# Logic-Math Exercises for Elementary-Age Children

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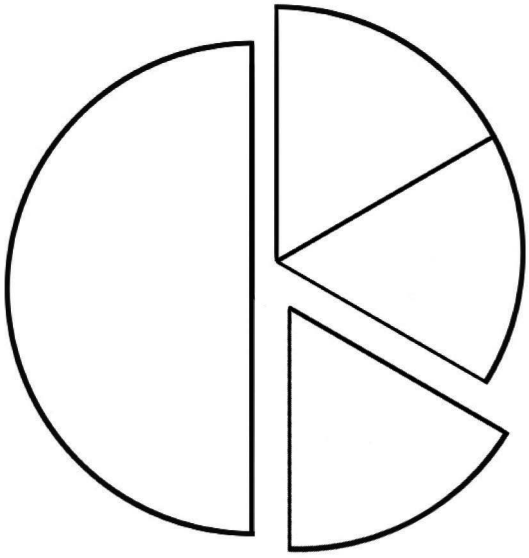

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# Logic-Math Exercises for Elementary-Age Children

## About This Book

*Logic-Math Exercises for Elementary-Age Children* is designed to develop critical-thinking skills and an understanding of selected math concepts in students in grades 3 and 4. In prior decades, critical thinking was reserved for much older children. Nothing in children's development, however, prevents us from introducing and nurturing these skills earlier. This book combines exercises involving organizing information, sequencing, pattern decoding, understanding relationships, inferring, solving analogies, and deducing in a format designed to allure and inspire children to develop a critical mindset for digging beneath the surface of presented facts. As 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 challenging 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 addition, subtraction, multiplication, division, fractions, decimals, percent, graphs, geometry, volume, money, time, and more, all as a means of mastering critical-thinking skills rather than as computational challenges.

The most important way to help children develop critical-thinking skills is 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. After all, interesting ideas and unusual ways of arriving at conclusions are the very foundation of the creative processes that lead to innovation and progress.

# Thinking Skills Presented in This Book

**Organizing Information.** There are several different kinds of exercises in this book to help children learn how to organize information. The first few of these 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.

The child should write the number of each trait in the appropriate section of the Venn diagram. If there is not enough room to write all of the numbers in a section, the child can write them outside of it and draw lines to the correct segments. Because the topics are challenging, provide the child with access to reference sources so that he or she can research the topics and the traits to find the correct answers.

Following the lessons that use Venn diagrams are lessons that require children to analyze facts and then categorize them as being characteristics of any of three related topics. Each fact is true for one of the topics, all three of the topics, or any combination of two of the topics. These exercises are, in essence, Venn diagrams without the diagrams, enabling children to approach categorization and find common elements among different topics in a new format. Like the topics for the Venn diagrams, the topics for these exercises are challenging, and children may need access to outside reference sources to solve them. Rather than being an obstacle to working out the problems, however, asking children to find information that they do not know will broaden their knowledge base and give them practice looking up information to find answers to their questions.

The final lesson in this section of the book uses a pie chart and requires children to calculate percentages into whole numbers using multiplication in order to organize how many people will be necessary to perform certain tasks in a much larger production. This lesson will give children practice with important mathematical processes and will familiarize them with a common but important type of graphic organizer.

**Sequences.** Sequencing problems require children to look at relationships in time, volume, height, location, or date as a way of arranging series of objects or events. Sequences require young thinkers to look at a group of illustrations and captions 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, there is only one logically acceptable solution; 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.

Two of the sequencing lessons use bar graphs; one uses a map. These lessons will provide practice for children in learning how to read and use both of these types of graphic tools.

The lesson about the Lewis and Clark Expeditions asks children to sequence forty different animals. This is a challenging lesson, not because of the content, but rather because of the attention that the child must pay to keeping the information organized. Charts at the end of the lesson can help and will encourage the child to be methodical and precise in his or her work.

**Patterns.** Exercises in pattern decoding present a series of figures, words, numerals, or math concepts that represent a pattern. Children must study the series to discover the pattern. Once they have discovered the pattern, they are to select the item that would come next, or they are to write the next two or three items that would follow. There is also an encryption exercise in this section of the book that requires children to use a key to decipher codes. There are several skills that come into play in these exercises. Children must be able to distinguish between the items, recognize the pattern that is presented, and forecast what the next element or elements in the sequence will be.

**Relationships.** When dealing with relationships, children will be looking for ways in which items relate to one another. 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. Children must examine the evidence presented and select a logical answer. Some of the lesson use images, and some of them use words. One of the lessons requires children to come up with an exhaustive list of letter and number combinations, and one uses a key to decipher

codes (although with missing letters that children must infer from context clues). The final lesson in this section includes a bar graph that children must read in order to answer the questions correctly.

**Analogies.** Analogies are comparisons between two sets of things based on their similar characteristics. The exercises in this section contain pictorial, figural, word, concrete, and abstract analogies that are similar to the literal or written 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. The last three lessons in this section are written out in much the same way that analogies for older students are presented, familiarizing children with the kinds of analogies that they will encounter later.

**Deduction.** Deduction is a form of inference in which the conclusion follows from premises or statements of fact. The lessons in this section are challenging, requiring children to fill in the information they know in order to deduce the information that they do not know. It may be helpful to inform the child that it often takes multiple times reading through the clues to be able to figure out all of the answers.

The last four lessons in this section require children to fill in a grid using only a few clues. Explain to the child that a grid is simply a useful tool for organizing information. The symbols that the child uses to mark the grid are arbitrary; as long as the child marks the correct answers in a consistent way, it does not matter what kind of mark or symbol he or she uses. Be sure the child understands this. Also, emphasize the fact that eliminating a square on the grid because it is not true is equally as important as marking a square because it is true.

The final lesson in the book includes not only a grid but also a pie chart and a bar graph, giving children practice plotting and manipulating information in a variety of formats in order to find the answers to all of the parts of the lesson.

# Lesson 1

## Organizing Information/Venn Diagrams

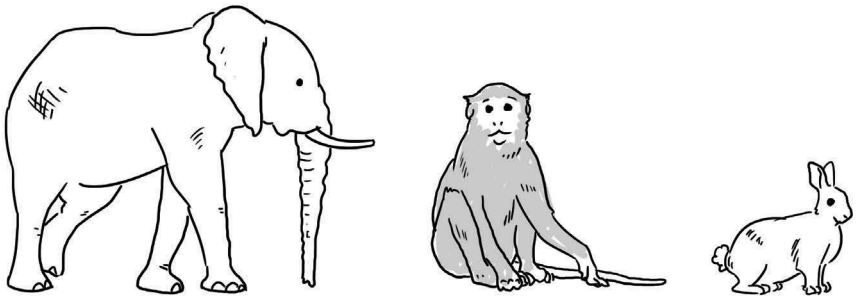
### Animal Classifications

Astrid, Diego, and Luca have just returned from a trip to the zoo, where they saw many different kinds of animals. They decide to learn more about mammals, fish, and reptiles. Read the traits carefully, and then write the number of each trait in the correct space in the Venn diagram on the page that follows.

**Traits**

1. May be able to swim
2. May grow antlers
3. Have gills
4. Are cold-blooded
5. May have fur
6. Include sea turtles
7. Can survive in frigid temperatures
8. Include mudskippers
9. Almost always lay eggs
10. May have neither legs nor fins
11. Breathe oxygen
12. Have fins
13. May have a forked tongue
14. Include brown bats
15. May be carnivores
16. Nurse their young
17. Include seahorses

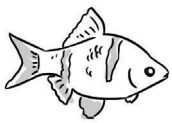
18. May have claws
19. May bury their eggs
20. Include several species that are endangered
21. Include pangolins
22. May have a hard shell
23. May be able to eat frogs
24. Include whale sharks
25. May be kept as pets

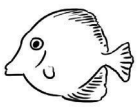


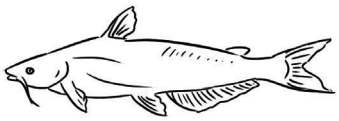
Mammals

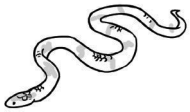
Fish

Reptiles









# Lesson 14

## Sequences/Bar Graphs

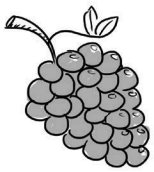
### Salt Content

Look carefully at the illustrations and captions below, and number them in the correct order from the smallest quantity of salt per single serving of food to the largest. Use the bar graph on the next page to help you.

a. _____
Peanut butter

b. _____
Pepperoni pizza

c. _____
Grapes

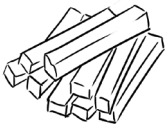


d. _____
Dill pickle

e. _____
Potato chips

f. _____
Celery

g. _____
Carrot sticks

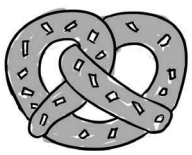


h. _____
Yogurt

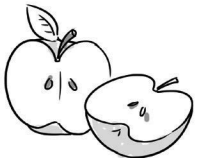
i. _____
Swiss cheese

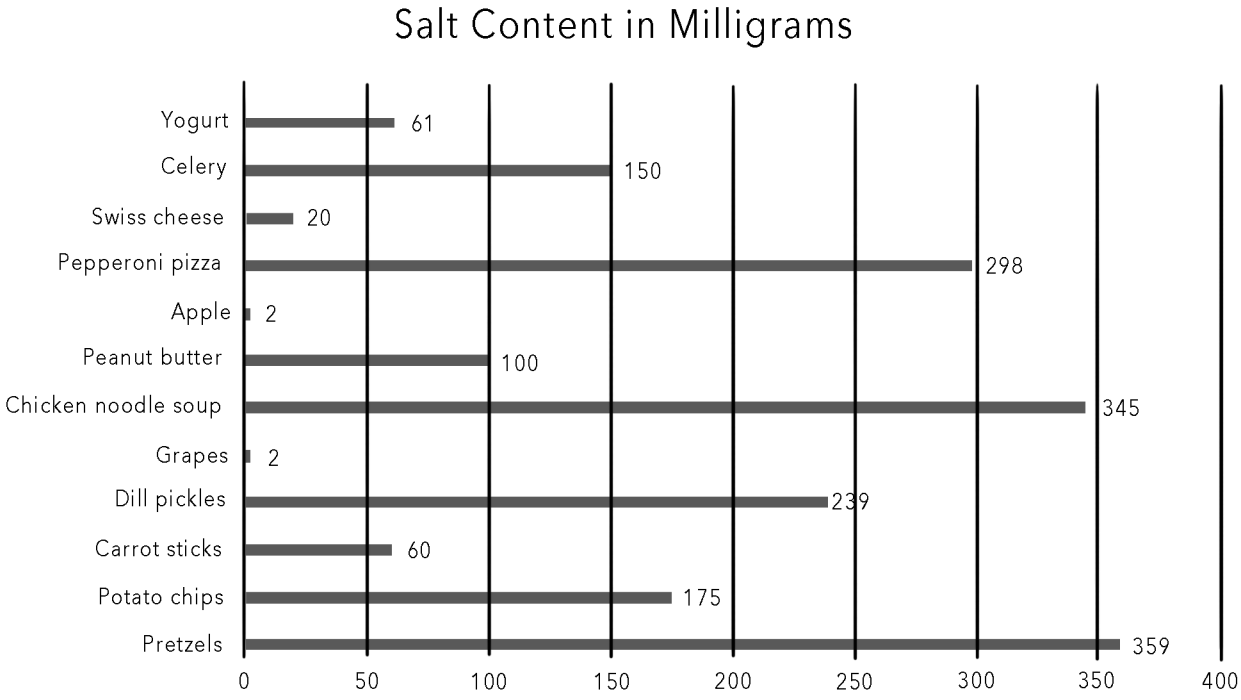
j. _____
Chicken noodle soup

k. _____
Pretzels



l. _____
Apple




Salt Content in Milligrams
Yogurt
61
Celery
150
Swiss cheese
20
Pepperoni pizza
298
Apple
2
Peanut butter
100
Chicken noodle soup
345
Grapes
2
Dill pickles
239
Carrot sticks
60
Potato chips
175
Pretzels
359
0
50
100
150
200
250
300
350
400

# Lesson 21

## Patterns/Math Concepts

Determine the math pattern of the first three items in each line. Then continue that pattern to fill in the blanks provided.

1. 0.2, 0.6, 1.0, _____ , _____ , _____

2. 5, 8, 11, _____ , _____ , _____

3. 600, 560, 520, _____ , _____ , _____

4. 1/2, 1/3, 1/4, _____ , _____ , _____

5. 0, 15, 30, _____ , _____ , _____

6. 8 a.m., 8:30 a.m., 9 a.m., _____ , _____ , _____

7. $5.00, $4.75, $4.50, _____ , _____ , _____

8. Oct. 1, Oct. 15, Nov. 1, _____ , _____ , _____

9. Room 18, Room 118, Room 218, _____ , _____ , _____

10. 5, 25, 125, _____ , _____

11. 11, 22, 33, _____ , _____ , _____

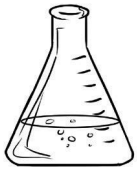
12. 3/3, 6/3, 9/3, _____ , _____ , _____

# Lesson 30

## Relationships/Math Concepts

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

1.

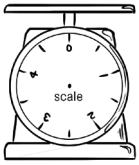


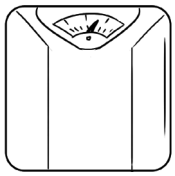
a. $2<1$

b. 

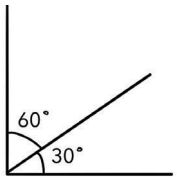
c. 


2.

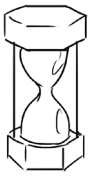



a. 

b. .083

c. 

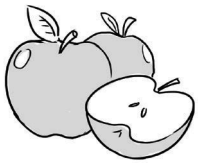

3.

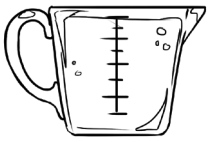

a. 

b. 0, 2, 4

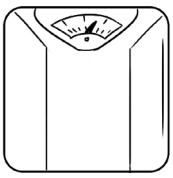
c. 

4.



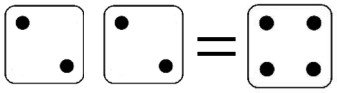
a. 

b. 

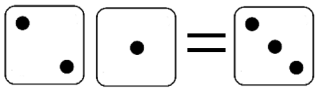
c. 

5.

$2 + 2 = 4$

a. 

b. 

c. 

# Lesson 33

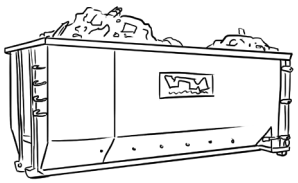
## Inferences/Weight

Look at each picture. Then write the letter of the amount that you might expect the pictured object to weigh.

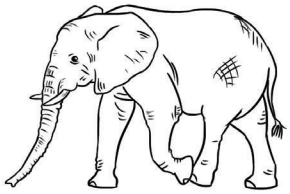
a. 10 pounds  b. 50 pounds  c. 100-200 pounds  d. 1 ton

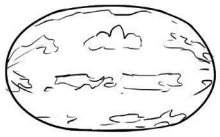
1. _____ 

2. _____ 

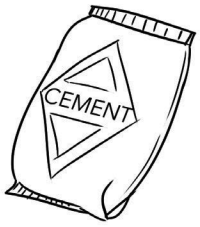
3. _____ 

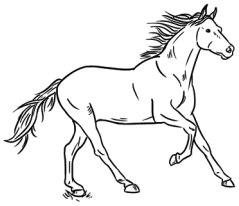
4. _____ 

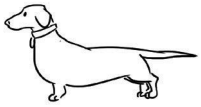
5. _____ 

6. _____ 

7. _____ 

8. _____ 


9. _____ 

10. _____ 

# Lesson 39

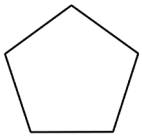
## Analogies/Geometry

Choose the pair of pictures that are related to each other in the same way that the top two pictures are related to each other. Circle the letter of the correct pair.

Example:  is like  as  is like 

1.  is to 4 as:

   a. 2 is to 

   b.  is to 5

   c. 25 is to 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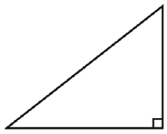
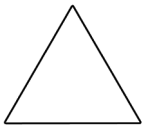
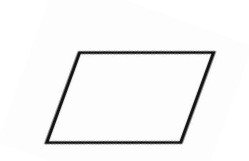
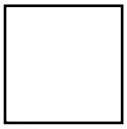
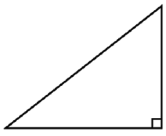
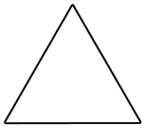
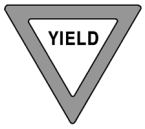
2.  is to  as:

   a.  is to 

   b.  is to 

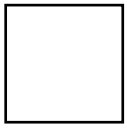
   c.  is to 

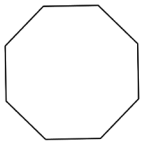
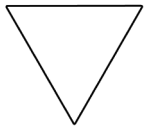
3. 

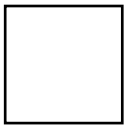
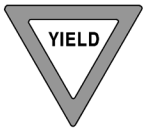
is to 

as:

a. 

is to 

b. 
is to 

c. 
is to 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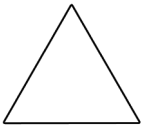
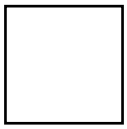
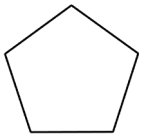
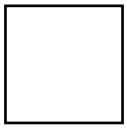
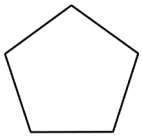
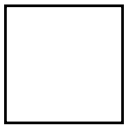
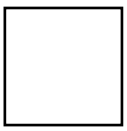
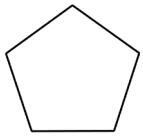
4.  + 1 is to  as:

a.  is to 

b.  - 1 is to 

c.  + 1 is to 

# Lesson 47

## Deduction/Money

### Dog Walking

Fiona, Kelly, Marcus, and Dirk are raising funds for a vacation. They decide to create a neighborhood dog-walking service. They need to raise $1,000. Read the clues carefully, and fill in the answers for each dog's route, the number of walks it took, and the amount of money the kids earned by walking it.

**Clues**

1. Only the dachshund and the corgi took the short route.
2. The pug always took the medium route.
3. The German shepherd, the Brittany spaniel, and the collie took the long route.
4. The dachshund used the walking service 60 times
5. The corgi and the collie both took an equal number of walks.
6. The pug and the dachshund both took an equal number of walks.
7. The Brittany spaniel only used the service 20 times.
8. The Barlows own Coby, the collie, and paid $350 to have him walked.
9. The kids exceed their goal of $1,000 by making an extra $285.

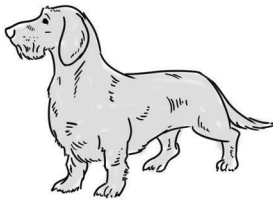
Short Route = $2.50
Medium Route = $4.00
Long Route = $7.00

Pug

Route _____

Walks _____

$_____

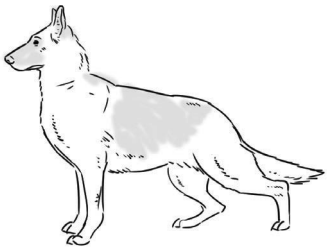


Dachshund

Route _____

Walks _____

$_____

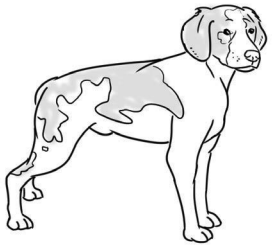


German shepherd

Route _____

Walks _____

$_____

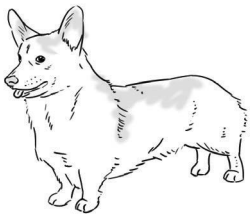


Brittany spaniel

Route _____

Walks _____

$_____



Corgi

Route _____

Walks _____

$_____

Collie

Route _____

Walks _____

$_____