Activities for Learning, Inc.

RIGHTSTART™ MATHEMATICS

by Joan A. Cotter, Ph.D.

LEVEL E LESSONS

FOR HOME EDUCATORS

FIRST EDITION

Special thanks to Sharalyn Colvin, who converted *RightStart™ Mathematics: Grade 4 Lessons* into *RightStart™ Mathematics: Level E For Home Educators*.

Note: Rather than use the designation, K-4, to indicate a grade, levels are used. Level A is kindergarten, Level B is first grade, and so forth.

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RightStart™ MATHEMATICS: OBJECTIVES FOR LEVEL E

Name ____

Teacher ____ **Year** ________

Objective	1ST QTR	2ND QTR	3RD QTR	4TH QTR
Numeration				
Understands decimals to two places	N/A			
Can read and write numbers to 99 million				
Understands prime numbers	N/A	N/A		
Can factor numbers into primes	N/A	N/A		
Understands and can use simple percents	N/A			
Multiplication				
Can multiply 4-digit numbers by 2-digit numbers	N/A			
Knows multiplication facts	N/A			
Division				
Can solve division story problems with remainders	N/A	N/A		
Can divide 4-digit numbers by 1-digit using short division	N/A	N/A		
Understands and can find averages	N/A	N/A		
Knows division facts	N/A	N/A		
Fractions				
Can add and subtract simple fractions				
Can convert between improper fractions and mixed fractions	N/A			
Calculator				
Can find squares and square roots	N/A			
Can divide and make sense of the remainder	N/A	N/A		
Money				
Can solve consumer problems involving money				
Problem Solving				
Works well in group to solve problems				
Clearly justifies his/her reasoning				
Geometry				
Can construct and measure angles	N/A	N/A	N/A	
Can sketch 3-dimensional shapes	N/A	N/A	N/A	
Understands rotational symmetry	N/A	N/A	N/A	
Knows terms prism, pyramid, cylinder, and sphere	N/A	N/A	N/A	
Knows terms acute, right, and obtuse angles	N/A	N/A	N/A	
Can find the area of a triangle	N/A	N/A		
Can locate points on a coordinate system	N/A	N/A		
Measurement				
Can measure to fourths & tenths of an inch	N/A			
Can measure to tenths of a centimeter	N/A			
Can find area to tenths of square inches or square cm	N/A			
Can construct and read pie graphs	N/A	N/A	N/A	
Patterns				
Can recognize and continue a pattern				
Can use algebraic thinking to write a pattern symbolically	N/A	N/A	N/A	
Can solve simple equations				
Data and Probability				
Can collect and display data	N/A	N/A	N/A	
Can determine the probability of an event	N/A	N/A		
Knows mean, median, and mode	N/A	N/A		

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. 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 9

Equivalent Fractions

OBJECTIVES
1. To find equivalent fractions using drawing tools
2. To learn the word *terms* as related to fractions

MATERIALS
Worksheet 11, Equivalent Fractions
Drawing board, T-squares, and 30-60 triangle
Tape for fastening the worksheet to the drawing board. (3M's Removable Tape works well and can be reused several times.)

WARM-UP
Give the child the equation puzzle, 5 1 1 6. Some solutions are:

$$5 = 11 - 6$$
$$5 + 1 = 1 \times 6$$
$$5 + 1 \times 1 = 6$$

Ask the child to write the multiples of 2, 4, 6, and 8 in two rows and ask for various multiplication facts. Also ask for the 9s facts.

ACTIVITIES
Reviewing fraction charts. Take out the worksheet. What does the top half of the sheet show? [2 fraction charts; that is dividing rectangles into halves, thirds, down to tenths] What pattern do you notice about the size of the pieces? Which is largest and which is smallest? [$1/2$ is largest and $1/10$ is smallest] Why is $1/10$ less than $1/9$? [Dividing something into 10 pieces means each piece must be smaller than if it was divided into 9 pieces.]

Note: Recipes and roadway signs use a slanted line for fractions, but in mathematics the horizontal line is preferred.

Write

$$\frac{2}{5}$$

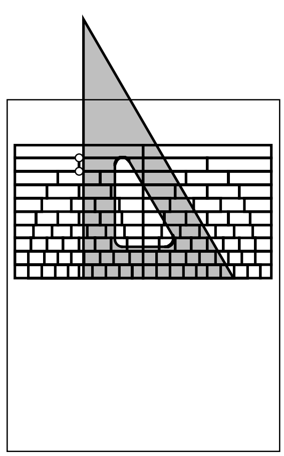
and ask the child to read it. [two fifths] What does it mean? [two $1/5$s or 2 divided into 5 pieces] Ask for both meanings on the charts. [two of the $1/5$s]

Seeing halves. Can you find other fractions equal to $1/2$? Write them as the child finds them:

$$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10}$$

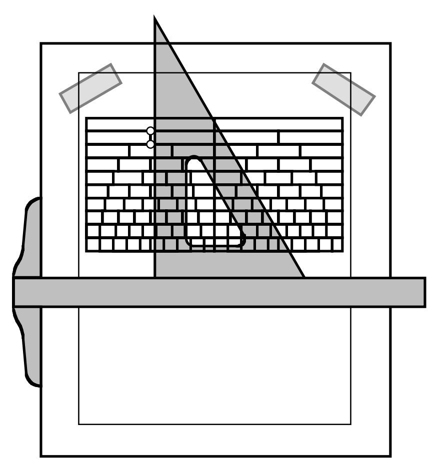
What pattern do you see? [The upper number is half of the lower number.] Tell her the numbers in a fraction are called *terms.*

Equivalent fractions. How could you use a drawing triangle to find all the halves? See the figure below on the left.



Using tools to line up the halves.

The little white dots show where to align the triangle.



Tell the child to tape the worksheet to the drawing board, in the upper corners as shown on the previous page.

Ask her to move the triangle to show two halves. What other fractions equal two halves? [3/3, 4/4, . . . 10/10]

What other fractions are equal to 3/9? [1/3, 2/6] Write them down.

$$\frac{3}{9} \quad \frac{1}{3} \quad \frac{2}{6}$$

Which of these fractions has the lowest numbers, called the *lowest terms?* [1/3]

Repeat for 6/8. What other fractions are equal to 6/8? [3/4] Write them down.

$$\frac{6}{8} \quad \frac{3}{4}$$

Which fraction has the lowest terms? [3/4]

Repeat for 9/6. What other fractions are equal to 9/6? [3/2, **6/4**, 12/8, 15/10] Write them down.

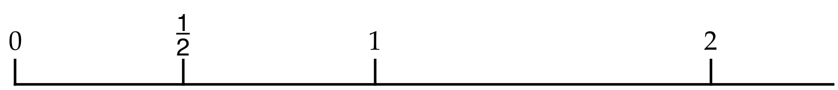
$$\frac{3}{2} \quad \frac{6}{4} \quad \frac{12}{8} \quad \frac{15}{10}$$

Which fraction has the lowest terms? [3/2]

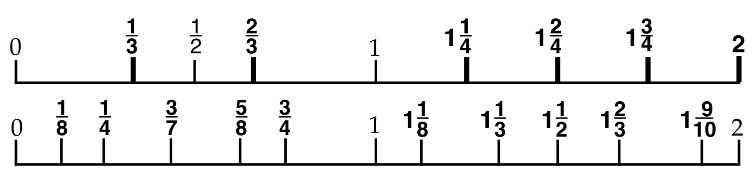
Fraction number line. Draw a horizontal line; label it with a 0 and 1 as shown below.

Where would you put a mark for 2? Ask the child to make the mark and write the number. Repeat for 1/2. See below.

Ask her to mark and write other fractions, such as 1/4, 3/4, 1 1/2, and 5/4.



Worksheet. The first two questions on the worksheet are similar to the above activity, except it is to be done with the precision of the drawing tools. The answers are below.



4/8: **1/2, 2/4, 3/6, 5/10**

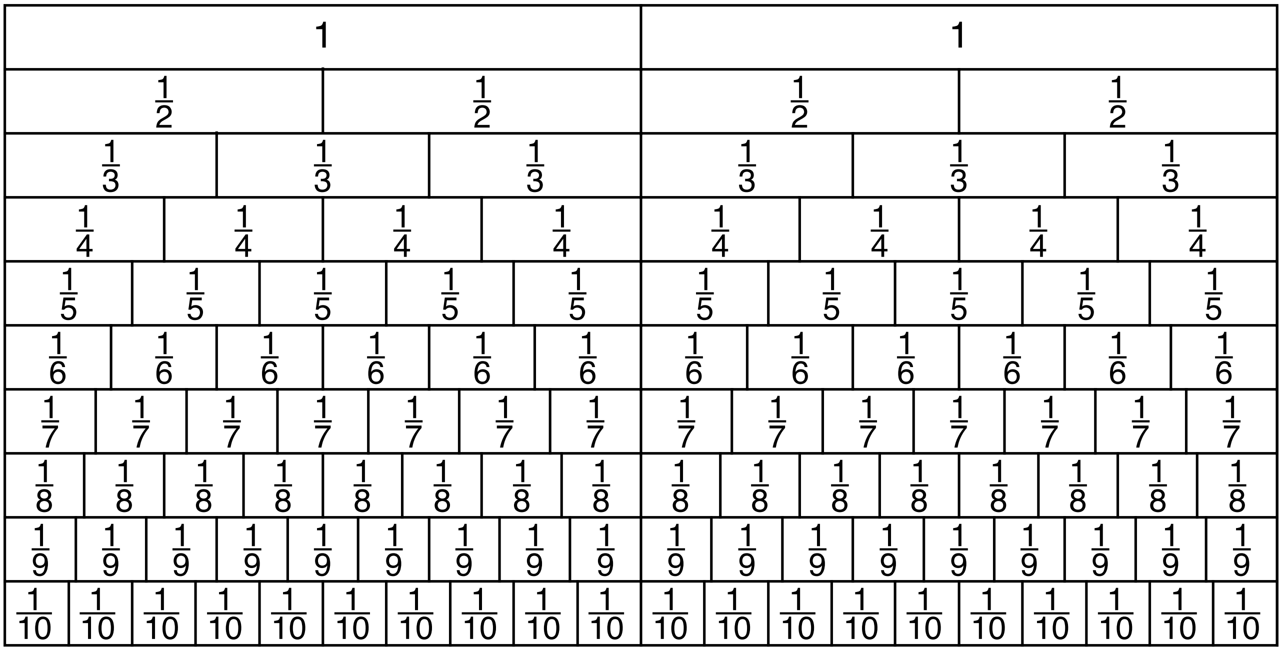
3/2: **6/4, 9/6, 12/8, 15/10**

2/6: **1/3, 3/9**

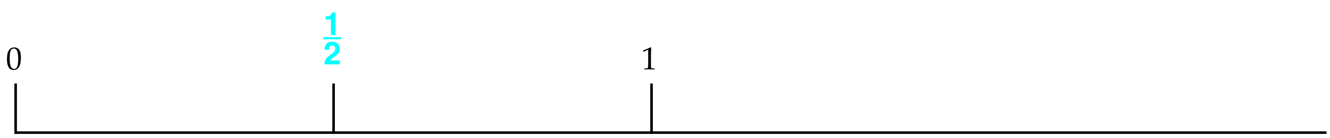
2/3: **4/6, 6/9**

Name ____________________________________

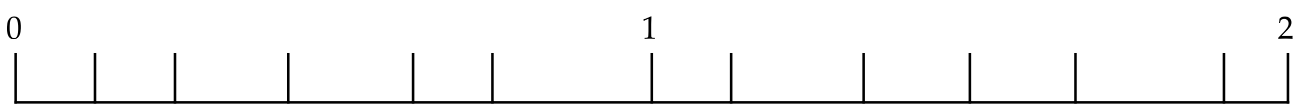
Date ____________________________



On the number line below mark and label these fractions: $\frac{1}{2}$ $\frac{1}{3}$ $\frac{2}{3}$ $1\frac{1}{4}$ $1\frac{2}{4}$ $1\frac{3}{4}$ 2.
Use the two fraction charts above and your drawing tools.



On the number line below, write the fraction with the lowest terms for each mark. Use your drawing tools.



Write other fractions equal to the one at the left.

$\frac{4}{8}$ ____________________________________

$\frac{3}{2}$ ____________________________________

$\frac{2}{6}$ ____________________________________

$\frac{2}{3}$ ____________________________________

Lesson 26

Percent Practice

OBJECTIVES
1. To find the percent of various numbers in the hundred chart
2. To review some general math and map concepts

MATERIALS Worksheets 23-1 and 23-2, "Percent Practice"
A map of the U.S. and a list of the 50 states

WARM-UP Write the puzzle numbers of 4 9 7 2. Some solutions are:

$$4\ 9 = 7^2$$
$$4 - 9 + 7 = 2$$
$$4 = 9 - 7 + 2$$

Write $100\% - 51\% = [49\%]$

to be solved mentally with only the answer written. Some methods: 100 – 50 is 50, so 100 – 51 = 49; 100 – 50 = 50 and 50 – 1 = 49.

Spend a few minutes doing a Practice sheet with the child.

ACTIVITIES ***Worksheet 23-1.*** Take out the worksheet. What chart is on the worksheet? [hundred chart, numbers 1 to 100]

Review by asking: What does percent mean? [a fraction of 100] Ask the child to read the questions and answer them. Then ask for explanations.

1. What percent of the numbers have only 1 digit? [**9%**]
2. What percent of the numbers have 3 digits? [**1%**]
3. What percent of the numbers have 2 digits? [**90%**]
4. What percent of the numbers are even numbers? [**50%**]
5. What percent of the numbers are odd numbers? [**50%**]
6. What percent of the numbers are multiples of 10? [**10%**]
7. What percent of the numbers are not multiples of 10? [**90%**]
8. What percent of the numbers are multiples of 5? [**20%**]
9. What percent of the numbers are not multiples of 5? [**80%**]
10. What percent of the numbers > 80? [**20%**]
11. What percent of the numbers < 15? [**14%**]
12. What percent of the numbers are perfect squares? [**10%**]
13. What percent of the numbers have a "1" in them? [**20%**]
14. What percent of the numbers are multiples of 9? [**11%**]
15. What percent of the numbers are not multiples of 9? [**89%**]

If interest remains, continue to ask him similar questions.

Worksheet 23-2. Assign the second worksheet to be done outside of lesson time. The child will need a map of the U.S. and a list of the 50 states. The answers are as follows:

16%	**16%**	**68%**	**20%**	**80%**
26%	**74%**	**20%**	**10%**	**36%**
26%	**16%**	**2%**	**8%**	**28%**
14%	**4%**	**98%**	**0%**	**6%**
4%				

Name ___________________________________

Date ____________________________

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

The questions refer to the numbers in the hundred chart.

1. What percent of the numbers have only 1 digit? __________

2. What percent of the numbers have 3 digits? __________

3. What percent of the numbers have 2 digits? __________

4. What percent of the numbers are even numbers? __________

5. What percent of the numbers are odd numbers? __________

6. What percent of the numbers are multiples of 10? __________

7. What percent of the numbers are not multiples of 10? __________

8. What percent of the numbers are multiples of 5? __________

9. What percent of the numbers are not multiples of 5? __________

10. What percent of the numbers > 80? __________

11. What percent of the numbers < 15? __________

12. What percent of the numbers are perfect squares? __________ (Perfect squares are numbers such as 1, 4, 9, 16, that is, the products of 1 × 1, 2 × 2, 3 × 3 and so on.)

13. What percent of the numbers have a "1" in them? __________

14. What percent of the numbers are multiples of 9? __________

15. What percent of the numbers are not multiples of 9? __________

Name ______________________________

Date ______________________________

The questions refer to the 50 states of the United States.

1. What percent of the states' names start with the letter *M*? __________

2. What percent of the states' names start with the letter *N*? __________

3. What percent of the states' names do not start with the letters *M* or *N*? __________

4. What percent of the states' names have two words? __________

5. What percent of the states' names have only one word? __________

6. What percent of the states were part of the original colonies? __________

7. What percent of the states joined after the original colonies? __________

8. What percent have the Mississippi River as part of their border? __________

9. What percent of the states have a coastline on the Pacific Ocean? __________

10. What percent have a coastline on the Atlantic Ocean or Gulf of Mexico?________

11. What percent of the states border Canada? __________

12. What percent of the states border the Great Lakes? __________

13. What percent of the states border both a Great Lake and an ocean? __________

14. What percent of the states border Mexico? __________

15. What percent of the states border only other states? __________

16. What percent of the states border Kentucky? __________

17. What percent of the states do not border any other state? __________

18. What percent of the states are in North America? __________

19. What percent of the states are in South America? __________

20. What percent of the states have borders that are only straight lines? __________

21. What percent of the states have borders that are an arc, or curve, of a circle? (Look near Delaware.) __________

Lesson 72

Triangle Area Using Different Bases

OBJECTIVES 1. To finding the area of a triangle using different bases
2. To find the area of triangles with a calculator

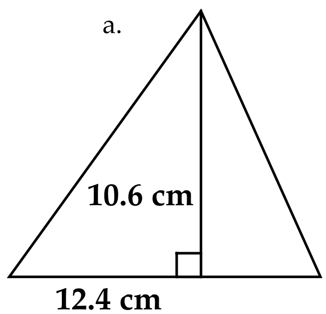
MATERIALS Worksheet 71, 74, or 77 "Division Practice-9 to 11," optional
Worksheet 80, "Triangle Area Using Different Bases"
Ruler
Calculator

WARM-UP Ask the child to find *d* in the following equations:

$2d + d = 9$ [$d = 3$] $4d + d = 20$ [$d = 4$]

ACTIVITIES ***Facts practice.*** If desired, give the child Division Practice 9, 10, or 11 found on Worksheets 71, 74, or 77. Answers are in Lessons 66 to 71.

Triangle a-1. Take out the worksheets and ask the child to find the measurements for finding the area in the top triangle. Show him how to make a little square to show that two lines are perpendicular. See the figure below.



$\boldsymbol{A = b \times a \div 2}$

$\boldsymbol{b = 12.4 \text{ cm}, a = 10.6 \text{ cm}}$

$\boldsymbol{A = 12.4 \times 10.6 \div 2}$

$\boldsymbol{A = 65.72 \text{ sq cm}}$

Finding the area of triangle a, using the horizontal side as base.

Explain that since both numbers have three digits, he can use the calculator. Before he uses the calculator, ask him to estimate the area. [about 60, ½ of 10×12]

Ask him to find a procedure to find the answer on the calculator without writing down any numbers except the answer. Then ask him to share his procedure.

One procedure is as follows:

12.4 [×] 10.6 [÷] 2 [=] 65.72

Another procedure is to recognize that ½ = 0.5:

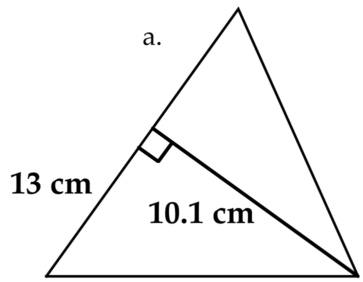
12.4 [×] 10.6 [×] .5 [=] 65.72

Is the answer reasonable? [yes]

Note: A common error in using calculators is to write down intermediate numbers, which introduces errors.

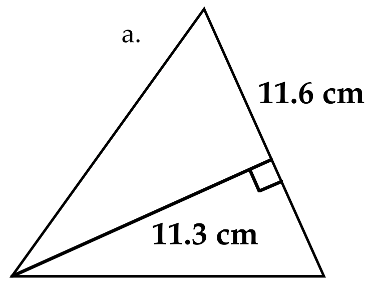
Triangles a-2 and a-3. Now ask the child to find the area again, but this time using the left side as a base. It may help if he turns the paper so the triangle is in its customary position. The solution is below on the left.

Repeat for the right side of the same triangle. The solution is below on the right.



A = 13 × 10.1 ÷ 2

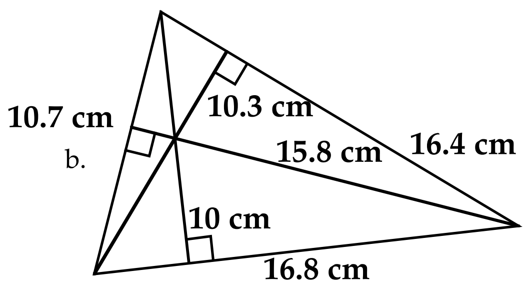
A = 65.65 sq cm



A = 11.3 × 11.6 ÷ 2

A = 65.54 sq cm

Worksheet. Ask the child to find the area of triangle b 3 ways. The solutions are below.



A = 16.8 × 10 ÷ 2	**A = 10.7 × 15.8 ÷ 2**	**A = 16.4 × 10.3 ÷ 2**
A = 84 sq cm	**A = 84.53 sq cm**	**A = 84.46 sq cm**

The three altitudes intersect at the same point.

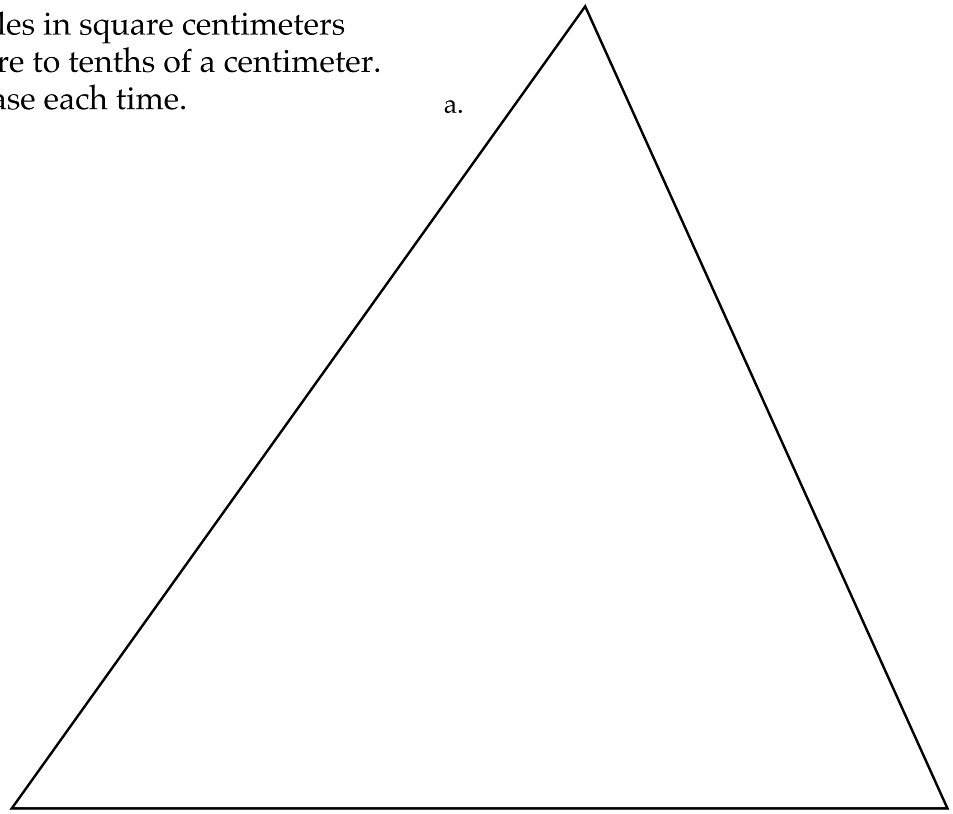
The answers are not exactly the same, but they are very close.

Name ________________________________

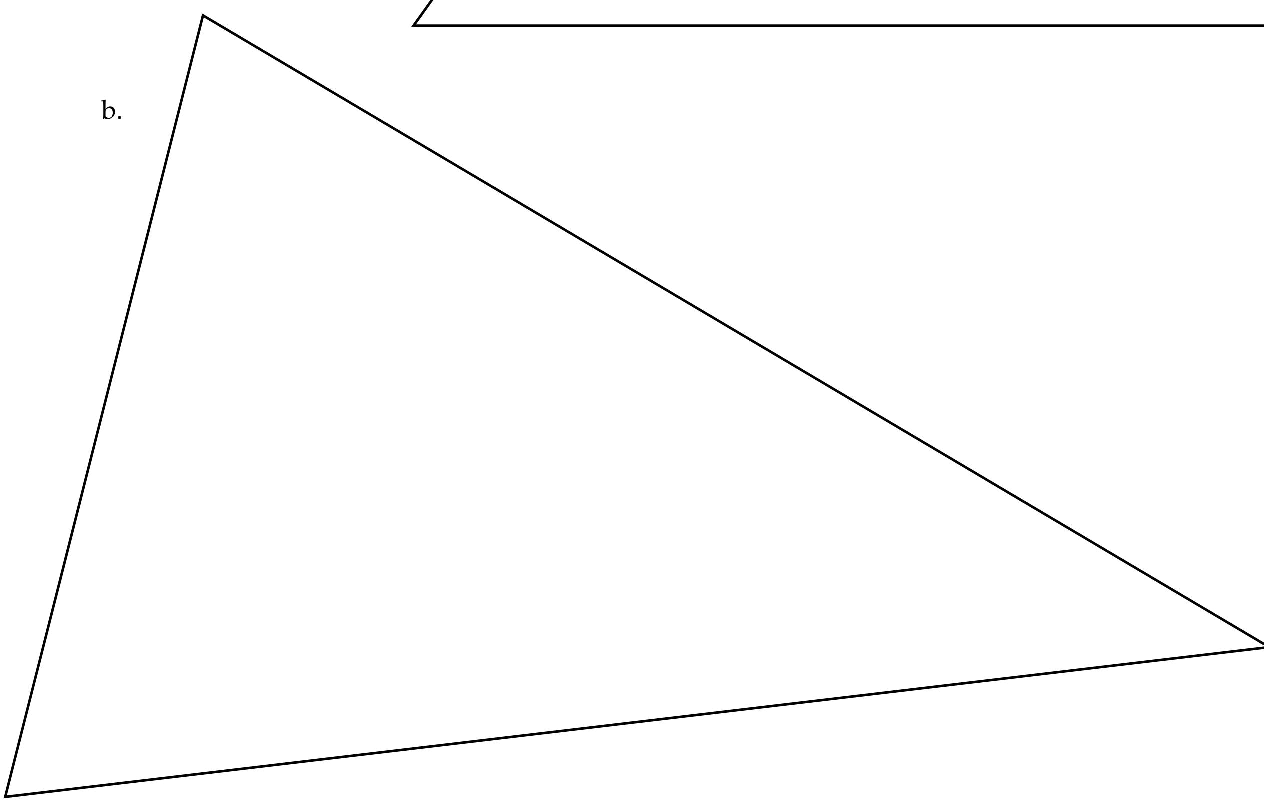
Date ________________________

Find the area of these triangles in square centimeters three different ways. Measure to tenths of a centimeter. Use a different side as the base each time.

a.



b.



What is special about the three altitudes? ______________________________

Are your three answers the same? Explain.