CHAPTER 12:

INTEGRATING MATHEMATICS INTO THE CURRICULUM

HOW TO BEGIN

Most "out-of-school" learning occurrences are natural, uncontrived and in the context of meaningful events. School is the only place where learning is separated into isolated subject areas. Mathematics can be used in all other disciplines and, for that reason, can be easily integrated throughout the school curriculum. Consider ways to weave mathematical experiences into all curriculum areas when you are scheduling classroom events and organizing the classroom environment.

The activity descriptions in this chapter are examples of how some teachers have integrated mathematics into their classroom. Use the examples as a starting point. Adapt the activities to fit your class's needs. Take advantage of spontaneous learning opportunities.

Remember, when you schedule classroom activities, make them as simple and natural as possible. Focus on the experience rather than the end result (e.g., bulletin board displays).

Topics in this Chapter
❏ Class Trip
❏ Seasonal Ideas (Pumpkin Math)
❏ Hundredth Day Activities
❏ Songs and Rhymes
❏ Children's Literature

CLASS TRIPS

Mathematical experiences can be integrated into class trips. For instance, several math related activities could develop from a trip to an apple orchard in the fall. The children could estimate the number of seeds in their apples, graph apples by various attributes (e.g., size, color, those with stems and those without…), estimate the circumference of apples and/or estimate how much applesauce can be made from a predetermined number of apples.
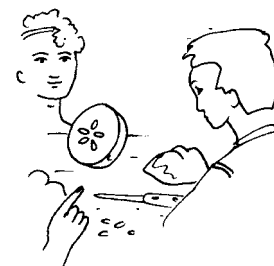
SEASONAL IDEAS

PUMPKIN MATH

Here are a few ideas using pumpkins and Halloween as the main topics. The activities would be spread out over the month of October. Some teachers introduce each activity to the whole class with one pumpkin and then provide several more pumpkins of various sizes for the children to repeat the activities either in pairs or individually. It is best if the children have more than one opportunity to experience the activities.

Attribute Game

Materials: pumpkin sealed in a box; chalkboard or chart paper
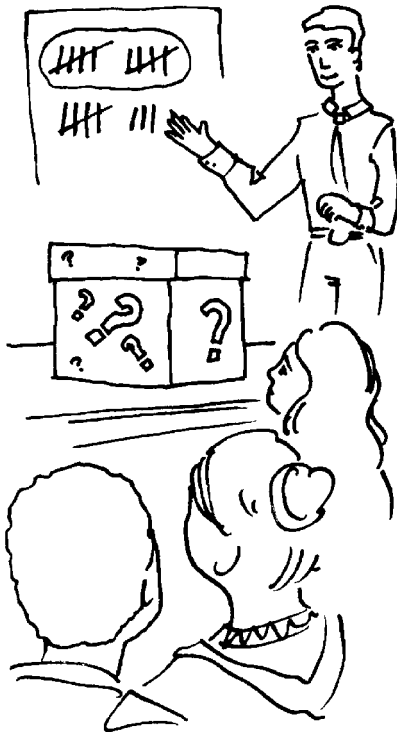
Show the box to your children. Explain that they will guess what is in the box by asking questions. Their questions must worded so you can answer either with a yes or no. The question cannot be, "Is it a ___?" Twenty questions must be used before attempting to guess what is inside. If a question is repeated, answer it again. With practice at this game, children will learn they need to pay attention to one another's questions to gain helpful information.

Keep track of the questions with a tally. When there are about five tallies on the board, stop and ask the children what information they already know to be true. Write the responses on the chalkboard (or a large piece of chart paper). This step reminds the children what has already been asked and displays all the known information together. After about fifteen questions, stop again and add to the list of information. Have the children who think they know ask questions which will assist the whole class.

After twenty questions and everyone seems to know, ask the children to whisper a guess to a neighbor. Remove the pumpkin from the box and review the attributes listed to see if they do indeed fit a pumpkin. The idea that children must ask only questions seems to be important. They must stretch their thinking to generate twenty attributes. As in junk box sorting (MTW, p. 64-69), new language often develops.

Weight Estimation

Materials: bathroom scale

Hold up the pumpkin. Ask the children how much they think the pumpkin will weigh. Record their guesses randomly on the board. Place the pumpkin on the scale and look eagerly at the scale to find out the weight of the pumpkin. Say something like, "I am so surprised! I didn't know it would weigh that!" Remove the pumpkin and set it on the floor. Leave the bathroom scale on the table. Go on to
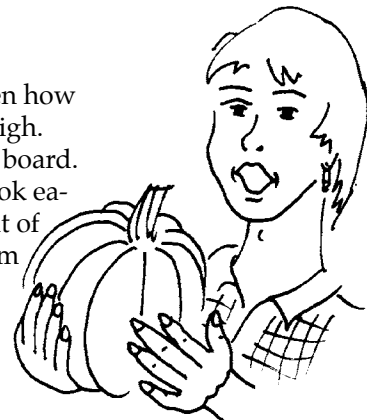
another activity. Children will stop you and want you to tell them how much the pumpkin weighed. Explain that you will leave the pumpkin and the scale right there all day. When they have an opportunity during the day, they may come up to check the weight for themselves.

There are two special rules, however, that they need to follow:
1. Don't tell anyone else how much the pumpkin weighs.

2. Take the pumpkin off the scale and put it back in its special place after you weigh it. This allows every child a chance to lift the pumpkin to the scale so the numbers on the scale take on some meaning with additional weighing experiences.
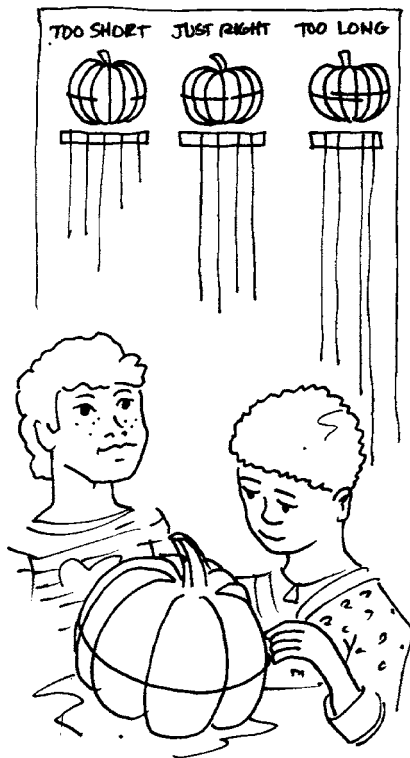
Circumference Estimation
Materials: string sticks (see Measuring Materials NL, p. 7.5), graph

Prepare the graph. Put up three pieces of masking tape approximately 10 inches in width with the sticky side facing out. Place three pictures of a pumpkin above the masking tape: the first picture indicates that the string is "too short"; the next "just right"; and the last picture will indicate "too long". A sign with these words could also be displayed for the older children.

Pass around the string sticks (one "string stick" per five children allows this activity to move rapidly). Each child estimates the circumference of the pumpkin and cuts the length of string he or she believes it will take to go around the fattest part of the pumpkin. Then each child takes his or her string and checks the estimate by wrapping the string around the pumpkin. The strings are placed on the graph after the estimates are checked. Encourage the children to try more times.

Vertical Lines Estimation
Materials: Graph (10 column); 1 one inch square piece of construction paper for each child

Ask the children to estimate how many vertical lines there are on the pumpkin. Demonstrate what you mean by vertical line. Have the children write a guess on a small square piece of paper. (Kindergarten children can just place the square on the graph in the chosen column.) Call one column at a time. ("If you guessed 0-5 lines, please bring up your paper square.") Apply glue in the column with a glue stick. Ask the children to stick their square on the graph.

Discuss the completed graph:
   Which number did the most/least children choose?
   Were there any numbers which were not chosen at all?
   How many (more/less) children chose ___ than ___ ?

Count the lines on the pumpkin together. (It is helpful to use a water color pen to write the numbers as you count.) How did we do with the guesses?

Jack-o'-lantern Face Graph

Materials needed for each child: one 3" inch square piece of construction paper for each child; crayons

Pass out the paper. Ask the children to draw a picture of the Jack-o'-lantern face they would like carved on the pumpkin. Graph the different types of faces.

Pumpkin Seed Estimation

Materials: Pumpkin seeds; portion cups; place value board; margarine bowls

Save the seeds after the pumpkin is carved. Wash the seeds and allow time for them to dry. Place the seeds in a jar. Ask the children to estimate how many pumpkin seeds there are in the jar. The guesses can be written randomly on the chalkboard. Ask the children to count the seeds into portion cups (10 per cup). Use a large place value board to count the seeds. If there are over 100 seeds, then stack the 10 portion cups of seeds and place them in a bowl. Once the seeds are all counted, record the total and place it under the place value board so the children can see how large numbers are written. Once the seeds are counted, they can be roasted and eaten for a snack.
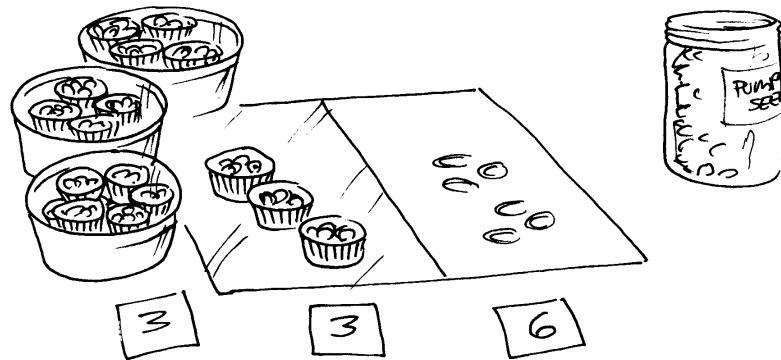
THE HUNDREDTH DAY OF SCHOOL

Some teachers plan a celebration on the hundredth day of school. Sometimes the celebration is a schoolwide event. The hundredth day is discussed long before it occurs. In anticipation of the day, the children might count in various groupings from the present date to one hundred or calculate how many more days before the hundredth day.

A few hundredth day activities are suggested in this section. It is important to choose activities appropriate for your present group of children. The class should participate in planning for the hundredth day.
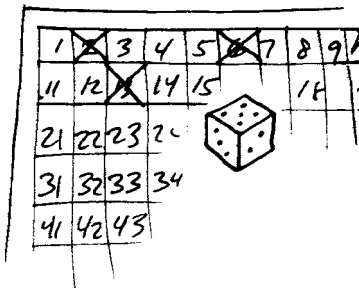
Sorting

❏ Ask the children to bring a collection of 100 things to class. Tell them the collection must fit into a shopping bag.

Hundred's Chart

❏ Ask the children how many different ways they think one hundred objects can be evenly divided. Display a large hundred's chart. Ask the children to choose any number on the chart and divide the into materials that many groups (i.e., If a child chooses two, he or she divides the materials into two groups.) The children can check either by grouping counting objects (e.g., beans) into portion cups or dividing a Unifix cube train into groups. As they find the numbers that divide evenly into a hundred, children can color them.

❏ Search for patterns on the hundred's chart (see NL, pp. 11.15 for examples).

❏ Play a dice game in a small group. Each child has a 100 grid (NL Blackline #44) and one or two dice. Ask the children to write an estimate at the bottom of the hundred's chart paper of how many throws of the dice it will take to get to 100. The children can play with either one die or two dice. Then ask them to roll the die (or two dice) and place an X on the number rolled. Next, the children roll the die (two dice) again and, starting at the box with the X, continue to count-on to a new number. An X is recorded on the new number. The children continue until they reach 100.

HOW MANY ROLLS TO GET TO 100?

Quantity

❏ Ask the children to estimate how many cups of popped popcorn 100 kernels would make. Then pop the popcorn and measure it with a cup. A graph could be made of the estimates.

❏ Using the calibrated jar (see NL, p. 7.6), ask the children to estimate how high a hundred of various materials would reach. Provide materials like beans, macaroni, shells, M&M's. The children could also measure a hundred using various sized scoopfuls of material like rice, sand, water, etc.

Length

THREE, FOUR, FIVE...

❏ Starting at a designated point, ask the children make a straight line with a 100 of various materials (e.g., 100 Popsicle sticks, Cuisenaire Rods, Unifix cubes, pattern blocks, wooden blocks from the block area). Then ask them to compare the different lengths and make predictions about new materials.

❏ Ask the children to take a hundred steps. They can try different ways to walk — e.g., toe to heel, giant steps, backwards or sideways, starting at the same point each time.

Ask the children to take a hundred steps starting from their classroom door (not all at once, of course). Where do you think you would end up? Try going from the door in different directions.

Time

❏ Ask the children to close their eyes and estimate when 100 seconds have passed. They can open their eyes when they think the time has passed.

❏ Using a timer, measure a hundred minutes. Set the timer in 25 minute increments.

❏ Discuss the length of a day (24 hours) with the children. Ask them to estimate approximately how many days a hundred hours would make. Check by beginning at a designated time and adding the 24 hour increments until a hundred hours pass. A concrete model representing the time passed can be built with Unifix cubes. Each 24 hours could be represented by a different Unifix cube color.

❏ Ask the children to estimate when a hundred days from the hundredth day of school would be. Check by counting ahead on a commercial calendar.

❏ Invite a local historian to visit the classroom to discuss what life was like one hundred years ago. Perhaps the historian could bring pictures and artifacts from one hundred years ago.

If there's a local person who is almost a 100 years old, extend an invitation to him or her to visit the class.

> One child's great grandmother was 98 years old. She was too weak to visit, so the class discussed the kinds of the questions they would ask if she could come to visit. The teacher made a list of the questions and sent them home with the child with a tape recorder. The child brought the taped conversation with the great grandmother back to share with the class.

Money

❏ Using the supermarket flier from the newspaper and coupons, find two items whose prices add up to exactly $1.00.

❏ Clip enough coupons from the newspapers so the total savings they represent equals $1.00.

❏ Assign a value to each letter of the alphabet (i.e., A=1¢, B=2¢, and so on). Ask the children to find the value of their first name (…first and last name, …first, middle and last names). Ask if anyone has a name that adds to $1.00. Then ask if they combined their names with a friend's can they make $1.00? A graph of the names might help the children find names that add to one hundred. Next ask the children to try to find other words that equal $1.00. The children could keep a class list of words that equal one dollar.

Note: For more ways to incorporate $1.00 words, consult Marilyn Burn's book, The $1.00 Riddle Book.

Language and Writing

❏ The children could write a story like: "If I Had $100 I'd…", "One Hundred Years Ago", "One Hundred Years from Now".

Science

❏ The children could plant 100 seeds. They could keep track of the growth of the plants, etc. When the seeds have grown into plants, the children could take them to a local nursing home for others to enjoy.

Art

❏ The children could make:
   - necklaces with a hundred objects (e.g., Cheerios, macaroni…).
   - mosaics with a 100 objects e.g., beans, cereal, pieces of paper.

❏ Ask the children to draw a picture of what it looked like one hundred years ago and/or what it might look like one hundred years from now.

❏ The children could build designs with a 100 manipulatives (e.g., tiles, Cuisenaire rods, Unifix cubes, pattern blocks, colored inch cubes, Legos, tooth-picks…)
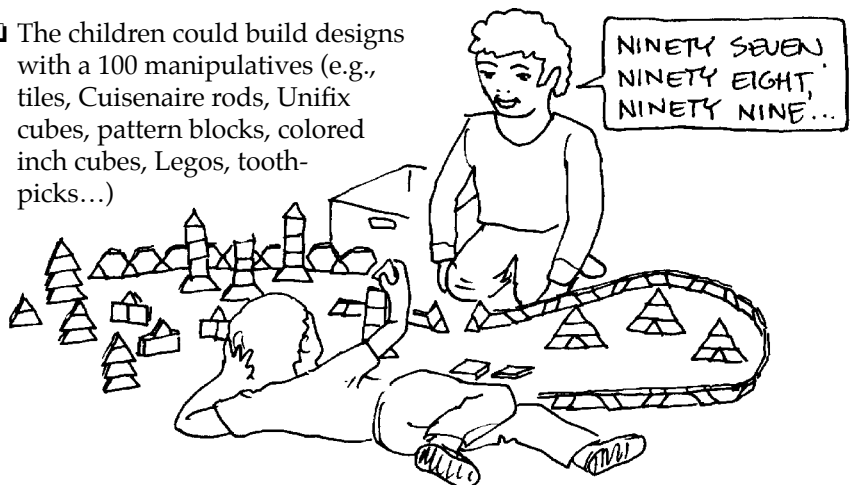
SONGS AND RHYMES

Adapt counting rhymes and songs to model number operations. It's a great way to create and act out word problems. Think of jump rope rhymes and nursery rhymes that use numbers or counting. The concept of pattern could be emphasized with rhymes and music. Favorite rhymes and songs could be made into whole class language charts or books. Children should be encouraged to create their own number rhymes.

Here are a few examples of adaptations of popular rhymes:

Ten Green Bottles
(7) green bottle(s) hanging on the wall.
(7) green bottle(s) hanging on the wall.
If (2) green bottle(s) should accidently fall,
There would be (5) green bottles hanging on the wall.

•   •   •   •   •

Five Little Frogs
(8) green and speckled frogs
Sat on a speckled log
Eating some most delicious bugs.
Yum! Yum!

(3) jumped into the pool
Where it was nice and cool
Now there are (5) green speckled frogs.
Glub! Glub!

•   •   •   •   •

Ten in the Bed
There were (6) in the bed and the little one said,
Roll over, roll over!
Well, they all rolled over and (3) fell out.
There were (3) in the bed…

•   •   •   •   •

Five Snowmen
(9) little snowmen fat
Each with a funny hat
Out came the sun and melted (4).
What a sad thing was that.
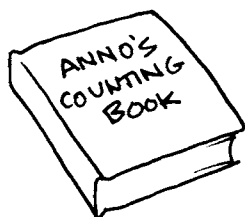Down,
        Down,
                Down.

Other Sources for Rhymes and Songs

And One and Two And…
Ella Jenkins' record

Count Me In (Counting Songs and Rhymes)
A&C Black Publishers

Aesthetics Foundations for Thinking
by Mary Helen Richards
Richards Institute of Music Education and Research

CHILDREN'S LITERATURE

Read children's literature in which mathematics occur or can be modeled. Some stories can be used to introduce or illustrate a concept. The children can use the framework of other stories to create their own stories with different numbers.

There are many wonderful children's books which illustrate mathematical concepts. The list grows every day. A booklist organized by mathematical topics has been included in this newsletter (see NL, pp. 12.10-12.12). Review the titles. Share the list with your school librarian.

Sources for Children's Literature Related to Mathematics

Beyond Numbers (The Mathematical Literature Connection)
by John Madison, & Roslynn Seidenstein
Math Education Trust, 1906 Association Drive, Reston, VA 22091

This book introduces ways to use children's literature to model mathematical concepts.

Mathematics Library (Elementary and Junior High)
Margaret Wheeler & Clarence Hardgrove
National Council of Teachers of Mathematics
1906 Association Drive, Reston, VA 22091

This book suggests a bibliography of books to enrich a mathematics program.

SUGGESTED CHILDREN'S LITERATURE

Counting Books

One Crow	Aylesworth, Jim	Lippincott
Ten, Nine, Eight	Bang, Molly	Picture Puffins
One Bear All Alone	Bucknall, Caroline	Dale Seymour Publishers
Six Little Ducks	Conover, Chris	Crowel
Ten Black Dots	Crews, Don	Greenwillow Books
Fish Eyes (A Book You Can Count On)	Ehlert, Lois	Harcourt, Brace, Jovanovich
Moja Means One (Swahili Counting Book)	Feelings, Muriel	Pied Piper Books
Roll Over	Gerstein, Mordicai	Crown Publishers
How Many Snails?	Giganti, P.	Greenwillow Books
Ten Green Bottles	Gretz, Susanna	Picture Puffins
Count Your Way Through China	Haskins, Jim	Carolrhoda Books, Inc.
Count and See	Hoban, Tana	Collier Books
More Than One	Hoban, Tana	Greenwillow
Seven Eggs	Hooper, Meridith	Harper & Row
1 Hunter	Hutchins, Pat	Greenwillow Books
One Bear at Bedtime	Inkpen, Mick	Little, Brown and Co.
Two, Four, Six, Eight (A Book About Legs)	Kessler, Ethel and Leonard	Dodd, Mead
When Sheep Cannot Sleep	Kitamura, Satashi	Farrar Straus Giroux
The Twelve Days of Christmas	Knight, Hilary	Aladdin Books
Ocean Parade	MacCarthy, Patricia	Dial Press
Counting Wildflowers	McMillan, Bruce	Lothrop Lee & Shepard
Farm Counting Book	Miller, Jane	Simon & Schuster
Monster Bubbles	Nolan, Dennis	Treehouse Paperback
Numbers of Things	Oxenbury, Helen	Dellacorte Press
A Farmer's Dozen	Russell, Sandra	Harper & Row
One Was Johnny	Sendak, Maurice	Harper & Row
Who Wants One?	Serfoza, Mary	Mary K. McElderry Books
A Light in the Attic ("How Many, How Much" p. 8)	Silverstein, Shel	Harper & Row
Where the Sidewalk Ends ("Eight Balloons" p. 58)	Silverstein, Shel	Harper & Row
One Sun, Two Eyes, and a Million Stars	Stobbs, Joanna and William	Oxford Press
One Woolly Wombat	Trinca, Rod	Kane/Miller Book Pub.
1 is One	Tudor, Tasha	Rand McNally & Co.
Who's Counting?	Tafuri, Nancy	Greenwillow Books
1 is No Fun But 20 is Plenty	Vogel, Ilse-Margret	Aladdin Books
Over in the Meadow	Wadsworth, Olive	Picture Puffins
An Invitation to the Butterfly Ball	Yolen, Jane	Philomel Books

Fractions

Pezzettino	Lioni, Leo	Pantheon
Gator Pie	Mathews, Louise	Dodd, Mead, & Co.

Geometry

Picture Pie	Emberley, Ed	Little, Brown and Co.
Shapes and Things	Hoban, Tana	MacMillan
Shapes, Shapes, Shapes	Hoban, Tana	MacMillan
Circles, Triangles and Squares	Hoban, Tana	MacMillan
Changes, Changes	Hutchins, Pat	Greenwillow Books
Square is a Shape	Lerner, Sharon	Lerner Publishing Co.
Straight as a Line	Lerner, Sharon	Lerner Publishing Co.
Shapes	Pienkowski, Jan	Harvey House
A Light in the Attic ("Shapes" p. 77)	Silverstein, Shel	Harper & Row

Graphing

Guess Who My Favorite Person Is	Baylor, Byrd	Aladdin
The Mysterious Tadpole	Kellogg, Steven	The Dial Press
Stone Soup	Sapienza, Marilyn (retold)	Weekly Reader
Red is Best	Stinson, Kathy	Annick Press Ltd.
Whose Shoes	Wildsmith, Brian	Oxford Press

Measurement

Ten Beads Tall	Adams, Pam	Child's Play
Mr. Archimedes' Bath	Allen, Pamela	Wm. Collins Publishers (Sidney)
The King's Flower	Anno, Mitsumasa	G. P. Putnam's Sons
The Chocolate Chip Cookie Contest	Douglas, Barbara	Lothrop, Lee, & Shepard
Jim and the Beanstalk	Kellogg, Steven	Coward
Much Bigger than Martin	Kellogg, Steven	Dial Press
The Carrot Seed	Krauss, Ruth	Harper & Row
Inch By Inch	Lionni, Leo	Astor-Honor
The Biggest House in the World	Lionni, Leo	Pantheon
The King's Shadow	Linn, Charles	Carolrhoda Books
How Big is a Foot	Myller, Rolf	Atheneum
The Borrowers (Chapter One)	Norton, Mary	Harcourt, Brace, Jovanovich

Money

$1.00 Word Riddle Book	Burns, Marilyn	Cuisenaire
Where the Sidewalk Ends ("Smart", p. 35)	Silverstein, Shel	Harper & Row
Alexander, Who Used to be Rich Last Sunday	Viorst, Judith	Atheneum

Number Relationships

One, Two, Three Going to Sea	Alaine	Scholastic
Anno's Mysterious Multiplying Jar	Anno & Nazaki	Philomel
Anno's Counting House	Anno, Mitsumasa	Philomel
Too Many Eggs	Butler, Christina	D. R. Godine Publishers
Millions of Cats	Gag, Wanda	Coward, McCann & Geoghan
Don't Count Your Chicks	d'Aulaire, Ingri and Parin	Doubleday
One, Two, Three, and Four. No More?	Gray, Catherine	Houghton Mifflin
More Than One	Hoban, Tana	Macmillan
The Doorbell Rang	Hutchins, Pat	Greenwillow Books
The Wolf's Chicken Stew	Kasza, Keiko	G.P. Putnam
One Watermelon Seed	Lottridge, Celia Barker	Oxford University Press
Bunches & Bunches of Bunnies	Mathew, Louise	Scholastic
The Hundred Penny Box	Mathis	Viking
Billions of Bugs	Petie, Haris	Prentice-Hall
A Grain of Rice	Pittman, Helena	Hastings House
So Many Cats	Schenk de Regniers, Beatrice	Clarion
How Much Is a Million	Schwartz, D. & Kellogg S.	Scholastic
If You Made a Million	Schwartz, D. & Kellogg S.	Lothrop, Lee & Shepard
Millions and Millions and Millions	Slobodkin, Louis	Vanguard
Where the Sidewalk Ends ("Bandaids"p. 140)	Silverstein, Shel	Harper & Row
The 500 Hats of Bartholomew Cubbins	Seuss, Dr.	Hale and Co.
I Can Count the Petals of the Flower	Wahl, John and Stacey	NCTM
The 329th Friend	Weinman, Marjorie Sharmat	Four Winds

Pattern

The Very Busy Spider	Carle, Eric	Philomel
Round Trip	Jonas, Ann	Scholastic
Reflections	Jonas, Ann	Greenwillow Books
A Light in the Attic ("Reflection"s p. 29)	Silverstein, Shel	Harper & Row
The Mirror Puzzle Book	Walter, Marion	Tarquin Publication

Probability

Anno's Hat Tricks	Anno & Nozaki	Philomel
Journey	Lobel, Arnold	Harper & Row
Mouse Tales	Lobel, Arnold	Harper & Row
Caps for Sale	Slobodkina, Esphyr	Scholastic
Elephant Buttons	Ueno	Harper & Row

Sorting

The Baby's Catalogue	Ahlberg, Janet and Allen	Little, Brown & Co.
Harriet's Halloween Candy	Carlson, Nancy	Puffin
Is it Red? Is it Yellow? Is is Blue?	Hoban, Tana	Greenwillow Books
Is it Rough? Is it Smooth? Is it Shiny?	Hoban, Tana	Greenwillow Books
A House is A House for Me	Hoberman, Mary Ann	Viking-Penguin
Growing Colors	McMillan, Bruce	Lothrop, Lee, & Shepard
People	Spier, Peter	Doubleday & Co.
Those Green Things	Stinson, Kathy	Annick Press

Time

Anno's Sundial	Anno, Mitsumasa	Philomel Books
Anno's Counting Book	Anno, Mitsumasa	Crowell
Anno's Sundial	Anno, Mitsumasa	Philomel Books
Caps, Hats, Socks, and Mittens	Borden, Louise	Scolastic
This is a Book About Time	Burns, Marilyn	Little, Brown Co.
The Grouchy Lady Bug	Carle, Eric	Crowell
The Very Hungry Caterpillar	Carle, Eric	Philomel Books NY
Ramona the Pest (Chapter 7)	Cleary, Beverly	William Morrow & Co.
Season of Arnold's Apple Tree	Gibbons, Gail	Harcourt, Brace, Jovanovich
Boss for a Week	Handy, Libby	Scholastic
Frederick	Lionni, Leo	Pinwheel
Knots on a Rope	Martin, Bill	Henry Holt & Co.
Time to…	McMillan, Bruce	Lothrop, Lee, & Shepard
Monday I Was An Alligator	Pearson, Susan	Lippincott
Time	Pienkowski, Jan	Little Simon
One Hundred Years Ago	Platt & Munk	Platt & Munk
On Friday Something Funny Happened	Prater, John	Penguin Books
Only Six More Days	Russo, Marisabina	Greenwillow Books
This Year's Garden	Rylant, Cynthia	Bradbury Press
The Tomorrow Book	Schwerin, Doris	Pantheon Books
Chicken Soup with Rice	Sendak, Maurice	Harper Row
One Monday Morning	Shulevitz, Uri	Charles Scribner's Sons
All Year Long	Tufuri, Nancy	Greenwillow Books
You'll Soon Grow Into It	Hutchins, Pat	Penguin

Miscellaneous

Anno's Math Games	Anno, Mitsumasa	Philomel Books
Anno's Math Games II	Anno, Mitsumasa	Philomel Books
Socrates and the Three Pigs	Anno & Mori	Philomel Books
First Grade Takes a Test	Cohen, Mariam	Morrow
Changes, Changes	Hutchins, Pat	Greenwillow Books
Numblers	MacDonald, Suse	Dial Press
Pumpkin, Pumpkin	Tithington, Jeanne	Greenwillow Books