. Try this Web site for practice in making patterns: **http://mathforum.org/sum95/suzanne/active.html (then click on the "Activity Pattern Block applet")**

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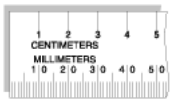
Home Activities for Math Skills Development -- Grades 5 & 6 (Continued)

Geometry & Spatial Relationships:

✫ In school, children use hands-on manipulatives to learn about spatial relationships. They may use tangrams -- a set of shaped blocks that includes a parallelogram, a square, and triangles varying in size, that can be manipulated to fit into a puzzle. On the home or public library computer, encourage your children to visit the following Web site: **http://cs.bmcc.cc.or.us/mth213/Labs/online%20tangrams.htm.** This site contains fun, tangram puzzles to solve by **rotating**, **flipping** and **sliding** pieces of the puzzle using the mouse. Use math vocabulary while solving these puzzles with your children, e.g., say, "I wonder what *rotating* the small triangle will do..."

✫ Visit **www.aaamath.com** for practice in finding perimeter, area, volume, and other geometrical concepts. This site offers grade appropriate practice in all areas of math, including number sense and operations, patterns, etc.

Measurement



✫ Include your child whenever you are measuring, such as finding the area of a room that you are going to put carpet in, or locating the center of the wall when hanging a picture. Talk about the units of measurements (the room is 40 *square feet)* and use different terms. For example, "The center of the room is five feet, six inches from the wall...*5 and a half feet."*

✫ When going on a road trip, work with your child in reading the map. Point out the map's Key (e.g., 5 miles = 1 inch) and let them figure out the distance of the trip.

Math Vocabulary:

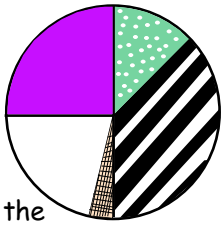
✫ Your elementary school children may have math homework containing some unfamiliar words; when we were children, our teachers used different math vocabulary! If you need to find the definition of a "polyhedron" or want to learn "the lingo" of today's math to help your children with their homework, visit: **www.harcourtschool.com/glossary/math2/index_temp.html.** This site lists math vocabulary used by grade level (PreK-6), along with definitions and visual examples.

✫ Ask your children to teach you the new math words they learn at school; use math vocabulary in conversations when possible.

Data Analysis, Statistics, & Probability

✫ In school, fifth and sixth graders are learning how to construct, compare, and interpret various graphs and tables. Continue to practice this at home. Oftentimes, graphs can be found in the newspaper or in magazines; whenever there is a poll or study done, there likely will be a graph to demonstrate the data. When you come across a graph, especially on a topic your children may be interested in, point it out to them. Help them interpret the information presented.

Study habits of tenth graders based on a survey of students



KEY

- Studies 1/2 hour per day (25%)
- Studies 2 hour per day (21%)
- Studies 3 or more hours per day (~12.5 %)
- Studies 1 hour per day (37.5 %)
- Never studies (~ 4%)

The circle graph above is just an example for the purpose of this tip sheet; the information is **not reflective of actual data from a survey.*

Play Commercial Games At Home That Reinforce Math Concepts:

✫ Masterpiece, Careers, and Life for **reading large numbers** and reinforcing concepts about **place value**

✫ Careers, Life, Monopoly, Easy Money, and Pay Day for money skills that run the gamut of **counting money, calculating change**, **bankruptcy**, **taxes**, **rent**, **salary**, **inflation**, **interest**, **bills**, **mortgage**, **loans,** and **budgeting**

✫ Masterpiece, Careers, Monopoly, Life, Backgammon, and Master Mind for **logical reasoning skills**, **predicting**, **planning, problem solving**, and **visual perceptual organization skills**

✫ If you do not have any of these games at home, oftentimes local museums or schools run "family game days/nights" where you can play these games together for FREE.

Parent Pointers:

◆ If unfamiliar with what children are learning in math, schedule a meeting with their teacher(s) or ask about the curriculum at the next open house.

◆ As children become "pre-teens" they may say they don't want your help. But, do not give up! Parents can still make a difference, even during these difficult years!

Sources: *The Massachusetts Mathematics Curriculum Framework (2000); "Math Standards Links" by the University of Massachusetts School of Education at* **www.ccbit.cs.umass.edu/SchoolofEducation/Preservice/standardsconnector/annframeworks/math/mathtarget.html;** *Harcourt School Publishers Math Glossary at* **www.harcourtschool.com/glossary/math2/index3.html;** *"Family Board Games Build Math Skills" by Julie Tiss, M.Ed. Washington Parent Magazine at* **www.washingtonparent.com/articles/9707/math.html**; and other Web sites, including **www.mathsurf.com**; **www.math.rice.edu**; **http://mathforum.org**; **http://cs.bmcc.cc.or.us**; *and* **www.aaamath.com**.