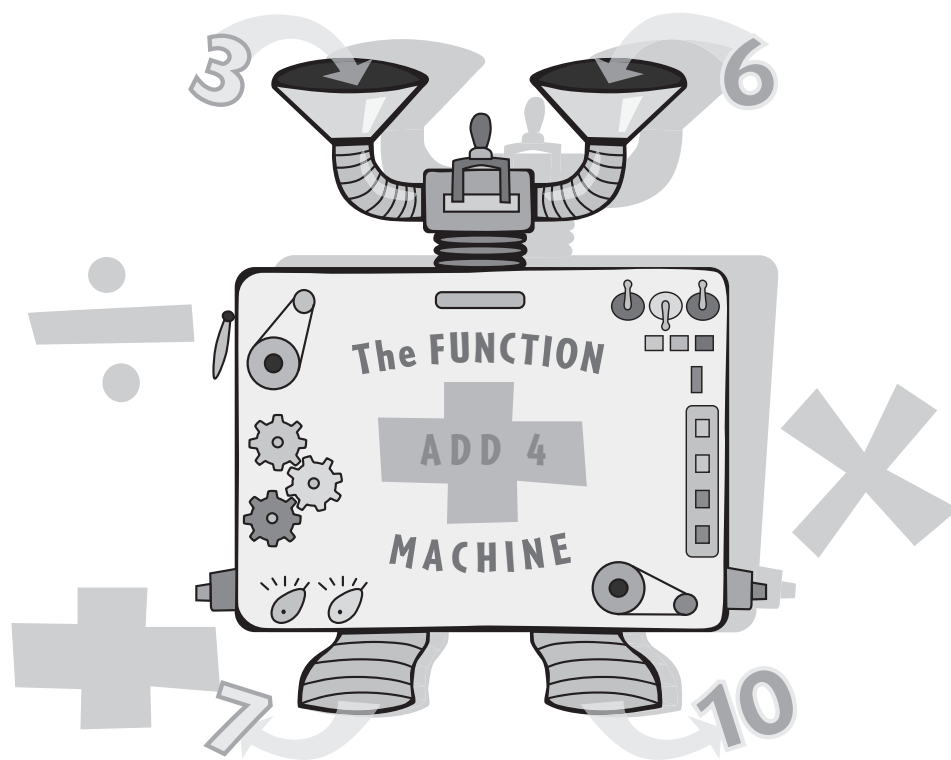


PRIMARY ALGEBRA

Developing Algebraic Reasoning

Hope Martin



Good Year Books
Tucson, Arizona

Dedication

My heartfelt thanks to Jill Martin, my daughter-in-law, for generously sharing her knowledge of the primary-grade mathematics curriculum and her experiences as a first-grade teacher.

Educational Standards

Primary Algebra contains lessons and activities that reinforce and develop skills as defined by the National Council of Teachers of Mathematics as appropriate for students in Grades K to 4. These include understanding patterns and functions; problem solving using numbers, pictures, and symbols; understanding equivalency and the meaning of equations; and making mathematical connections. See www.goodyearbooks.com for information on how lessons correlate to specific standards.

Good Year Books

Our titles are available for most basic curriculum subjects plus many enrichment areas. For information on other Good Year Books and to place orders, contact your local bookseller or educational dealer, or visit our website at www.goodyearbooks.com.

For a complete catalog, please contact:

Good Year Books
PO Box 91858
Tucson, AZ 85752-1858
www.goodyearbooks.com

Cover Design and Illustrations: Sean O'Neill
Text Design: Doug Goewey

Copyright © 2009 Hope Martin.
Printed in the United States of America.
All Rights Reserved.

ISBN-10: 1-59647-126-3
ISBN-13: 978-1-59647-126-9
ISBN-eBook: 978-1-59647-138-9

1 2 3 4 5 6 7 8 9 14 13 12 11 10 09 08

No part of this book may be reproduced in any form or by any means, except those portions intended for classroom use, without permission in writing from the publisher.

Art Credits

Fotolia.com: coin photos (all except half-dollar), pp. 76, 90, 91, 131–134, © Mario Bruno; bananas illustration, pp. 41, 44, 45, by Dawn Hudson; French fries photo, p. 72, © khz.

iStock.com: ghost illustration, p. 75, © Brendon De Suza; toy train, jack-in-the-box, teddy bear illustrations, pp. 93, 94, © Alison Hess; half-dollar photo, pp. 90, 91, 135, © Samuel Kessler; playing card illustrations, pp. 99–102, © Carol Woodstock.

Library of Congress: photo of Helen Keller, p. 66; portrait of Benjamin Franklin, p. 63, by Chas. Wilson Peale; photo of Florence Nightingale, p. 70, by Perry Pictures; portrait of George Washington, p. 65, by Gilbert Stuart.

Sean O'Neill: Legs illustration, p. 77; function machine illustrations, title page, pp. 30–34; illustration of Martin Luther King, Jr., p. 67; illustration of Rosa Parks, p. 69.

U.S. Department of State: photo of Colin Powell, p. 64.

Wikipedia.org: photo of one-dollar bill, pp. 91, 136.



Contents



Introduction	1
1 Understanding Patterns and Functions	5
Over and Over Again—Patterns That Repeat	7
Pattern Block Patterns That Grow	11
What Comes Next?	14
Patterns in the 100-Table	19
Using Patterns to Help Us Count	23
The Function Machine	28
What’s My Rule?	35
2 Problem Solving Using Numbers, Pictures, and Symbols	39
Sudoku Puzzles	40
Number Riddles	54
Find the Year Puzzles	61
Math Jokes	71
Find the Missing Number	78

3 Understanding Equivalence and Equations	83
Domino Equations	85
Equations with Money	89
Find the Missing Toy	93
Balance the Scales with Shapes	95
Balance the Scales with Cards	99
The Unbalanced Scale	103
Spinner Math	108
Domino Algebra Game	113
Frog Jumps	116
Making Connections to Children’s Literature	119
Bibliography	121
Interesting Web Sites	122
Appendix	123
Pattern Block Pieces	124
100-Chart	130
Play Money	131
Dominoes	137
Blank Spinners	139

Over and Over Again—Patterns That Repeat

What is the algebra?

Describing, extending, and analyzing patterns

What do you need?

- ▶ “Over and Over Again—Patterns That Repeat” activity sheets (pp. 8–9) for each child
- ▶ “Design Your Own Patterns That Repeat” activity sheet (p. 10) for each pair of students.
- ▶ Pattern blocks (available in the Appendix)
- ▶ Crayons

Some classroom procedures

Introduce patterns to students. Patterns that repeat usually begin as sound patterns, such as clap, clap, snap, snap, clap, clap, snap, snap. Students then work with visual patterns, such as:



They can also be patterns formed using repeating geometry shapes such as the ones in this lesson. The sound pattern above is an A A B B pattern—clap, clap is represented by the letter A and snap, snap by the letter B. The visual or color pattern is an A A B pattern: Two white squares (A) and one dark square (B) make up the pattern. It is important that students understand how the letters used help define the pattern. To help students become comfortable with this model, have them design a sound pattern that is an A A B B B pattern. Ask, “How do you know that it can be defined in this way?” Once students are comfortable with patterns, hand out the “Over and Over Again—

Patterns That Repeat” activity sheet and the pattern blocks. Then:

1. Have students use their pattern blocks to form patterns and define them using the AB model.
2. Design an original pattern block pattern that has the same model as the one shown above.

Give students a chance to describe and name their patterns based on the symbols used. Not all students will understand that a collection of symbols can only be described as a pattern if we can predict what will come next. Discussing student examples will help clarify, using this hands-on activity, the meaning of a repeating pattern.

How to extend the lesson

After students have completed the pattern worksheet, they can make their own unique repeating patterns working with a partner and using templates of pattern blocks or other geometric shapes. These can be shared with the rest of the class who will then be asked to “name” the patterns using letters from the alphabet.

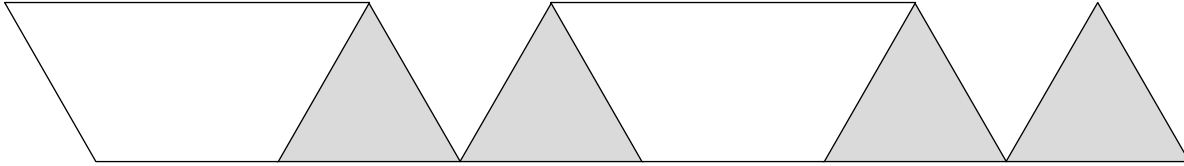
Activity answers

1. ABB, ABB
2. AB, AB, AB

Over and Over Again— Patterns That Repeat



Directions: Use your pattern blocks to make this pattern.



1. This is called an , pattern. Explain why you named this pattern the way you did.

.....

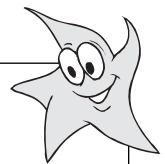
.....

.....

.....

Use your pattern blocks to design a pattern that is also an ABB pattern.

Draw it in this space.

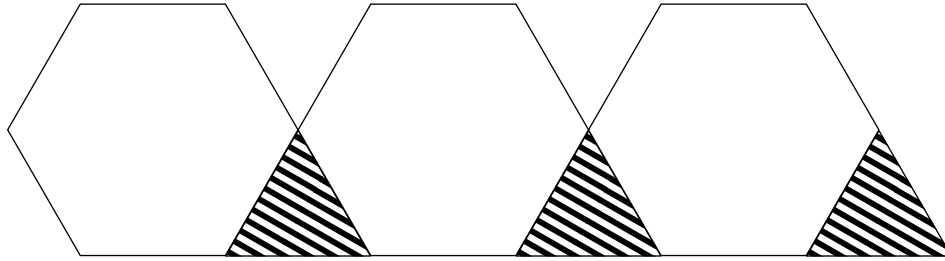


Over and Over Again—Patterns That Repeat

(continued)



Directions: Use your pattern blocks to make this pattern.



2. This is called an , , , pattern. Explain why you named this pattern the way you did.

.....

.....

.....

.....

Use your pattern blocks to design a pattern that has the same name as the one above. Draw it in this space.


.....

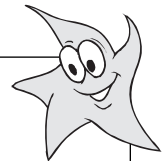
Design Your Own Patterns That Repeat



Directions: Use your pattern blocks to design your own original pattern. It can use two or three different pattern blocks . . . but remember that if it is a **pattern**, your partner must be able to predict what will come next.

My pattern is named an _____
because:

This is a picture of my pattern: 



Large empty rectangular box for drawing the pattern.