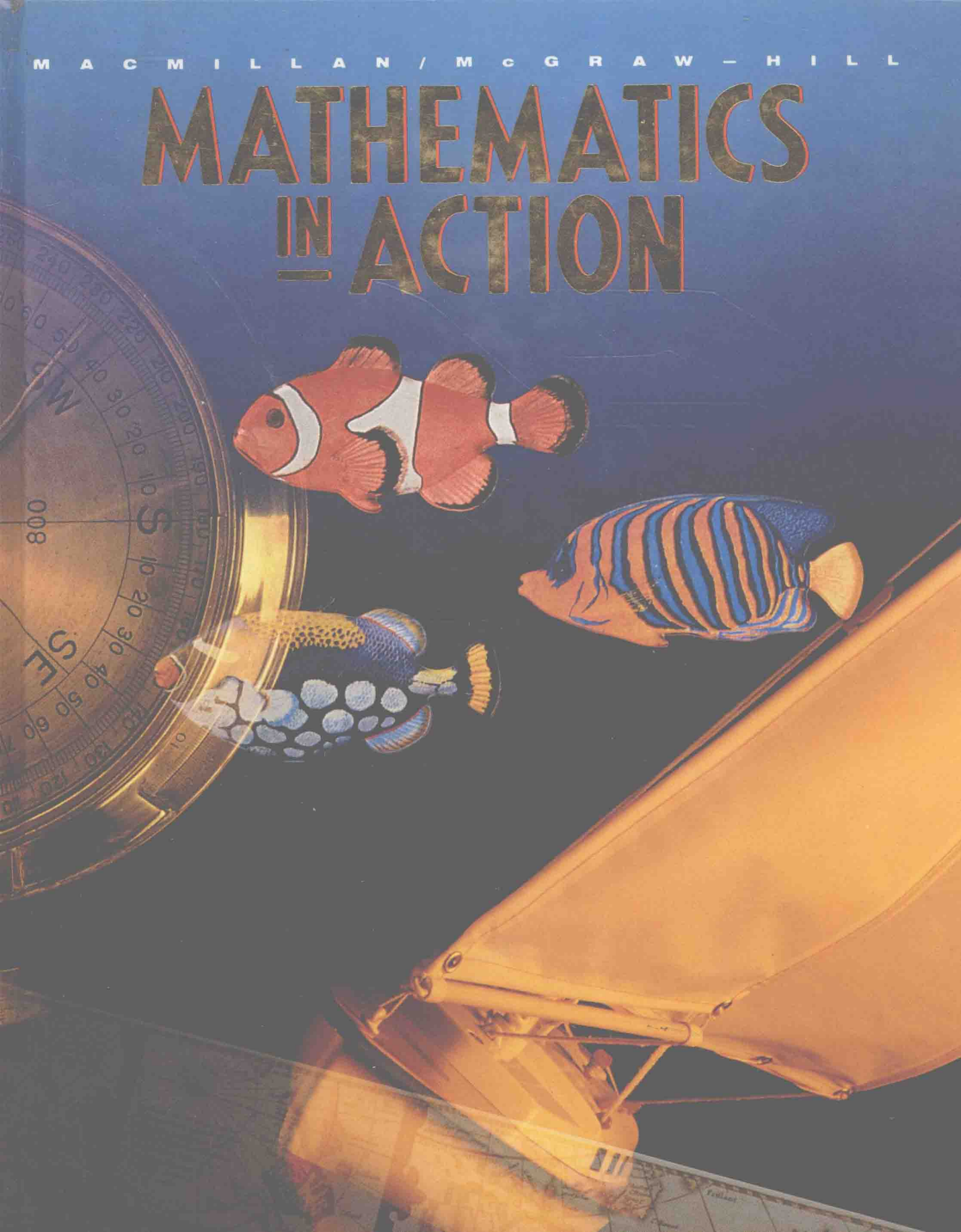
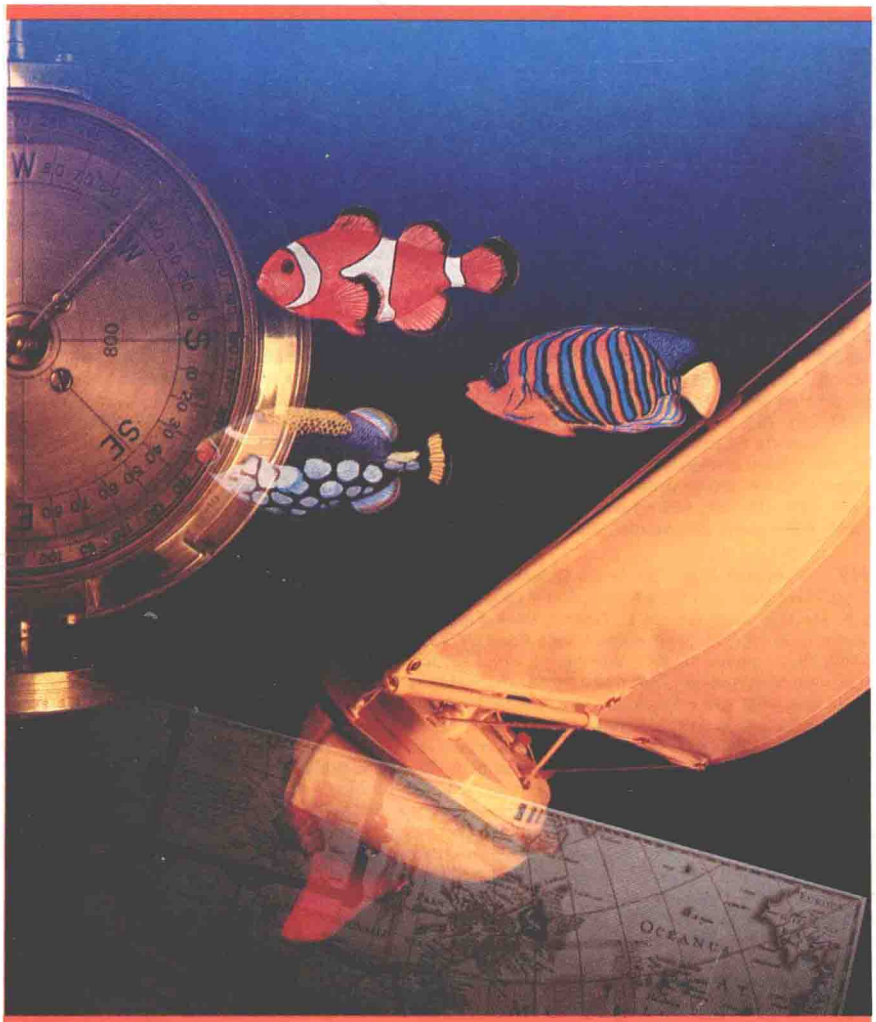
MACMILLAN / McGRAW-HILL

MATHEMATICS IN ACTION



MACMILLAN / McGRAW-HILL

MATHEMATICS IN ACTION



Alan R. Hoffer Steven J. Leinwand Gary L. Musser

Martin L. Johnson Richard D. Lodholz Tina Thoburn

MACMILLAN/McGRAW-HILL SCHOOL PUBLISHING COMPANY

New York / Chicago / Columbus

CONSULTANTS

Zelda Gold, Mathematics Advisor, Los Angeles Unified School District, Panorama City, California • Audrey Friar Jackson, Math Specialist K-6, Parkway School District, Chesterfield, Missouri • Susan Lair, Department Chairperson, Wedgwood Middle School, Fort Worth Independent School District, Texas • Gail Lowe, Principal, Conejo Valley United School District, Thousand Oaks, California

ACKNOWLEDGMENTS

The publisher gratefully acknowledges permission to reprint the following copyrighted material:

Chart of "Tallest Trees Found in the United States." Excerpted from AMERICAN FORESTS MAGAZINE, a publication of the American Forestry Association, 1516 P Street N.W., Washington, D.C. 20005. Used by permission.

"Olympic Swimming—100-Meter Freestyle Records," from THE WORLD ALMANAC, 1989. Copyright © Newspaper Enterprise Association. New York, N.Y. 10166. Used by permission.

COVER DESIGN B B & K Design Inc. **COVER PHOTOGRAPHY** Scott Morgan

ILLUSTRATION Ray Alma; 447 • Phil Anderson; 6, 7 • George Baquero; 77, 121, 163, 245, 291, 306, 318, 319, 331, 373, 419, 434, 461, 505 • Rick Berlin; 230, 304, 305, 308 • Rose Mary Berlin; 286, 287 • Craig Berman; 136, 137 • Lloyd Birmingham; 162, 228, 236, 237 • Rick Brown; 2, 3 • Patrick Chapin; 12, 13, 58, 59 • Circa 86, Inc.; 173, 215, 216 • William Colrus; 93 • Jack E. Davis; 26, 27 • Bruce Day; 144, 150, 151, 406, 407 • Jim Deigan; 272, 273 • Steve DeStefano; 222 • Cathy Diefendorf; 310, 311, 390 • Bert Dodson; 366, 367, 418 • Eldon Doty; 60, 61, 87, 110, 111, 217, 255, 408, 409, 438, 439, 471, 484 • Leslie Dunlap; 444, 496 • Steve Duquette; 234, 235 • Julie Durell; 490 • Kim Wilson Eversz; 102, 103 • Barbara Friedman; 156, 157, 278, 279 • Ignacio Gomez; 178, 179, 260, 261, 268, 269 • Gershom Griffith; 362, 388 • Patricia Gural-Hinton; 324, 325 • Marika Hahn; 364 bottom • Meryl Henderson; 116 • Al Hering; 206 • Dennis Hockerman; 196, 197, 276, 277 • Paula Holland; 517, 518, 519, 520, 521, 522 • Marilyn Janovitz; 176, 177 • Terry Kovalcik; 148, 149, 262, 263 • Ron Le Hew; 194, 195 • Jeff Lewin; 322 • Benton Mahan; 383 • Wallop Manyum; 22, 23 • Ginidir Marshall; 203 • Claude Martinot; 356, 357 • Bill Mayer; 488, 489 • Kimble Mead; 232, 233 • Patrick Merrell; 72, 73, 90, 91, 108, 109, 146, 147 • Mike Quon Design Office, Inc.; 142, 143, 220, 221, 320, 321 • MKR Design; Handmade props • Leo Monahan; 1 • Sal Murdocca; 96, 97, 352, 353 • Ann Neumann; 326 • Hima Pamoedjo; 104, 177 right, 186, 202, 203, 258, 259, 289, 354, 355, 364 top, 502 • Alex Pietersen; 207 • Jan Pyk; 392, 393 • Marcy Dunn Ramsey; 515 • Chris Reed; 64, 65 • Suzanne Roz; 16, 17 • Phil Scheuer; 8, 9, 412, 413, 478, 479 • Bob Shein; 358, 476 • David Sheldon; 192, 314, 315 • Blanche Sims; 188, 189 • Terry Sirrell; 190, 191 • Steve Smallwood; 365 • Joel Snyder; 131, 217, 255 • Peter Spacek; 448, 449 • Leslie Stall; 404 • Arvis Stewart; 134 • Wayne Anthony Still; 270 • Susan Swan; 10 • George Ulrich; 337 • Vantage Art, Inc.; 328 • Joe Veno; 24, 25 • Josie Yee; 159, 328, 415, 453, 455 • Rusty Zabransky; 36, 74, 118, 160, 204, 242, 288, 289, 348, 370, 416, 458, 502 • Ron Zalme; 4, 5, 138, 346, 442, 446, 494 • Jerry Zimmerman; 34, 35, 100, 101, 398, 399 • Robert Zimmerman; 394, 395

PHOTOGRAPHY Rudy Von Briel, 28 • Bruce Coleman, Inc. / A.J. Deane, 185; Frank Oberle, 373B; David Overcash, 120; Dr. David Schwimmer, 160 • Esto Photographics / Ezra Stoller, 303 • Folio, Inc. / John Keith, 324R; Jerry Mesmer, 372; Al Messerschmidt, 486 • FPG International, 68; E.A. McGee, 370T; Gerald L. French, 94 • Fundamental Photographs / Richard Megna, 461 • Grant Heilman / Runk Schoenberger, 38; Barry L. Runk, 274, 288T • The Image Bank / T.I. Baker, 244; Gary Cralle, 275; Mel DiGiacomo, 492R; Gerard Mathieu, 324B; Roger Miller, 492; Co Rentmeester, 345; Weinberg-Clark, 325; A.T. Willett, 493 • The Image Works / Mark Antman, 474. International Stock Photography Ltd. / Richard Pharaoh, 39T. Jerry Jacka, 75T • Magnum Photos / Marilyn Silverstone, 520R • Michal Heron, 54, 281, 284, 285, 386, 387, 397, 400, 433, 454, 456 • Lawrence Migdale, 68R • Monkmeyer Press / Nancy Lehmann, 317C • Warren Ogden, 31, 160 • Stephen Ogilvy, 18, 19, 30, 53, 66, 94, 113, 267, 396, 415, 436, 457, 482, 483, 502, 503 • Omni-Photo Communications / Ken Karp, 39, 54, 76, 112, 154, 155, 159, 182, 205, 322, 410, 411, 414, 416, 417, 441; John Lei, 49, 52, 95, 106, 158, 226, 227, 238, 239, 266, 344, 401, 432, 440, 452, 455, 459, 501, 500 • Photo Edit / Robert Brenner, 481; Tony Freeman, 183; Alan Odie, 280 • Photo Researchers / M.H. English, 350; Explorer, 317R; Jacana, 204B; Kent & Donna Dannen, 204T; Tom McHugh, 161, 203; Lawrence Migdale, 316C; Hans Namuth, 482; J.H. Robinson, 181 • Rainbow / Larry Brownstein, 63; Dan McCoy, 160, 312BL; Hank Morgan, 360 • Photori / Mauritius, 402B; Leonard Rue, 403 • Research Plus, 288; Kurt Anderson, 119, 257; Gene Anthony, 37; Franklin Avery, 51, 75; Laurence Bartone, 11, 37, 133, 161, 219, 243, 289, 328, 343, 371, 385, 417, 431, 459, 473, 503; Lawrence Migdale, 89; Karen Rantzman, 175, 205; John Running, 330 • Joseph Sachs, 118, 458 • Shostal / Superstock / David Forbert, 313; August Upitis, 312TC • Elliott Varner Smith, 282 • Starlight / NASA JSC, 224; Roger Ressmeyer, 225 • Stock Boston / Dietz, 267 • The Stock Market / G. Anderson, 520; Peter Beck, 307; Steve Elmore, 420; David Frazier, 329; Michael Furman, 370B; Ted Horowitz, 458; K. Iwaski, 290; Roy Morsch, 76, 373T; Dave Wilheim, 373M • Viesti Associates, Inc. / Dan Barba, 20; Larry Kolvoord, 21; Skye Mason, 33 inset, 368; Ginny Ganong Nichols, 32, 62L, 71, 98, 114, 140, 141, 198, 199, 240, 241 Courtesy of The Fernbank Science Center, Atlanta Georgia, 369, 402L, 450L, 451T, 480, 498; Ken Ross, 70, 115, 152, 153, 266, 316L, 450R, 451B, 499; Kevin Vandivier, 33T, Joe Viesti, 62R, 317L • Bill Waltzer, 75 • West Light / Craig Aurness, 67; Bill Ross, 324M; H.D. Thoreau, 330T • Woodfin Camp / John Blaustein, 312TL; Robert Frerck, 283.

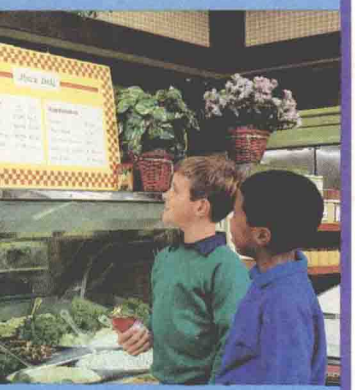
Macmillan/McGraw-Hill School Division
866 Third Avenue
New York, New York 10022

Printed in the United States of America
ISBN 0-02-108504-8
9 8

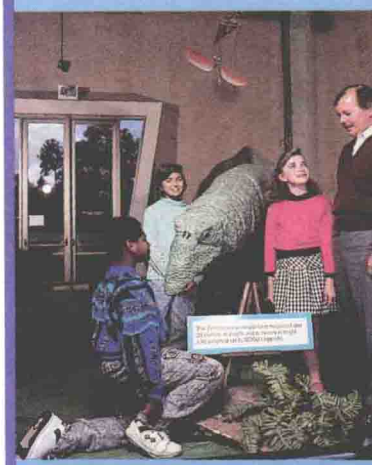
CONTENTS

DECISION MAKING
Choosing a Job to Earn Money, pages 11 and 36

DECISION MAKING
Planning a Vacation,
pages 51 and 74



DECISION MAKING
Planning a Lunch,
pages 89 and 118



DECISION MAKING
Planning a Trip to the Museum,
pages 133 and 160

DECISION MAKING
Adopting a Pet,
pages 175 and 204

DECISION MAKING
Planning a Trip to Mars,
pages 219 and 242

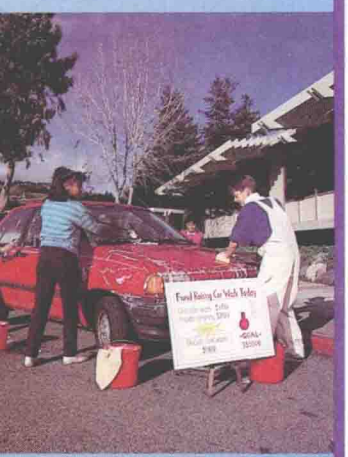
DECISION MAKING
Giving a Fruit Basket,
pages 257 and 288

DECISION MAKING
Arranging Your Room,
pages 303 and 328

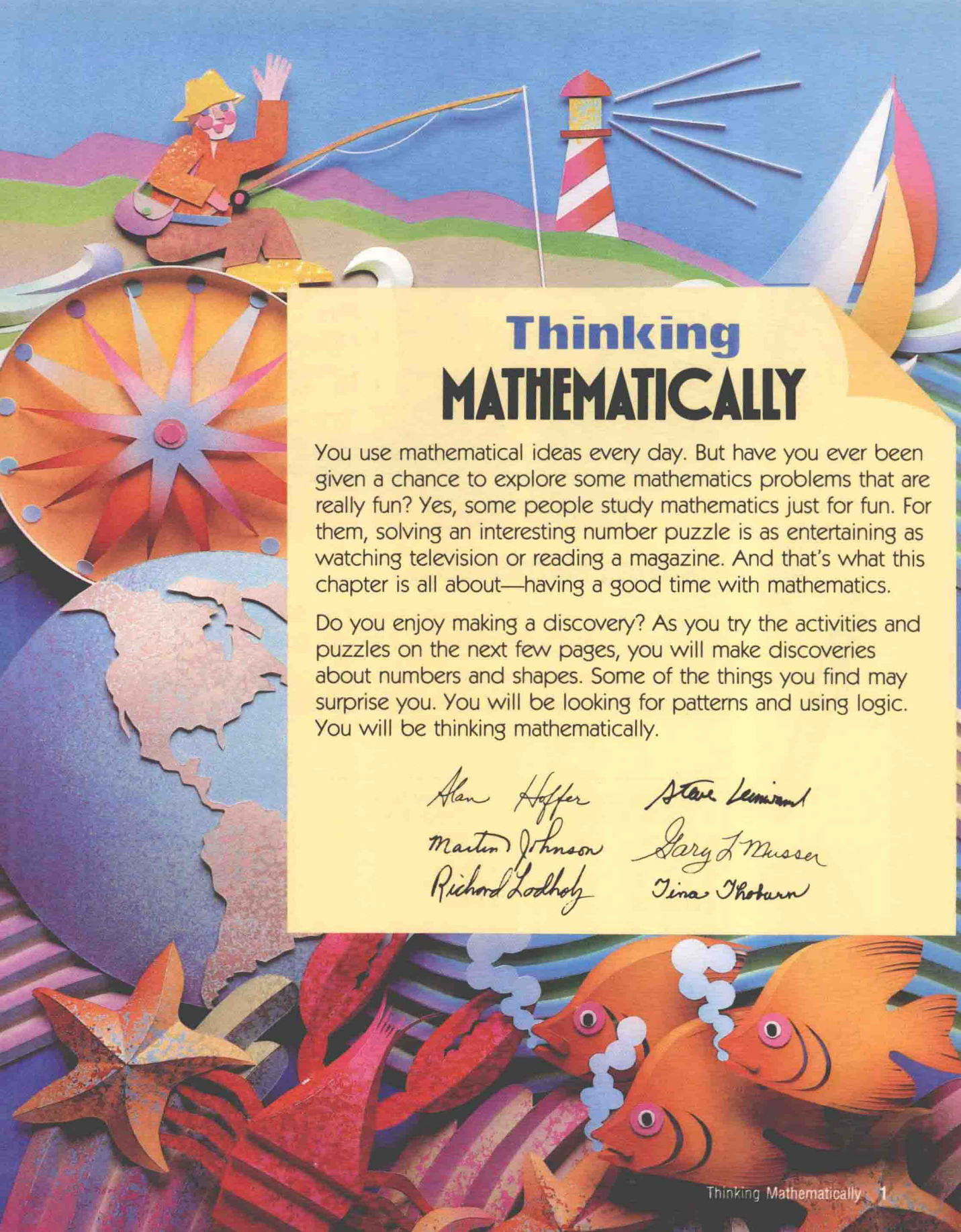
DECISION MAKING
Choosing a Musical
Instrument to Play,
pages 343 and 370

DECISION MAKING
Planning a Hiking Trip, pages 385 and 416

DECISION MAKING
Choosing the Right Gift, pages 431 and 458



DECISION MAKING
Planning a Car Wash,
pages 473 and 502

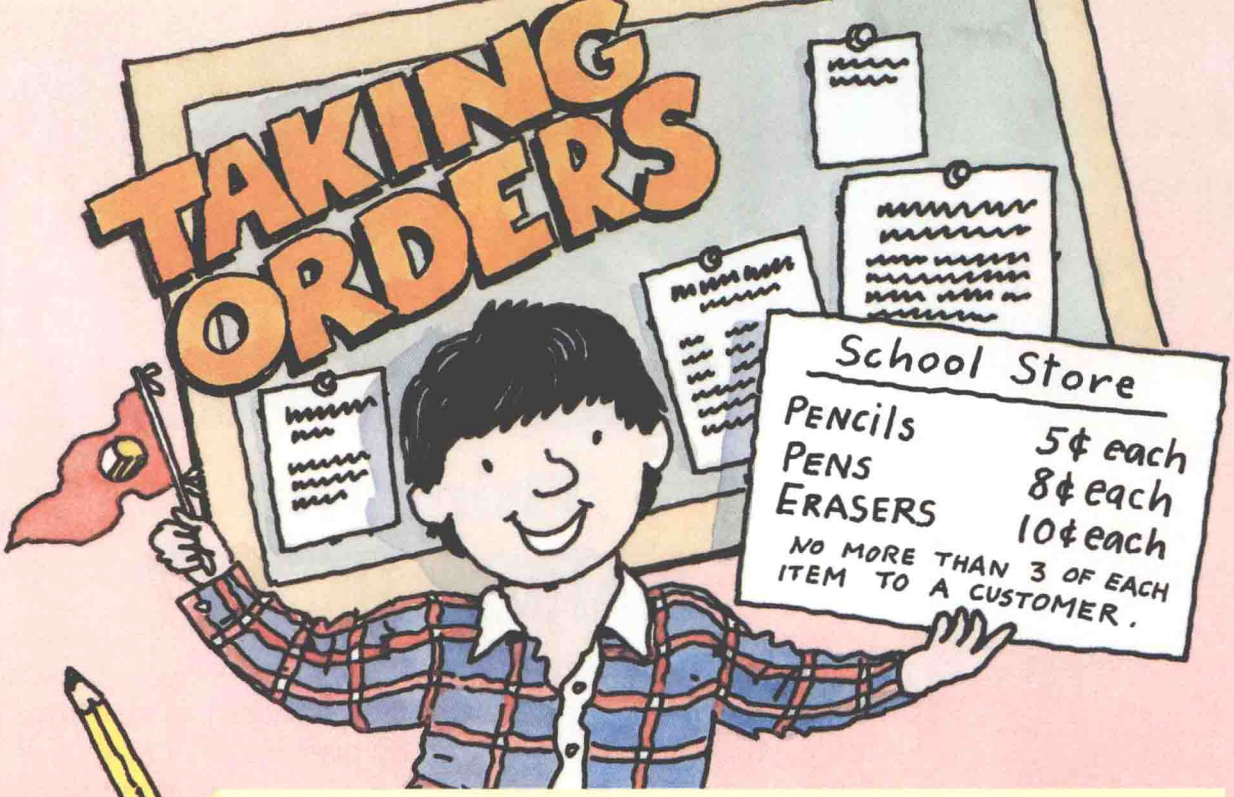


Thinking MATHEMATICALLY

You use mathematical ideas every day. But have you ever been given a chance to explore some mathematics problems that are really fun? Yes, some people study mathematics just for fun. For them, solving an interesting number puzzle is as entertaining as watching television or reading a magazine. And that's what this chapter is all about—having a good time with mathematics.

Do you enjoy making a discovery? As you try the activities and puzzles on the next few pages, you will make discoveries about numbers and shapes. Some of the things you find may surprise you. You will be looking for patterns and using logic. You will be thinking mathematically.

Alan Hoffer Steve Leinwand
Marlin Johnson Gary L. Musser
Richard Lodholz Tina Thoburn



Applying Mathematics

You use mathematics to solve problems all the time. Think about buying and selling items in a school store.

Suppose you are running the school store. Copy and complete the following order forms from other students.

1.

School Store Order Form

#	Item	Cost
2	Pencils	_____
3	Erasers	_____
	Total Cost	_____

2.

School Store Order Form

#	Item	Cost
1	Pencil	_____
3	Pens	_____
2	Erasers	_____
	Total Cost	_____

3.

School Store Order Form

#	Item	Cost
3	Pens	_____
3	Pencils	_____
	Total Cost	_____

4. Make up your own order and find its cost.

5. A friend of yours spent exactly 30¢ in the store. What possible purchases could your friend have made?

6. Can you spend exactly 50¢? Why or why not?

Thinking MATHEMATICALLY

Suppose you are the clerk in the school store. Solve the following problems.

7. Mike pays for 1 pencil, 3 pens, and 1 eraser with 2 quarters.
How much does Mike spend?
How much change does Mike get?
What coins would you give him to make the change?

8. Alissa buys one of each item with a dollar.
How much does she spend?
How much change does she get?
What coins would you give her to make the change?

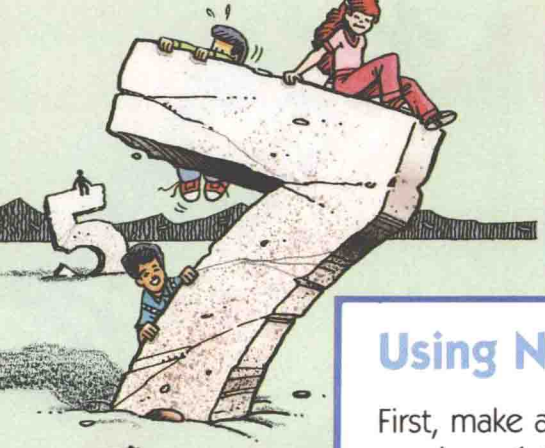
9. Lonnie needs 3 pencils and 2 pens. He has a quarter. What problem does Lonnie face?
What can Lonnie do to solve his problem?

Now suppose you are a customer in the store.

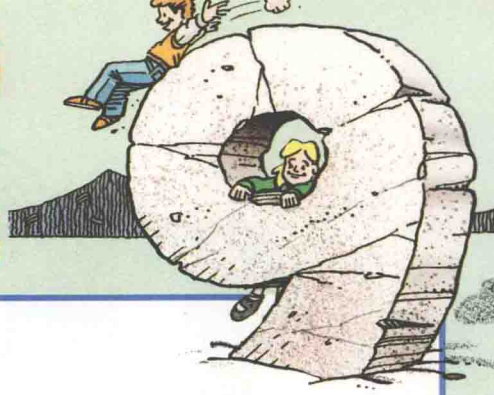
10. What is the greatest amount you could spend at one time in the school store? (*Hint:* Remember the sign.)

11. List all the different orders you can make of 3 or more items that have a total cost of 25¢ or less.

12. Suppose you had exactly 26¢. Could you spend the 26¢ exactly in the school store? How? Is there more than one way to spend exactly 26¢ in the store? What other ways could you spend exactly 26¢?



PLAYING ····WITH···· NUMBERS

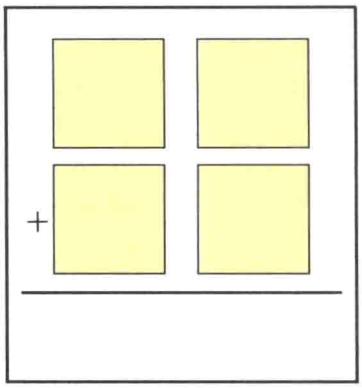


Using Number Concepts

First, make a set of 9 playing cards, one card for each of the numbers 1 to 9. Use blank cards or cut sheets of paper into 9 equal-sized pieces.

1	2	3	4	5	6	7	8	9

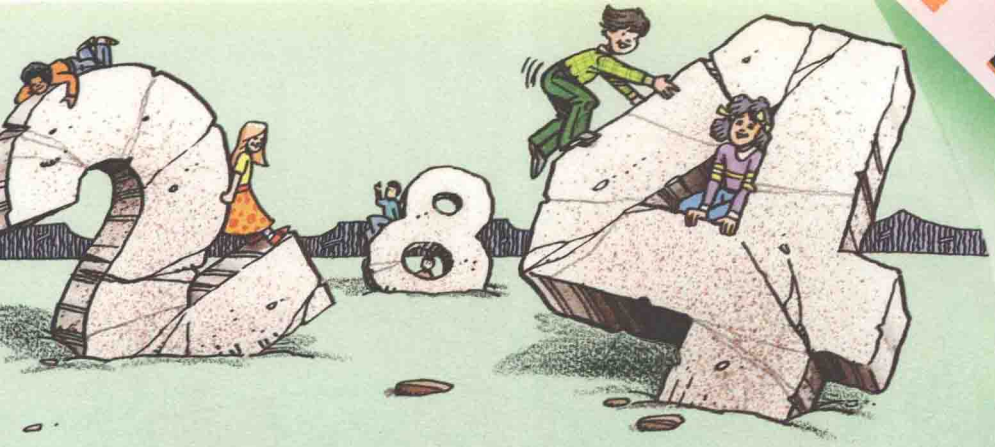
Next, on another sheet of paper, draw a board like the one at the right. The spaces should be about the same size as your cards.



Play the games.

1. Pick any 4 of your cards. Place them on your board so that you get the greatest sum. How did you arrange the numbers you picked?
2. Now pick the 4 cards that would give you the greatest sum. How would you arrange these cards? What is the greatest possible sum?
3. Pick the 4 cards that would give you the least possible sum. How would you arrange these cards? What is the least possible sum?
4. Can you use 4 cards to get a sum of exactly 75 in this game?

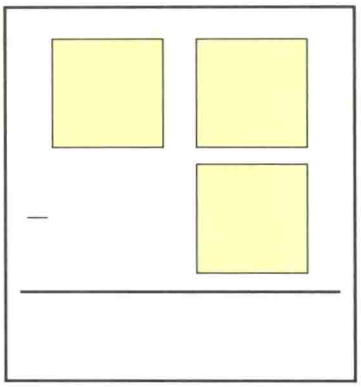
   How many different ways can you get 75 using 4 cards?



Thinking MATHEMATICALLY

5. Try making up some of your own questions using the addition arrangement. Try out your questions with a partner.

Now make a subtraction board like the one to the right.



6. Pick any 3 cards. Arrange them on the board to get the greatest possible difference.

7. Use these same 3 cards to get the least possible difference.

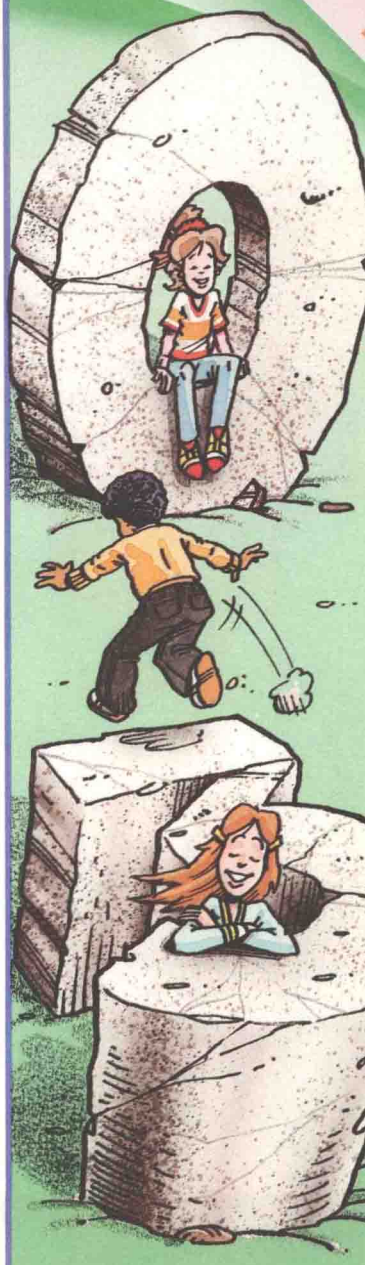
8. Which 3 cards would you pick to get a difference closest to 10? What is the difference? Is there another way?

9. Discuss your reasoning on Problems 6, 7, and 8 with a partner.

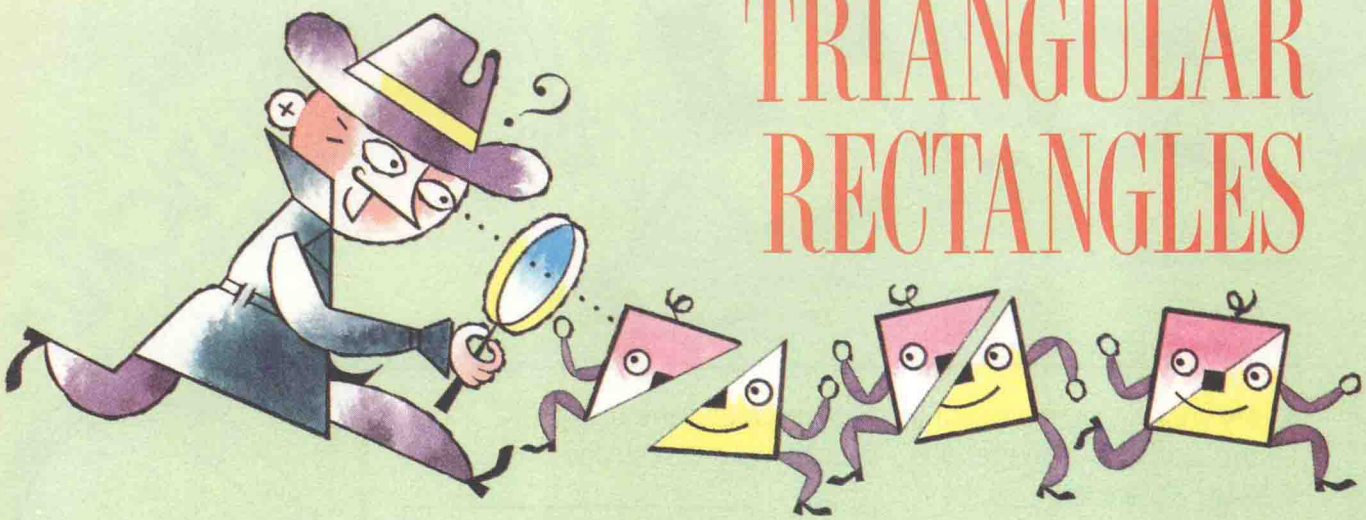
10. Now pick the 3 cards that will give you the greatest possible difference. What is this difference? How do you know that it is the greatest possible difference?

11. Pick the 3 cards that will give you the least possible difference. What is this difference? How do you know that it is the least possible difference?

12. Make up your own questions using the subtraction arrangement. Try them out with a partner.

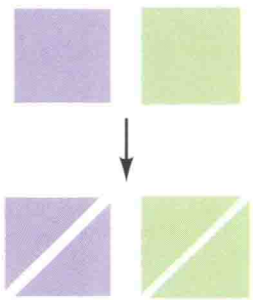


TRIANGULAR RECTANGLES



Visual Reasoning

Cut out two identical squares from two sheets of different-colored paper. Then fold each square in half to make a triangle and cut along the fold. You should have four triangles—two of each color.



Now experiment with your triangles. Put them together to make a rectangle. Then move the triangles around to make another rectangle with a different design. Each time you create a new design, draw a picture of it. For example:

Be careful.  and  are not different designs.

You can make the design on the second rectangle simply by turning the first rectangle.

1. Work with a partner. Compare your designs. Did you both find the same designs? Can you find other designs working together?
2. How many different rectangular designs can you make?
3. What other shapes and designs can each of you make using your four triangles? Do you have to decide on some rules for how to arrange the triangles?
4. Work with your partner and use all eight of your triangles to create shapes and designs. See what you can discover. Do you think you will make more shapes and designs than you did with four triangles? Why?