RIGHTSTART™ MATHEMATICS

by Joan A. Cotter, Ph.D.
with Tracy Mittleider, MSEd

KINDERGARTEN LESSONS

Second Edition

Activities for Learning, Inc.

A special thank you to Kathleen Cotter Lawler for all her work on the preparation of this manual.

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RightStart™ Mathematics Objectives for Kindergarten

Name ____ Year _________

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Numeration				
Can recognize quantities to 100 by grouping in 5s & 10s				
Knows even numbers				
Knows odd numbers				
Can count by twos to 100				
Can count by fives to 100				
Can count by tens to 100				
Money				
Knows name and value of penny, nickel, and dime	N/A			
Place Value				
Knows 10 ones is 1 ten	N/A			
Knows 10 tens is 1 hundred	N/A	N/A		
Knows 37 as 3-ten 7	N/A	N/A		
Addition				
Understands addition as combining parts to form a whole	N/A			
Can partition numbers 3–10 into parts	N/A			
Knows number combinations equal to 10	N/A	N/A		
Knows number combinations up to 10	N/A	N/A		
Subtraction				
Understands subtraction as missing addend	N/A	N/A		
Understands subtraction as separating	N/A	N/A		
Problem Solving				
Can solve addition problems	N/A	N/A		
Can solve missing addend problems	N/A	N/A		
Can solve basic subtraction problems	N/A	N/A		
Geometry				
Knows mathematical names for triangle, rectangle, and circle				
Knows mathematical names for cubes, cylinder, sphere, and cone				
Knows parallel and perpendicular lines				
Can continue a pattern on the geoboard	N/A			
Time				
Knows days of the week	N/A			
Knows months of the year	N/A			
Can tell time to the hour	N/A	N/A	N/A	
Can tell time to the half hour	N/A	N/A	N/A	
Measurement				
Can determine length in centimeters and inches	N/A	N/A	N/A	
Fractions				
Can divide into halves and fourths	N/A	N/A	N/A	
Knows unit fractions up to 1/10	N/A	N/A	N/A	

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developed by Joan A. Cotter, Ph.D.

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Dear Educator,

The following are some of the principles that make the RightStart™ approach different from traditional primary mathematics as taught in the U.S.

• **Minimizing counting.** We know from research that 5-month-old babies are able to add and subtract up to 3. This they do, not by counting, but by visualizing quantities. Japanese teachers believe that rote counting does not further a child's mathematical ability. In other words, counting to 100 is no more helpful in learning math than reciting the alphabet helps in learning to read. In RightStart™, visualization is emphasized.

• **Grouping in fives.** It is relatively easy to detect up to five objects—five can be distinguished from four because it has a middle while four does not. Beyond five, very few people can identify or visualize objects. Thus, the Romans grouped their numerals in fives; consider VIII (8). Orchestral arrangers grouped the 10 lines of music into two staffs with five lines. RightStart™ groups in fives and tens.

• **Naming numbers explicitly.** In the U.S. children speaking English experience considerable difficulty learning place value. Indeed, only half of them master it by the end of the fourth grade. On the other hand, Asian children master place value in the first grade. Asian languages support this understanding through explicit number naming. For example, numbers 11-13 are called "ten-1, ten-2, ten-3" and 20-22 are "2 ten, 2 ten-1, 2 ten-2." RightStart™ introduces the explicit number naming in the early grades, then transitions to traditional names.

• **Overlapping place-value cards.** Children have difficulty with the concept that the 3 in 32 actually means 3 tens. RightStart™ uses place-value cards. For example, the card with "30" is read 3-ten. To build 32, the child places the 2-card on the 0 of the 30-card, forming 32. Note these cards encourage reading numbers in the normal left to right order.

• **Working with the AL Abacus.** To continue developing the visualization skills they possessed as infants, children use the AL Abacus. The beads are grouped in fives to allow quick recognition and subsequent visualization. The reverse side teaches trading in the thousands. To learn their facts, the AL Abacus provides children with visual strategies. Children enjoy using the AL Abacus, but it doesn't become a crutch. When 5-year-old Stan was asked, "How much is 11 + 6?" He said 17. He was asked how he knew. He replied, "I've got the abacus in my mind."

• **Playing games.** Flash cards are not part of RightStart™. With flash cards, students do not learn better methods; they merely practice their old habits, albeit faster. Frequently, they merely become faster counters. Flash cards and timed tests come with a tremendous cost: the stress takes the joy out of learning mathematics. We have millions of people in this country who avoid math whenever possible; many have said that is the reason. Instead, the children using RightStart™ play games to become fluent with their facts and computation. Parents are encouraged to play games with their child.

• **Introducing thousands in the first grade.** To understand the never-ending pattern that ten ones equals 10, ten tens equals 100, ten hundreds equals 1000, and so forth, children must work with thousands. This gives the child the whole picture before working with details. In first grade with RightStart™, the children learn to add four-digit numbers with trading early.

• **Computing mentally.** Most people when adding 24 + 38 compute it mentally, rather than resorting to paper and pencil or a calculator. Therefore, in RightStart™, first graders learn to add two-digit numbers mentally. They use the efficient method of starting at the left.

• **Learning fractions with a linear model.** The linear model gives children an overview of fractions and allows them to see the relationship between fractions and allows understanding of fractions greater than one.

• **Using correct vocabulary.** RightStart™ stresses correct terminology. Equation, which indicates equality, is used rather than "number sentence." The phrase "take away" is avoided because it limits students' understanding of subtraction—sometimes subtraction is going up as in making change. Trading is used instead of "regrouping" because the latter does not imply equality to children as does trading.

Helping children understand, apply, and enjoy mathematics.

How This Program Was Developed

We have been hearing for years that Japanese students do better than U.S. students in math in Japan. The Asian students are ahead by the middle of first grade. And the gap widens every year thereafter.

Many explanations have been given, including less diversity and a longer school year. Japanese students attend school 240 days a year.

A third explanation given is that the Asian public values and supports education more than we do. A first grade teacher has the same status as a university professor. If a student falls behind, the family, not the school, helps the child or hires a tutor. Students often attend after-school classes.

A fourth explanation involves the philosophy of learning. Asians and Europeans believe anyone can learn mathematics or even play the violin. It is not a matter of talent, but of good teaching and hard work.

Although these explanations are valid, I decided to take a careful look at how mathematics is taught in Japanese first grades. Japan has a national curriculum, so there is little variation among teachers.

I found some important differences. One of these is the way the Asians name their numbers. In English we count ten, eleven, twelve, thirteen, and so on, which doesn't give the child a clue about tens and ones. But in Asian languages, one counts by saying ten-1, ten-2, ten-3 for the teens, and 2-ten 1, 2-ten 2, and 2-ten 3 for the twenties.

Still another difference is their criteria for manipulatives. Americans think the more the better. Asians prefer very few, but insist that they be imaginable, that is, visualizable. That is one reason they do not use colored rods. You can imagine the one and the three, but try imagining a brown eight–the quantity eight, not the color. It cannot be done without grouping.

Another important difference is the emphasis on non-counting strategies for computation. Japanese children are discouraged from counting; rather they are taught to see quantities in groups of fives and tens.

For example, when an American child wants to know 9 + 4, most likely the child will start with 9 and count up 4. In contrast, the Asian child will think that if he takes 1 from the 4 and puts it with the 9, then he will have 10 and 3, or 13. Unfortunately, very few American first-graders at the end of the year even know that 10 + 3 is 13.

I decided to conduct research using some of these ideas in two similar first grade classrooms. The control group studied math in the traditional workbook-based manner. The other class used the lesson plans I developed. The children used that special number naming for three months.

They also used a special abacus I designed, based on fives and tens. I asked 5-year-old Stan how much is 11 + 6. Then I asked him how he knew. He replied, "I have the abacus in my mind."

The children were working with thousands by the sixth week. They figured out how to add 4-digit numbers on paper after learning how on the abacus.

Every child in the experimental class, including those enrolled in special education classes, could add numbers like 9 + 4, by changing it to 10 + 3.

I asked the children to explain what the 6 and 2 mean in the number 26. Ninety-three percent of the children in the experimental group explained it correctly while only 50% of third graders did so in another study.

I gave the children some base ten rods (none of them had seen them before) that looked like ones and tens and asked them to make 48. Then I asked them to subtract 14. The children in the control group counted 14 ones, while the experimental class removed 1 ten and 4 ones. This indicated that they saw 14 as 1 ten and 4 ones and not as 14 ones. This view of numbers is vital to understanding algorithms, or procedures, for doing arithmetic.

I asked the experimental class to mentally add 64 + 20, which only 52% of nine-year-olds on the 1986 National test did correctly; 56% of those in the experimental class could do it.

Since children often confuse columns when taught traditionally, I wrote 2304 + 86 = horizontally and asked them to find the sum any way they liked. Fifty-six percent did so correctly, including one child who did it in his head.

The following year I revised the lesson plans and both first grade classes used these methods. I am delighted to report that on a national standardized test, both classes scored at the 98th percentile.

Joan A. Cotter, Ph.D.

Some General Thoughts on Teaching Mathematics

1. Only five percent of mathematics should be learned by rote; 95 percent should be understood.
2. Real learning builds on what the child already knows. Rote teaching ignores it.
3. Contrary to the common myth, "young children can think both concretely and abstractly. Development is not a kind of inevitable unfolding in which one simply waits until a child is cognitively 'ready.'" —*Foundations for Success* NMAP
4. What is developmentally appropriate is not a simple function of age or grade, but rather is largely contingent on prior opportunities to learn." —Duschl & others
5. Understanding a new model is easier if you have made one yourself. So, a child needs to construct a graph before attempting to read a ready-made graph.
6. Good manipulatives cause confusion at first. If a new manipulative makes perfect sense at first sight, it is not needed. Trying to understand and relate it to previous knowledge is what leads to greater learning. —Richard Behr & others.
7. According to Arthur Baroody, "Teaching mathematics is essentially a process of translating mathematics into a form children can comprehend, providing experiences that enable children to discover relationships and construct meanings, and creating opportunities to develop and exercise mathematical reasoning."
8. Lauren Resnick says, "Good mathematics learners expect to be able to make sense out of rules they are taught, and they apply some energy and time to the task of making sense. By contrast, those less adept in mathematics try to memorize and apply the rules that are taught, but do not attempt to relate these rules to what they know about mathematics at a more intuitive level."
9. Mindy Holte puts learning the facts in proper perspective when she says, "In our concern about the memorization of math facts or solving problems, we must not forget that the root of mathematical study is the creation of mental pictures in the imagination and manipulating those images and relationships using the power of reason and logic." She also emphasizes the ability to imagine or visualize, an important skill in mathematics and other areas.
10. The only students who like flash cards are those who do not need them.
11. Mathematics is not a solitary pursuit. According to Richard Skemp, solitary math on paper is like reading music, rather than listening to it: "Mathematics, like music, needs to be expressed in physical actions and human interactions before its symbols can evoke the silent patterns of mathematical ideas (like musical notes), simultaneous relationships (like harmonies) and expositions or proofs (like melodies)."
12. "More than most other school subjects, mathematics offers special opportunities for children to learn the power of thought as distinct from the power of authority. This is a very important lesson to learn, an essential step in the emergence of independent thinking." —*Everybody Counts*

13. The role of the teacher is to encourage thinking by asking questions, not giving answers. Once you give an answer, thinking usually stops.
14. Putting thoughts into words helps the learning process.
15. Help the children realize that it is their responsibility to ask questions when they do not understand. Do not settle for "I don't get it."
16. The difference between a novice and an expert is that an expert catches errors much more quickly. A violinist adjusts pitch so quickly that the audience does not hear it.
17. Europeans and Asians believe learning occurs not because of ability, but primarily because of effort. In the ability model of learning, errors are a sign of failure. In the effort model, errors are natural. In Japanese classrooms, the teachers discuss errors with the whole class.
18. For teaching vocabulary, be sure either the word or the concept is known. For example, if a child is familiar with six-sided figures, we can give him the word, hexagon. Or, if he has heard the word, multiply, we can tell him what it means. It is difficult to learn a new concept and the term simultaneously.
19. Introduce new concepts globally before details. This lets the children know where they are headed.
20. Informal mathematics should precede paper and pencil work. Long before a child learns how to add fractions with unlike denominators, she should be able to add one half and one fourth mentally.
21. Some pairs of concepts are easier to remember if one of them is thought of as dominant. Then the non-dominant concept is simply the other one. For example, if even is dominant over odd; an odd number is one that is not even.
22. Worksheets should also make the child think. Therefore, they should not be a large collection of similar exercises, but should present a variety. In RightStart™ Mathematics, they are designed to be done independently.
23. Keep math time enjoyable. We store our emotional state along with what we have learned. A person who dislikes math will avoid it and a child under stress stops learning. If a lesson is too hard, stop and play a game. Try the lesson again later.
24. In Japan students spend more time on fewer problems. Teachers do not concern themselves with attention spans as is done in the U.S.
25. In Japan the goal of the math lesson is that the student has understood a concept, not necessarily has done something (a worksheet).
26. The calendar must show the entire month, so the children can plan ahead. The days passed can be crossed out or the current day circled.
27. A real mathematical problem is one in which the procedures to find the answer is not obvious. It is like a puzzle, needing trial and error. Emphasize the satisfaction of solving problems and like puzzles, of not giving away the solution to others.

RightStart™ Mathematics

Ten major characteristics make this research-based program effective:

1. Refers to quantities of up to 5 as a group; discourages counting individually. Uses fingers and tally sticks to show quantities up to 10; teaches quantities 6 to 10 as 5 plus a quantity, for example 6 = 5 + 1.
2. Avoids counting procedures for finding sums and remainders. Teaches five- and ten-based strategies for the facts that are both visual and visualizable.
3. Employs games, not flash cards, for practice.
4. Once quantities 1 to 10 are known, proceeds to 10 as a unit. Temporarily uses the "math way" of naming numbers; for example, "1 ten-1" (or "ten-1") for eleven, "1-ten 2" for twelve, "2-ten" for twenty, and "2-ten 5" for twenty-five.
5. Uses expanded notation (overlapping) place-value cards for recording tens and ones; the ones card is placed on the zero of the tens card. Encourages a child to read numbers starting at the left and not backward by starting at the ones.
6. Proceeds rapidly to hundreds and thousands using manipulatives and place-value cards. Provides opportunities for trading between ones and tens, tens and hundreds, and hundreds and thousands with manipulatives.
7. Teaches mental computation. Investigates informal solutions, often through story problems, before learning procedures.
8. Teaches four-digit addition on the abacus, letting the child discover the paper and pencil algorithm.
9. Introduces fractions with a linear visual model, including all fractions from 1⁄2 to 1⁄10. "Pies" are not used initially because they cannot show fractions greater than 1. Later, the tenths will become the basis for decimals.
10. Teaches short division (where only the answer is written down) for single-digit divisors, before long division.

Second Edition

Many changes have occurred since the first RightStart™ lessons were begun in 1994. First, mathematics is used more widely in many fields, for example, architecture, science, technology, and medicine. Today, many careers require math beyond basic arithmetic. Second, research has given us new insights into how children learn mathematics. Third, kindergarten has become much more academic, and fourth, most children are tested to ensure their preparedness for the next step.

This second edition is updated to reflect new research and applications. RightStart™ Mathematics Second Edition, incorporates the Common Core State Standards as the basic minimum. Topics within a grade level are always taught with the most appropriate method using the best approach with the child and teacher in mind.

Daily Lessons

Objectives. The objectives outline the purpose and goal of the lesson. Some possibilities are to introduce, to build, to learn a term, to practice, or to review.

Materials. The Math Set of manipulatives includes the specially crafted items needed to teach RightStart™ Mathematics. Occasionally, common objects such as scissors will be needed. These items are indicated by boldface type.

Warm-up. The warm-up time is the time for quick review, memory work, and sometimes an introduction to the day's topics. The dry erase board makes an ideal slate for quick responses.

Activities. The Activities for Teaching section is the heart of the lesson; it starts on the left page and continues to the right page. These are the instructions for teaching the lesson. The expected answers from the child are given in square brackets.

Establish with the children some indication when you want a quick response and when you want a more thoughtful response. Research shows that the quiet time for thoughtful response should be about three seconds. Avoid talking during this quiet time; resist the temptation to rephrase the question. This quiet time gives the slower child time to think and the quicker child time to think more deeply.

Encourage the child to develop persistence and perseverance. Avoid giving hints or explanations too quickly. Children tend to stop thinking once they hear the answer.

Explanations. Special background notes for the teacher are given in Explanations.

Worksheets. The worksheets are designed to give the children a chance to think about and to practice the day's lesson. The children are to do them independently. Some lessons, especially in the early levels, have no worksheet.

Games. Games, not worksheets or flash cards, provide practice. The games, found in the *Math Card Games* book, can be played as many times as necessary until proficiency or memorization takes place. They are as important to learning math as books are to reading. The *Math Card Games* book also includes extra games for the child needing more help, and some more challenging games for the advanced child.

In conclusion. Each lesson ends with a short summary called, "In conclusion," where the child answers a few short questions based on the day's learning.

Number of lessons. Generally, each lesson is be done in one day and each manual, in one school year. Complete each manual before going on to the next level. Other than Level A, the first lesson in each level is an introductory test with references to review lessons if needed.

Comments. We really want to hear how this program is working. Please let us know any improvements and suggestions that you may have.

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Lesson 2: Subitizing 4 and Patterning

OBJECTIVES:

1. To learn finger sets and tally marks for 4
2. To recognize quantities 1 to 4 without counting
3. To recognize and continue a simple pattern

MATERIALS:

1. Music for "Yellow is the Sun"
2. *Yellow is the Sun* book
3. Finger cards, cut apart (Appendix p. 2)
4. Tally sticks
5. Tiles

ACTIVITIES FOR TEACHING:

Warm-up. Gather in the circle; continue teaching the song, "Yellow is the Sun."

Yellow is the Sun

Yellow is the sun.
This is only one. (Raise one finger.)

Why is the sky so blue?
Let me show you two. (Raise two fingers.)

Salty is the sea.
One more and it's three. (Raise three fingers.)

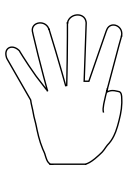
Hear the thunder roar.
Here's the mighty four. (Raise four fingers.)

Ducks will swim and dive.
My whole hand makes five. (Raise five fingers.)

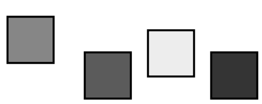
Read the book *Yellow is the Sun* to the children.

Show the finger card with 2 for one to two seconds and ask the children to show the quantity with their fingers on their left hands and to build it with tally sticks. Repeat with finger cards 1 and 3. Also, clap 2 times. Ask: How many claps did you hear? [2] Repeat with 3.

Subitizing 4. Show 4 with your fingers and ask the children to show 4 with their left hand. Then show 4 tiles and say: This is 4. See the figures below.



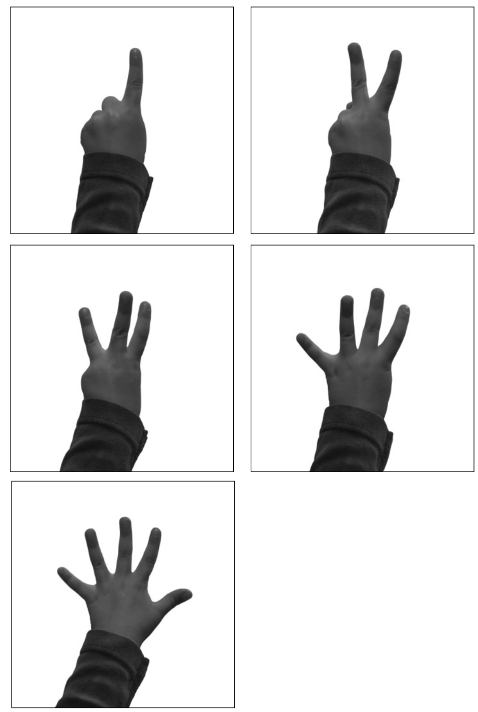
Four.



Four tiles.

Rearrange the 4 tiles and ask how many they see. Remove 1 tile and ask: How many? [3] Replace it and again ask: How many? [4] Now clap 4 times and ask: How many claps they hear? [4]

EXPLANATIONS:

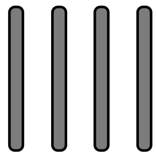


It is unimportant which fingers on the left hand the children use to show the quantities.

The finger, dot, bead, and tally stick cards pattern cards are found on pp. 2, 6, 7, and 19. If necessary, copy onto card stock, using one color for the sets of finger cards, another color for the tally sticks, and a third color for the bead pattern cards. You will also need two sets of dot cards, which can be in a fourth color.

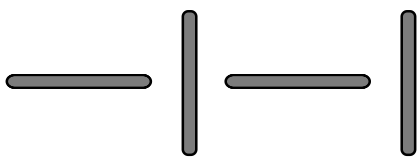
ACTIVITIES FOR TEACHING CONTINUED:

Changing quantities. Tell them to make 4 with 4 tally sticks. Then ask them to remove 2 sticks and say how many? [2] Ask them to add 1 and say how many? [3] Repeat with one more.



Four.

Introducing patterning. Take a group of tally sticks and lay one out horizontally. Place another next to the first vertically, the third one horizontally and the fourth one vertically. Give a child a tally stick and ask: What do you think comes next? Tell them we will call this the "do-re" (doe-ray) pattern. Tell the children to continue to lay out the pattern.



Continuing the pattern with tally sticks.

Next take out the tiles and lay out a red tile followed by a blue tile and then another red tile. Ask the children which color would come next in the do-re pattern? [blue] Ask the children to continue the pattern.

Continuing the do-re (AB) pattern.

Encourage the children make the same pattern with different colors.

In conclusion. Ask the children to say how many fingers they see while you do the following: Raise 4 fingers, then put 1 down and back up several times. [4, 3, 4, 3, . . .] Ask: Do you hear a do-re pattern? [yes]

EXPLANATIONS CONTINUED:

Our brains are wired to look for patterns.

Patterns are often named using letters of the alphabet. The letters are used sequentially, naming each different element of the pattern. For example, a strictly alternating pattern is AB. To avoid using the letters of the alphabet for beginning readers, we will use musical scale names to designate pattern names. The names are do (doe), re (ray), mi (me), fa (fah).

You might want to teach the children the "Do Re Mi" song from the "Sound of Music."

Conclusions may be a summary of the day's lesson or an expansion of the lesson to challenge higher level thinking.

K.CC.1

Lesson 8: Subitizing 7 and the AL Abacus

OBJECTIVES:

1. To subitize 7
2. To learn the terms *above* and *below*
3. To learn the terms *top* and *bottom*
4. To enter 1 to 5 beads on the AL Abacus without counting

MATERIALS:

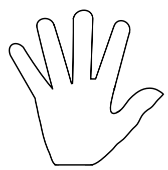
1. *Yellow is the Sun* book
2. Finger cards
3. Tally sticks
4. Tiles
5. AL Abacuses

ACTIVITIES FOR TEACHING:

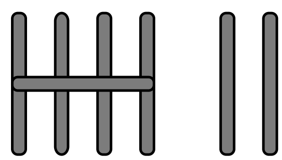
Warm-up. Continue reading the book and singing the song, "Yellow is the Sun."

Show the finger cards 1 to 6 at random for 2 seconds and ask the children to show them on their fingers. Also have them show the number with tally sticks and say the numbers.

Quantity 7. Show 7 to the children with your fingers. Ask them to show it on their fingers. Also ask them to build it with the tally sticks. Now, ask them to make a 7 with the tiles, using two colors as shown below.



Seven.



Seven.

Seven.

Above and below. To help the children understand the words *above* and *below*, ask the children is your nose above or below your mouth. Ask: Is your chin above or below your eyes? Repeat with different parts of the face using the words above or below.

Now have the children show you something under the table or desk. Ask them to name something above their heads.

Top and bottom. Point out examples of *top* and *bottom*, such as "Where is the *top* of the window" and "Where is the *bottom* of the window." Repeat for the top and bottom of a page in a book.

AL Abacus. Show the children the AL Abacus. Help them learn to handle it with respect, as due any tool. You might give them a few minutes to make patterns and designs.

EXPLANATIONS:

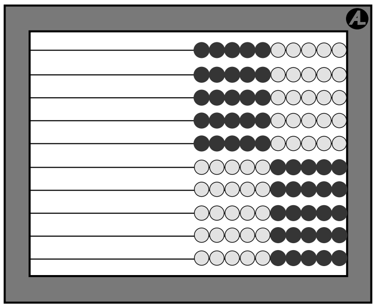
It might help to say "sev-en" as you point to the "two" part of 7.

As this point, 7 must be shown as 5 on the left hand and 2 on the right, not, for example, as 4 on one hand and 3 on the other.

The terms *above*, *below*, *top*, and *bottom* are part of the spatial terms suggested by the Common Core State Standards.

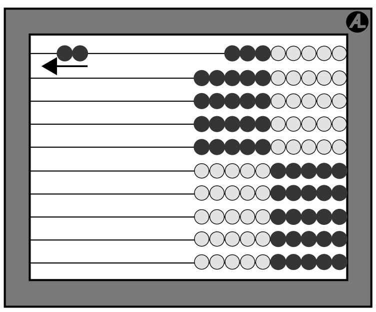
ACTIVITIES FOR TEACHING CONTINUED:

Entering quantities. Show them how to place the abacus with the circle logo at the top. This means the circle will be on the right and the wires horizontal. Demonstrate clearing the abacus by lifting the left edge so the beads fall toward the side with the circle. See the figure below.

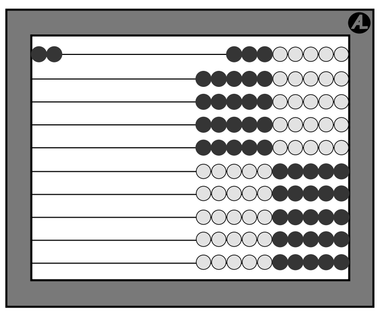


AL Abacus cleared.

Ask the children to clear the abacus. Ask them to show 2 with their fingers. Ask them to enter 2 on the top wire. See the figures below.

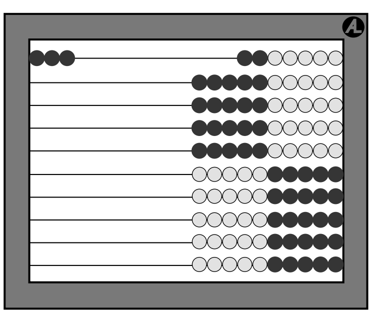


Entering 2 as a unit.

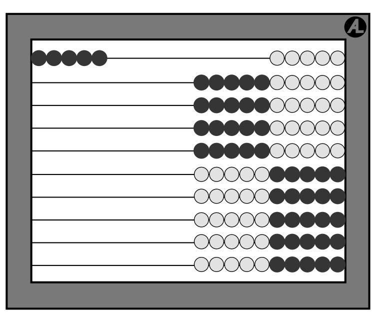


Two.

Ask them to clear the abacus. Then ask them to show 3 with fingers and enter 3 on the abacus. Repeat for 5 and ask how they could tell it was 5. [a whole hand, all the dark colored beads on a wire] Lastly, ask them to show 4 and enter 4.



Three.



Five.

In conclusion. Show 5 on your fingers and ask: How much is this? [5] Repeat for 7.

EXPLANATIONS CONTINUED:

To enter a quantity on the AL Abacus, move the beads from right to left. This allows the eyes to travel from left to right as in reading.

Quantities are entered on the abacus as a group; they are not counted. If a child counts when entering a quantity, simply say: Okay, now can you enter (3) without counting.

K.CC.1, K.G.1

Lesson 94: Dozens & Partitioning Teens into Tens

OBJECTIVES:

1. To introduce the term *dozen*
2. To partition teens

MATERIALS:

1. **Egg carton with 2 eggs or other objects**
2. Place-value cards
3. AL Abacuses
4. Dry erase boards
5. Worksheet 34, Partitioning Teens

ACTIVITIES FOR TEACHING:

Warm-up. Ask the children to count by 1s to 80.

Ask the children to count by 10s to 200.

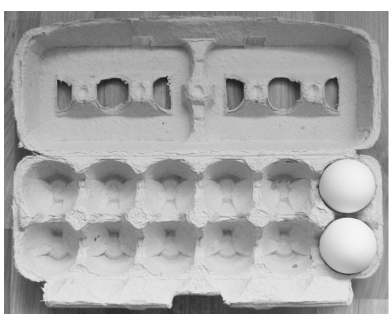
Ask the children to count by 5s to 100.

Ask: How much is 43 + 1? [44] How much is 44 + 2? [46] How much is 78 + 1? [79] How much is 99 + 1? [1 hundred]

Ask the children to show parallel lines using their arms. Then ask them to show perpendicular lines.

Ask the children to listen to the pattern and to continue it with the next number: 46, 47, 48; [49] 57, 56, 55; [54] and 50, 60, 70. [80]

Dozen. Show the children an egg carton. Tell them that it holds one *dozen* eggs. Open the carton and display it as shown below. Ask them: How many eggs would fit? [12] Ask: How many eggs are in a dozen eggs? [12] How many buns are in a package of a dozen buns? [12]



An egg carton.

Then ask the children to solve the following problem:

How many eggs are in 2 dozen eggs.

Let them solve the problem in their own way and to explain how they did it. Ask them to show their solution with place-value cards. [24]

If appropriate, ask them to find the number of eggs in 3 dozen. [36]

EXPLANATIONS:

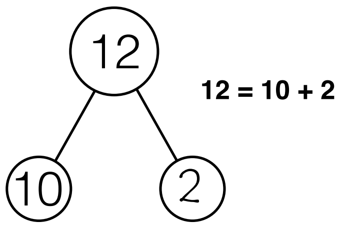
While the term dozen has virtually no mathematical significance, 12 continues to be important in a cultural sense. We have 12 in a dozen, 12 months in a year, 12 hours on the clock, and 12 inches in a foot.

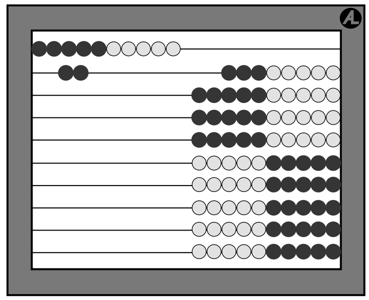
Showing the egg carton with two eggs (or similar objects) makes the ten empty spaces more prominent.

ACTIVITIES FOR TEACHING CONTINUED:

Ask the children if it is easier to count by dozens or by tens and why.

Partitioning the teens. Draw a part-whole circle set and write 12 in the whole and 10 in the left part-circle. Ask: What goes in the other part-circle? Ask them to demonstrate the partitioning on the abacus and to explain it.





Partitioning 12 into 10 and 2.

Next ask them to say and write the equation. [12 = 10 + 2] Also ask them for the inverse: What is 10 + 2? [12]

Repeat with 15 written in the whole-circle and 10 in the left part-circle. Continue with other teen numbers.

Practice. Ask the children: Sixteen is 10 and what. [6] Fifteen is 5 and what? [10] Thirteen is 3 and what? [10] Nineteen is 10 and what? [9]

Problem. Give them the following problem:

> Lee hid a dozen eggs. Lee's friends found 10 of them. How many of them are still hidden?

Ask: What does the word dozen means? [12] How many eggs were found? [10] How many eggs are still hidden? [2]

Worksheet 34. Ask the children to do the worksheet for partitioning the teens into 10 and another number. The problems and solutions are as follows:

15 = 10 + **5**
19 = 10 + **9**
13 = 10 + **3**
11 = 10 + **1**
17 = 10 + **7**
16 = 10 + **6**
14 = 10 + **4**
18 = 10 + **8**
12 = 10 + **2**
20 = 10 + **10**

In conclusion. Ask: How much is a dozen? [12] How much is a half dozen? [6]

EXPLANATIONS CONTINUED:

English-speaking children usually have difficulty conceptualizing the teen numbers as 10 + another number. In other words, the children tends to see 14 as 14 ones, rather than a ten and 4 ones. The following activities are designed to help them make that connection, which becomes harder since they started using the traditional names. Refer back to math way saying the numbers, if necessary.

K.NBT.1

Name: ____________________

15 = 10 + ___
19 = 10 + ___
13 = 10 + ___
11 = 10 + ___
17 = 10 + ___
16 = 10 + ___
14 = 10 + ___
18 = 10 + ___
12 = 10 + ___
20 = 10 + ___

Lesson 104: Comparing Weights

OBJECTIVES:

1. To become aware of weight
2. To introduce the term *heavier*
3. To compare weights

MATERIALS:

1. **Two identical glasses, one empty** and **with water**
2. Geometric solids
3. *Math balance, two weights, **two 4-inch (10 cm) paper cups,** and **two rubber bands**
4. **Small objects to weigh: plastic, metal, etc.**

ACTIVITIES FOR TEACHING:

Warm-up. Ask: How much is 15 plus 1? [16] How much is 15 minus 1? [14] How much is 10 plus 1? [11] How much is 10 minus 1? [9] How much is 12 plus 1? [13] How much is 12 minus 1? [11]

Ask the children: Is 1 plus 1, adding or subtracting? [adding] Is 9 and 2 more, adding or subtracting? [adding] Is 10 minus 1, adding or subtracting? [subtracting] Is taking 2 from 8, adding or subtracting? [subtracting]

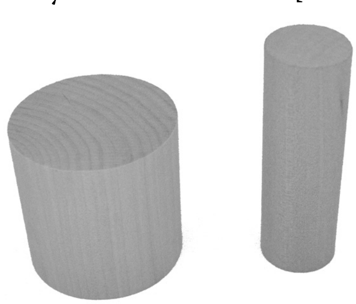
Ask the children: After adding on the abacus, will your answer be greater or less? [greater] After subtraction, will your answer be greater or less? [less]

Ask the children: How long is one edge of a tile? [1 inch] How long are 2 edges of a tile? [2 inches] How long are 3 edges of a tile? [3 inches] How long are all four edges of a tile? [4 inches]

Ask: Which is longer, an inch or a centimeter? [inch] Which is shorter? [centimeter]

Comparing weights. Set two glasses in front of the children, one empty and one half full of water. Ask one child to carefully lift the empty glass and set it down. Then ask him to lift the glass with water and tell him the second glass is *heavier.* Explain that the glasses look alike, but the one with water feels heavier.

Ask the children to find the two cylinders from the geometric solids. Ask: Which one is taller? [the right cylinder shown below] Ask one child to lift each one. Which cylinder is heavier? [the left cylinder]



The two cylinders.

EXPLANATIONS:

*To prepare the math balance to be used as a scale, punch holes in two paper cups and insert a rubber band in the holes as shown above. Instead of the rubber bands, twist ties or two paper clips per side will also work.

Clear plastic cups allow the children to see the contents of the cups more easily, but use only cups with plastic code 1. The code is found in the recycling triangle, usually on the bottom. A cup with plastic code 6 is brittle and often breaks when making the hole, leaving sharp edges.

ACTIVITIES FOR TEACHING CONTINUED:

EXPLANATIONS CONTINUED:

Comparing weights using the scale. Hang a cup from each 10-peg on the math balance as shown below. Tell the children we will now use this as a scale and we will not using the numbers.

The math balance converted to a scale.

If necessary, move the little white weights to adjust the balance.

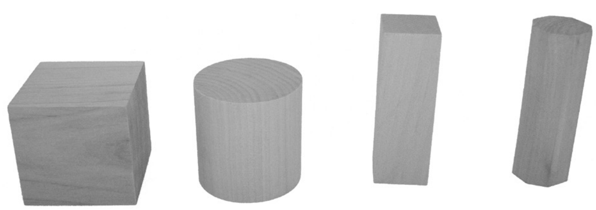
Ask the children: What do you think will happen if we put a blue weight in each cup? Tell them to try it. [stays balanced]

Comparing the solids using the scale. Ask: What do you think will happen if we put one cylinder from the geometric solids in each cup? Ask them to try it. [The cup with the heavier cylinder sinks.]

Ask them to choose any two geometric solids, guess which is heavier, and then check with the scale. Ask them to try several combinations.

As a challenge, give them several solids and ask them to use the scale to figure out which one is heaviest. Then ask them to put the solids in order from heaviest to lightest.

This can be done by first comparing any two items. Then take the heavier one and compare it with the others.



Four geometric solids in order by weight.

Your solids may have a different order because the weights may vary.

Comparing other objects using the scale. Ask them to compare two other objects, such as a piece of styrofoam and a piece of plastic or metal. Encourage them to find things to compare.

In conclusion. Ask: Can you always tell which of two things is heavier by just looking? [no] How can you find out? [by weighing]

K.MD.1, K.MD.2