Logic-Math Exercises for Young Children

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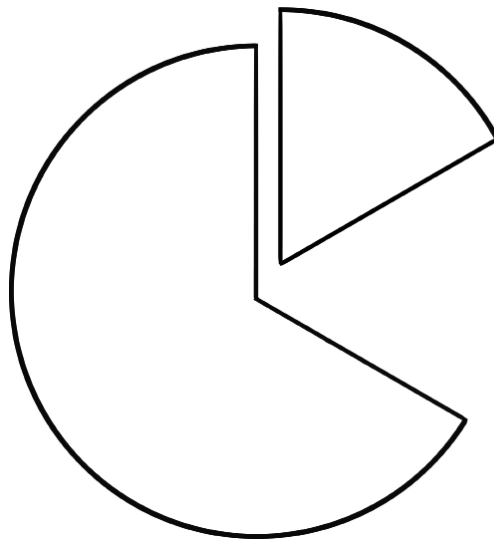
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About This Book

Logic-Math Exercises for Young Children is designed to develop critical-thinking skills in children who may not yet have mastered reading skills. In prior decades, critical thinking was reserved for much older children. Aside from reading proficiency, however, nothing in children's development prevents us from introducing and nurturing these skills earlier. This book is unique in that it provides exercises involving organizing information, sequencing, pattern decoding, understanding relationships, inferring, solving analogies, and deducing in a format designed to appeal to students in grades K-2, all without any reading barrier. As young students develop these thinking skills, expect to see them approach all materials with critical forethought.

At the same time that we are introducing critical-thinking skills, we are presenting children with math concepts. Some of these concepts are customarily introduced to this age group; others are typically reserved for older students. However, their introduction at this level is done in a fun and age-appropriate manner. These concepts include number signs, counting, addition, subtraction, fractions, decimals, graphs, geometry, volume, money, time, and more, all as a means of mastering critical-thinking skills rather than as computational challenges.

The most important element in making critical-thinking skills work for young children is the instructor, who typically is the parent but who may be a teacher. It is the instructor's role not only to present the process but also to foster an atmosphere in which creative and critical thought is more important than answers. It is important to discuss the methods that the child uses to arrive at conclusions and to be tolerant of creative diversions from the norm. Instructors should present and discuss each new type of skill with the child before that child is challenged to work independently. There are clear directions for solving the problems in each exercise, but these directions can be read by the instructor if the child is pre-literate or has reading difficulties.

Thinking Skills Presented in This Book

Organizing Information. In this book, the organizing information exercises take the form of Venn diagrams. A Venn diagram is a figure that represents mathematical or logical sets visually. It typically consists of overlapping circles to represent sets and subsets with common elements. The common elements are represented by the area of overlap between or among the circles. For example, if there are three circles representing bullfrogs, dragonflies, and butterflies, there will be three sets of characteristics distinctive to each of these animals. Traits belonging to only one animal (e.g., bullfrogs) will fit into the portion of the circle not overlapping with any other animal. Traits shared by two animals (e.g., bullfrogs and dragonflies) will fit into the portion of the circles overlapping only these two animals but excluding the third. Traits shared by all three animals will fit into the central portion of the diagram where all three circles overlap.

Once children are comfortable with the structure of a Venn diagram, they can fit the number of each trait appropriately into it. Children who can read are welcome to read the traits themselves to solve the diagrams, but for pre-literate children, the instructor should read the traits slowly, pause to allow for comprehension, and then slowly reread the traits. Repeat this as many times as necessary.

Although the answer key lists the answers for these exercises, in this section of the book particularly, children may choose answers that diverge from those listed as correct. If this happens, it is best to discuss the reasons for the discrepancies. Many times, especially with gifted or advanced children, their reasoning for selecting alternative answers is based on unusual and creative thinking, which is certainly not something we wish to punish! Welcome out-of-the-box thinking, and praise it in children who exhibit it.

Sequences. Sequencing problems require children to look at time relationships. Pictorial sequences require young thinkers to look at a group of illustrations to determine their relationship before selecting the item that must come first, the one that will come second, and so forth. For the sequencing exercises, explain to the child that there is only one logically acceptable solution, and caution the child against marking the blanks too quickly, without careful consideration. Remind him or her that an error in an early step of the solution will cause subsequent errors in the sequencing pattern.

Patterns. Exercises in pattern decoding present a series of illustrations that represent a pattern. Children must study the illustrations to discover the pattern. Once they have discovered the pattern, they are to select an illustration that would come next in

the pattern. There are several skills that come into play in these exercises. Children must be able to distinguish between the visual images, recognize the pattern that is presented, and forecast what the next element in the sequence will be.

Relationships. When dealing with relationships, children will be looking for ways in which items relate to one another. Explain to the child that some of the relationships will be obvious; others will be more subtle. It could be that they are the same shape, the same design, the same math value, or something else. Remind the child to be flexible and creative when completing these exercises.

Inferences. Inference is a broad area of logic that involves reaching conclusions from gathered evidence. It means going from the known to the unknown and forming educated guesses based on either facts or premises. Pictorial exercises introduce children to inference-based thinking. Children must examine the evidence presented and select a logical answer.

Two of the inferring lessons in this book require the use of a bar graph. Spend some time going over the graph with the child, and make sure that he or she understands that bars of varying lengths represent varying quantities. Explain how to interpolate the numbers on the graph in order to estimate values of bars that fall between the whole numbers given.

Analogies. Analogies are comparisons between two sets of things based on their similar characteristics. The exercises in this section contain both pictorial and figural analogies that are similar to the literal or verbal analogies undertaken by older students. To solve the analogies, children must find the relationship between the first two items and then establish the same or a similar relationship between a second pair of items. However, they will need to compare features that are not always obvious.

Approach the analogies by going through some examples with the child. Although their first attempts may be clumsy, young children tend to catch on to analogies readily, find them challenging, and relate to them with the adventurousness of one learning a new sport. For the analogies in this book, you may need to spend time reviewing math symbols (=, <, >), time and clock values, and coin and currency values.

Deduction. Deduction is a form of inference in which the conclusion follows from premises or statements of fact. Children who can read are welcome to read the clues themselves to solve the problems, but for pre-literate children, the instructor should read the clues clearly, repeat them carefully, and then allow the child adequate time to solve the problem by logically linking together all of the facts. Read the clues as many times as necessary. This requires listening comprehension in the child. The child

must also be able to distinguish among the characters or objects in each lesson. The characters and objects are labeled, but some children may wish to color or visually code them so that they can remember them individually.

You may need to review pertinent math concepts, fractional measurements, fractional weights, geometric shapes, and the concepts of vertical and horizontal in order for the child to complete these exercises.

The last deduction exercise is substantially more challenging than the rest of the lessons in this book. Most children will struggle with it, but if they go through it several times, filling in details each time, they should ultimately be able to work through it and solve it. However, instructors should use their judgment as to this lesson's appropriateness for children who may become overwhelmed with the level of challenge.

Lesson 4
Organizing Information/Venn Diagrams
Pets

Meredith and Jackson are thinking of getting a pet. Because they don't have a big yard, they are considering getting a small dog, a cat, or a fish. Read the traits carefully, and then write the number of each trait in the correct space in the Venn diagram on the next page.

Traits

1.   Can be petted

2.   Must live in a tank

3.   Requires feeding and care

4.   Requires a commitment to walking

5.   Usually doesn't make noise

6.   Plays with toys for entertainment

7.   Comes in long-haired and short-haired varieties

8.   Requires a food and water dish

9.   Needs a litter box

10.   Can bark to warn strangers to stay away

11.   Never needs house training

12.   Needs special furniture for climbing

13.   Is good for people with fur allergies
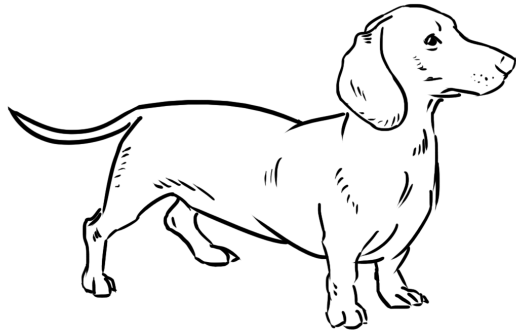
Dog
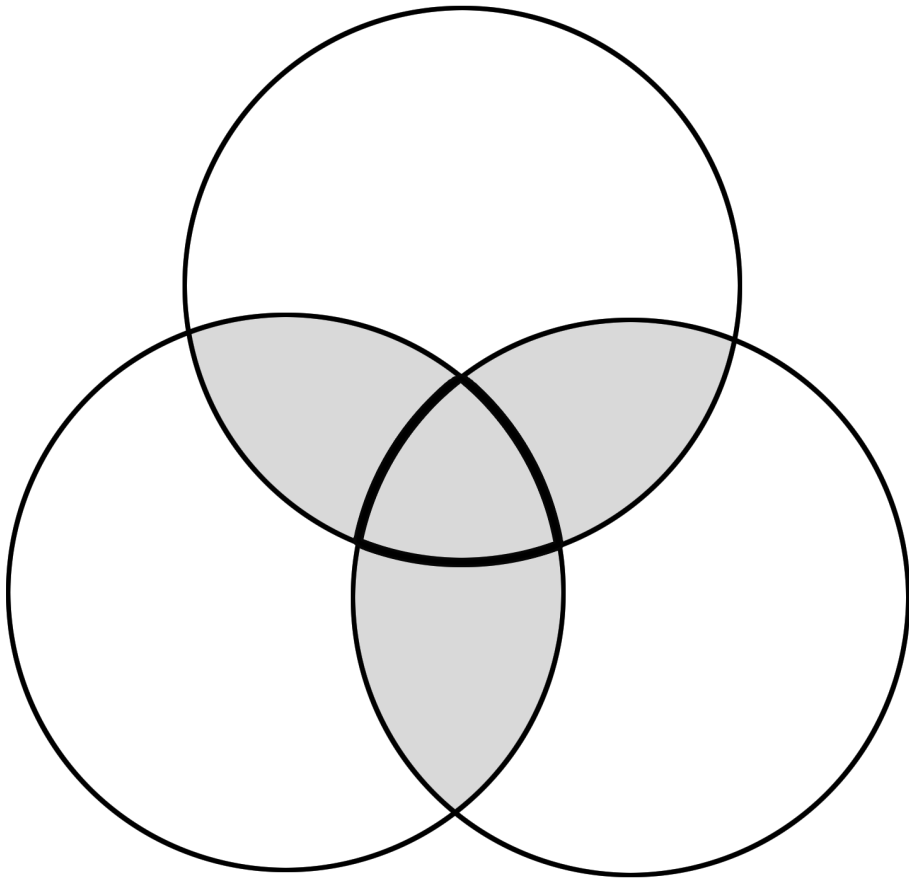
Cat   Fish
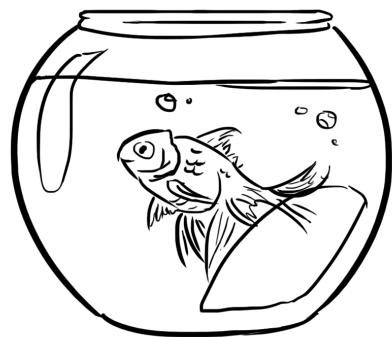
Lesson 13
Sequences/Whole Numbers
Pies at the Bake Sale

Carlos is in charge of pies at a local bake sale. Look carefully at the pie illustrations, and number them in the correct order. Begin with fewest slices sold. Pie in the pie dishes has not been sold yet. Slices on plates have been sold.

a. _____

5/6 pie in pie dish

1 slice sold

b. _____

1/2 pie in pie dish

3 slices sold

c. _____

1 whole pie in pie dish

0 slices sold
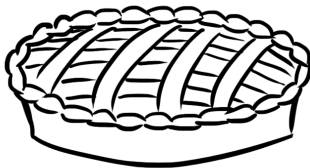
d. _____

2/3 pie in pie dish

2 slices sold
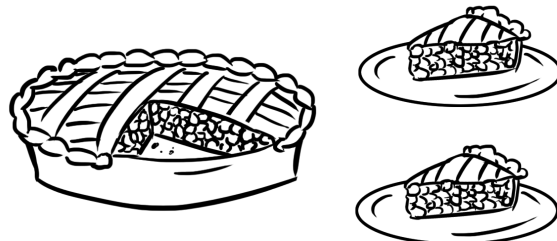
e. _____

1/6 pie in pie dish

5 slices sold
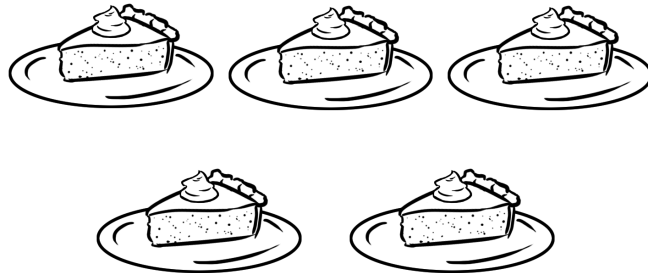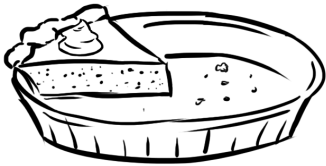
f. _____

1/3 pie in pie dish

4 slices sold
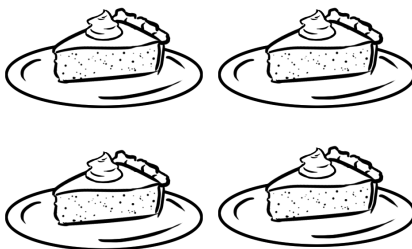
Lesson 22
Patterns/Math Symbols

Study the patterns carefully. Then draw a line to the object that should come next in each pattern.

1.

$$\pi \quad \infty \quad \% \quad \pi \quad \infty$$

a. $\neq$

2.

$$\neq \quad \pi \quad \infty \quad \neq \quad \pi$$

b. $\%$

3.

$$\div \quad > \quad \neq \quad \div \quad >$$

c. $\div$

4.

$$\pi \quad \div \quad > \quad \% \quad \pi$$

d. $>$

5.

$$\neq \quad > \quad > \quad \neq \quad >$$
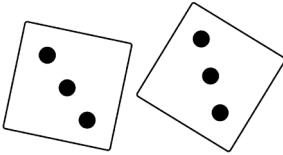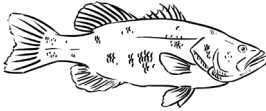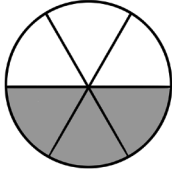
e. ∞
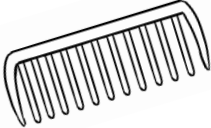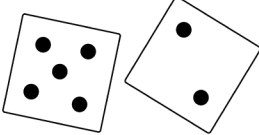
Lesson 31
Relationships/Math Concepts

Draw a circle around the picture that has something in common with the first picture in each set.
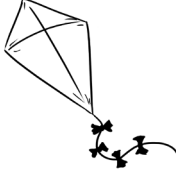
1.

	a.	b.	c.
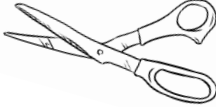
2.

5 > 2	a.	b.	c.

3.

	a.	b.	c. 1/3

4.

÷	a.	b.	c.

5.
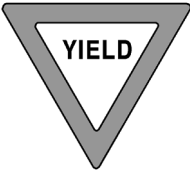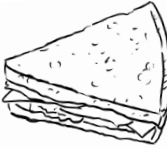
YIELD	a.	b.	c.

Lesson 39
Inferences/Graphs
Cookie Bake Sale

Kayla and Anthony are ordering ingredients for a cookie bake sale. They are trying to earn money for their class trip, so they must order correctly. Use the graph below to help you fill in the correct number of cups in each blank of the cookie recipes on the following pages. You must estimate the values for the bars on the graph that end between whole numbers.
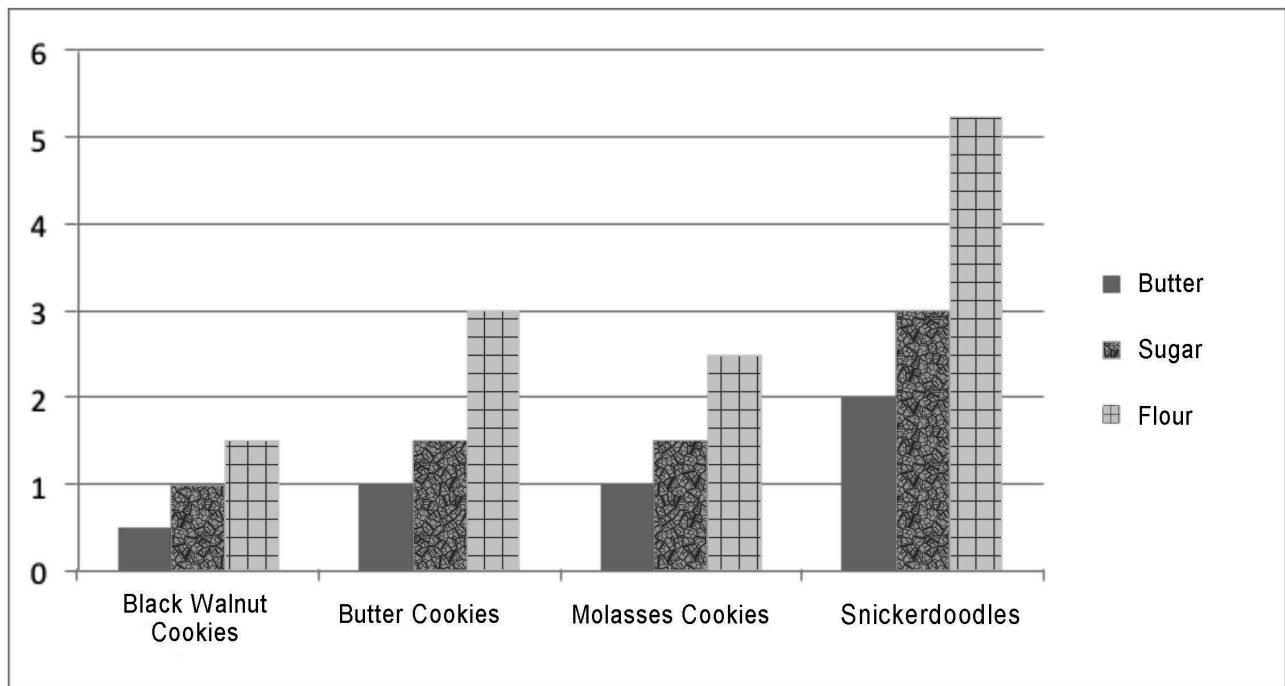
Black Walnut Cookies

- _____ cup(s) butter
- _____ cup(s) flour
- _____ cup(s) white sugar
- 1/4 tsp. baking soda
- 1/2 cup brown sugar
- 1/2 tsp. salt
- 1 egg
- 1/2 cup chopped black walnuts

Butter Cookies

- _____ cup(s) butter
- 1/2 tsp. salt
- _____ cup(s) sugar
- 1 tsp. vanilla
- 1 tsp. baking soda
- _____ cup(s) flour
- 1 egg

Molasses Cookies

- _____ cup(s) butter
- _____ cup(s) flour
- _____ cup(s) powdered sugar
- 1 tsp. baking soda
- 1 egg
- 1 tsp. cream of tartar
- 1 tsp. vanilla
- 1/4 tsp. salt
- 1/4 cup molasses
- 1 tsp. ginger
- 2 tsp. cinnamon
- 1/2 tsp. nutmeg

Snickerdoodles

- _____ cup(s) butter
- _____ cup(s) flour
- _____ cup(s) sugar
- 4 tsp. cream of tartar
- 4 eggs
- 1/2 tsp. salt
- 2 tsp. baking soda

Lesson 43
Analogies/Math Concepts

Look at each set of boxes. In each set, a is like b in some way. Then look at c. Which box from the set x, y, z is like c in the same way that a is like b? Circle the correct answer.

1.

a	b	c		x	y	z
			a is like *b* as *c* is like... (Circle one)			

2.

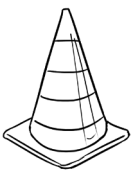| a	b	c		x	y	z
+	−	X	*a* is like *b* as *c* is like... (Circle one)	÷	%	=

3.

a	b	c		x	y	z
			a is like *b* as *c* is like… (Circle one)			

4.

a	b	c		x	y	z
0 > –4	–4 < 0	0 > –2	*a* is like *b* as *c* is like… (Circle one)	2 = 4/2	4 = 8/2	–2 < 0

5.

a	b	c		x	y	z
			a is like *b* as *c* is like… (Circle one)			

Lesson 52
Deduction/Fractions
The Pumpkin Patch

Noah, Ynez, Charlotte, and Kwan went to the pumpkin patch to pick out pumpkins for Halloween. They pulled their pumpkins back from the field in wagons. Before they left the farm, the farmer weighed each of their pumpkins. Read the clues carefully, and then draw a line connecting each person with his or her pumpkin.
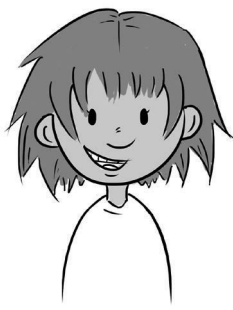
Clues

1. Charlotte's pumpkin weighs half as much as Noah's.

2. Kwan's pumpkin weighs 1-1/3 as much as Charlotte's.

Noah   Ynez   Charlotte   Kwan

30 pounds   25 pounds   20 pounds   15 pounds