

To my mother and my father, Nancy and Ted, who showed me
how to love children.

And to Laura and Ryan, who gave me a million reasons to do so.

To Gary, who never complained, even about sharing the dinner table
with a typewriter for ten months.

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CONTENTS

Introduction

How Can this Book Help You?
How Should this Book Be Used?
Communicating with Parents
Needed Materials
How Should You Begin?
Cross-Curriculum Index

Shapes 1

Activity 1, Shape Walk 2

Children explore and compare shapes as they move along large chalk shapes drawn outdoors.

Activity 2, Steer-a-Shape 3

Children explore and compare shapes made with tape on tabletops as they push toy vehicles along the shapes.

Follow-Up, Tracing Shapes 3

Children get a feel for shapes as they trace over them with cotton swabs dipped in paint.

Activity 3, Box Prints 4

Children create squares and rectangles by printing with boxes and lids dipped in paint.

Activity 4, Dough Shapes 4

Children make their own dough, then use the dough to make shapes drawn on cards.

Activity 5, Cookie Crayons 6

Children see crayons change from straight lines to circles as crayons are melted in a muffin tin.

Activity 6, Stick Shapes 7

Children manipulate popsicle sticks to create designs and duplicate shapes.

Follow-Up, Toothpick Shapes 8

Children use toothpicks to create designs and duplicate shapes.

Activity 7, What Did I Trace? 8

Children find objects in the room that were traced and match objects to their tracings.

Follow-Up, Shape Match 8

Children match and glue objects to their traced outlines.

Activity 8, Cereal Sort 9

Children sort dry cereals according to their shape and then eat the squares and circles.

Follow-Up, Sorting Shapes 9

Children sort circles, triangles, and squares made of construction paper.

Activity 9, Cookie Cutter Shapes 10

Children experiment with cookie cutters to gain an awareness of many shapes; cutters are used for printing, and for cutting dough, bread, cheese, and clay.

Follow-Up, Cutters and Cookies 10

Children match "cookies" with the "cutters" that made them.

Activity 10, Shape Hunt 10

Children hunt for hidden shapes around the room, collecting them in lunch bags.

Activity 11, Shape Puzzles 11

Children use shapes to complete puzzles made from cereal boxes.

Activity 12, Elastic Shapes 12

Children use their bodies to make a long piece of elastic become a circle, a square, a triangle, or a diamond.

Follow-Up, String Shapes 13

Children use yarn dipped in glue to form shapes.

Activity 13, Spaghetti Shapes (uncooked) 13

Children snap spaghetti sticks into various lengths and use them to form shapes and designs.

Activity 14, Spaghetti Shapes (cooked) 14

Children use cooked spaghetti to create shapes and designs, which are, at first, flexible and later harden and adhere to the paper with their own starch.

Activity 15, Styro Shapes 15

Children sort and match Styrofoam packing pieces by noting various shapes.

Activity 16, Missing Shapes 16

Children create pictures and designs radiating from multishaped holes in their papers.

Activity 17, Tracing Objects 17

Children predict the shapes that will result from tracing around particular objects; they check their predictions when the shapes are traced.

Follow-Up, Templates 17

Children create shapes by using templates made from cardboard.

Follow-Up, Shapes on a Fold 17

Children create surprise shapes by cutting shape halves on a fold.

Activity 18, Circle Imprint 18

Children create a giant circle by painting an old, scratched 33 rpm record and making an imprint by pressing paper on it.

Activity 19, Strawberry Squares 18

Children create square grids by printing with strawberry containers dipped in paint.

Activity 20, Quick Doughnuts 19

Children really get to know circles as they cook their own doughnuts and eat them.

Sizes 20

Activity 21, Big and Small Bubbles 21

Children compare big bubbles and small bubbles blown by the teacher and blow some bubbles of their own.

Follow-Up, Big and Small Circles 22

Children create big and small circles by printing with paper cups and film containers.

Activity 22, The Big and Small Bag 22

Children find items that are alike except for size and then sort items into "big" and "small" piles.

Activity 23, Big and Small Dough Creations 23

Children make their own dough, then create a "big" object and a "small" object.

Follow-Up, Draw a Bigger One! 23

Children learn about comparative size by drawing bigger objects than those on their papers.

Activity 24, Ordering from Smallest to Biggest 24

Children see balloons inflated to various sizes and then order them by size.

Follow-Up, Ordering Paper Balloons 25

Children paste paper balloons in size order.

Activity 25, Boxes and Lids 25

Children think about size as they match lids to boxes.

Activity 26, Presents and Boxes 26

Children put "presents" in appropriate-size boxes.

Activity 27, Cards and Envelopes 27

Children use size clues to match greeting cards to envelopes.

Follow-Up, Note Cards and Envelopes 27

Children match note cards to envelopes of the same size.

Activity 28, Graduated Circles 27

Children pile circular objects from biggest to smallest and from smallest to biggest.

Follow-Up, Tracing Graduated Circles 28

Children trace around circular items of decreasing size.

Activity 29, Block Height 28

Children pile blocks to match the height of their partners, allowing children to see their height in blocks.

Activity 30, Tape Height 29

Children build block towers to match the height of tape on the wall.

Activity 31, Short to Tall Bottles 30

Children arrange bottles in increasing height order.

Activity 32, Tall to Short Candles 30

Children see candles burn to various heights and order the candles by height.

Follow-Up, Melting Candles 31

Children draw shorter candles than the ones on their papers as they show how melting candles will soon look.

Activity 33, Short Snakes/Long Snakes 31

Children create snakes of various lengths out of clay, then connect them all together to make one very long snake.

Activity 34, Snapping Spaghetti 32

Children snap spaghetti into shorter and shorter pieces, then cook and eat it.

Activity 35, Long Straws, Short Straws 32

Children connect specially cut drinking straws to create longer and longer straws, then pull them apart and cut them to create shorter and shorter straws.

Follow-Up, Straw Bracelets 33

Children use straw pieces to create bracelets by stringing them on pipe cleaners.

Activity 36, The Long and Short of It! 33

Children take turns making fishing line, a retractable tape measure, and elastic become shorter and longer.

Follow-Up, Long and Short Pieces 34

Children cut and glue long and short pieces of yarn, thread, and string.

Activity 37, If the Shoe Fits! 34

Children try out predictions of which shoe will fit a doll, which lid will fit a jar, which picture will fit a frame, and so on.

Follow-Up, Baby Talk 35

Children bring in baby photos and items they wore as babies to assess changes in their size.

Activity 38, Measuring Cup Order 36

Children match measuring cups with mounds of brown sugar.

Follow-Up, Leaf Sizes 37

Children collect leaves on a nature walk and order them by size.

Activity 39, Cork Sizes 37

Children match corks of the same size.

Follow-Up, Ordering Corks 38
Children order corks by size.

Activity 40, Cork It! 38
Children match corks to bottles.

Follow-Up, Cork Prints 38
Children print with corks of varied sizes after dipping them in paint.

One-to-One Correspondence 39

Activity 41, Establishing Oneness 41
Children use pretzel sticks to begin to develop the concept of one versus more than one.

Follow-Up, Just One 41
Children find a set of one within a set of more than one.

Activity 42, Hats on Heads 41
Children experience one-to-one correspondence as they each find and wear one hat at a time in a hat parade.

Follow-Up, Doughnuts on Dishes 42
Children place one doughnut (reinforcement) on each dish as they develop an understanding of one-to-one correspondence.

Activity 43, Shoe Bag Game 42
Children place one shoe in each compartment of a shoe bag.

Activity 44, Scrambled Pebbles 42
Children place one pebble in each compartment of an egg carton, shake the carton to scramble the pebbles, and then arrange them, one-to-one again.

Follow-Up, One-to-One Gluing 43
Children glue pebbles, one-to-one, in the compartments of an egg carton.

Activity 45, One-to-One Popsicles 43
Children prepare their own orange-juice popsicles by using one-to-one matching in a variety of ways.

Follow-Up, Popsicle Pictures 44
Children glue one popsicle stick on one popsicle picture.

Activity 46, Matching One-to-One 45
Children match wallpaper designs, one-to-one.

Follow-Up, Patch Match 45
Children use one-to-one matching to match and glue wallpaper pieces.

Activity 47, Gift Wrap Match 46
Children match wrapping paper designs, one-to-one.

Follow-Up, Wrap-Match 46
Children match and glue wrapping paper designs next to one another.

Activity 48, One-to-One-to-One Buffet! 46
Children create healthy "cracker sundaes" as they use one-to-one correspondence.

Activity 49, One-to-One Stamping 47
Children stamp once in each square until all squares contain one and only one stamp.

Activity 50, One-to-One Go Togethers 48
Children match objects that go together.

Follow-Up, Go Togethers 48
Children match and glue items with pictures that are related in some way.

Activity 51, Noncompetitive Musical Chairs 49
Children see one-to-one correspondence in action as they lose seats in the game line but gain seats in the rhythm band line.

Counting with Understanding 50

Activity 52, Table of 1 51
Children create their own sets of 1.

Follow-Up, Set of 1 51
Children glue a set of 1 to take home.

Activity 53, Table of 2 52
Children create a set of 2 items and see that it has 1 more member than the set of 1.

Follow-Up, Two Feet 53
Children have their feet traced to create a set of 2 to take home.

Activity 54, Twoness 53
Children discover that carbon paper allows them to create a set of 2 drawings while only drawing 1 picture!

Activity 55, Pairs of Gloves 53
Children have their hands traced on wallpaper samples to create pairs of gloves; these are scrambled and children find matching pairs.

Follow-Up, Mitten Match 54
Children match pairs of paper mittens as they gain experience with the concept of twoness.

Activity 56, Pairs of Shoes 54
Children match members of shoe pairs.

Activity 57, Pairs Bag 55
Children match objects that come in pairs, such as earrings and socks, and discover that pairs are sets of 2.

Activity 58, Making Snowmen 55
Children use an Ivory Snow mixture to create snowmen consisting of 3 "snowballs" stacked on top of one another.

Activity 59, Ring Counter 56

Children use a broom and “rings” to create sets of particular numbers.

Follow-Up, Stringing Sets 57

Children string sets of Cheerios as they count them.

Activity 60, Counting Peanut Butter Balls 58

Children follow a recipe to create peanut butter balls, then count them. As they eat them, they see their sets dwindling in number.

Activity 61, Peas in Pods 58

Children remove fresh peas from their pods, collect them in cups, and then count the peas.

Activity 62, Fill Your Plate 59

Children place as many food pictures on their plates as numerals indicate.

Activity 63, Use-Your-Noodle Necklaces 60

Children help dye rigatoni, then count out a particular number of rigatoni “beads” to string.

Activity 64, Action Sets 60

Children create sets by using interesting tools such as a hole punch, hammer, stapler, and so on.

Activity 65, Break the Record 61

Children predict the number of classmates who will fit inside a hula hoop. They check their predictions when one child after another tries to break the record!

Follow-Up, Stick Fit 62

Children estimate the number of popsicle sticks that will fit inside a rectangle, then check their estimates by lining up popsicle sticks inside the rectangle and counting.

Activity 66, Mind Reading 62

Children count the number of times other children perform certain actions, to “read minds” and guess secret numbers.

Activity 67, Create It Equal! 62

Children create sets of objects that are equal in number to the teacher’s sets.

Activity 68, Make an Equal Set 63

Children help to create sets of objects that are equal or unequal to other sets.

Follow-Up, Bean Sets 65

Children create sets of beans that are equal to sets found on their papers.

Activity 69, More or Fewer 65

Using hoops and objects, children make sets of more members and fewer members.

Follow-Up, The More, the Merrier 66

Children gain experience with the concept of *more* as they add more hair, more stripes, more buttons, and so on, to pictures.

Activity 70, Guess, then Count! 66

Children see the value of counting as they guess the number of a variety of sets and then use counting to verify their answers.

Activity 71, Little Porcupines 67

Children use clay to make porcupines, then count as they add spaghetti quills!

Recognizing and Ordering Numerals 69

Activity 72, Pretzel Numerals 70

Children make their own hot pretzel dough and form the dough into edible numerals!

Activity 73, Wax-Resist Numerals 71

Children paint over papers on which numerals seem to magically appear.

Activity 74, Sand Numerals 72

Children make sand numeral cards to see and feel with sand and glue.

Activity 75, Card Match 73

Children match the numerals on playing cards with block towers of matching number.

Activity 76, Four Corners 73

Children play an exciting game that makes use of numeral signs.

Activity 77, Listen and Count 74

Children count the number of interesting sounds they hear and hold up numeral cards to show totals.

Activity 78, Sweet Numerals 75

Children fingerpaint with chocolate syrup, creating shiny numerals that can easily be “erased” and practiced again.

Activity 79, Giant Follow-the-Dots 76

Children follow numbered dots on the floor to create large shapes with masking tape.

Follow-Up, Follow-the-Dots 77

Children follow numbered dots with pencils to create a picture.

Activity 80, Book Pages 77

Children look for particular numerals on pages in books.

Activity 81, How Many Raindrops? 78

Children use eyedroppers to create raindrops under cotton clouds; numerals tell how many raindrops are needed.

Activity 82, Numbered Pockets 78

Children place the appropriate number of items in numbered pockets of a shoe bag.

Activity 83, Button Cards 79

Children count buttons on one side of a card to determine the “secret” numeral on the other side of the card.

Activity 84, Tiny Treasure Boxes 80

Children fill tiny jewelry boxes with the appropriate number of "jewels."

Activity 85, Bumpy Bugs 80

Children count the bumps on egg carton "bugs" and label them with appropriate numeral cards.

Follow-Up, Fingerprint Bugs 81

Children create sets of bugs from their fingerprints.

Activity 86, Numbered Obstacle Course 82

Children enjoy an obstacle course by following numerical order.

Follow-Up, Crazy, Mixed-up Numerals 82

Children cut numerals from a page and rearrange them so that they are in numerical order.

Activity 87, Fishy Numerals 83

Children "fish" for numerals with a magnet to gain practice in recognizing numerals.

Follow-Up, Fish on a String 83

Children cut out numbered fish and string them in numerical order.

Parts and Wholes 84

Activity 88, Face Sandwiches 85

Children create faces with edible face parts.

Follow-Up, Make a Face 86

Children create interesting faces with parts from assorted faces.

Activity 89, Bag of Halves 86

Children find matching halves of concrete objects

Activity 90, Plate Halves 86

Children find matching shape halves, placing them so that they appear whole.

Follow-Up, Shape Puzzles 87

Children cut out shape pieces and paste them together to create whole shapes.

Activity 91, Car Parts 87

Children manipulate cut-up car pieces to make cars whole again.

Activity 92, Parts to Wholes 88

Children match whole objects to similar objects that have been torn or broken into parts.

Activity 93, Parts Bag 89

Children use experience, logic, and language to decide what whole things the parts in a bag are derived from.

Activity 94, Name Puzzles 89

Children put the parts of their names together to form their whole names.

Joining and Separating Sets 91

Activity 95, Addition Soup 92

Children bring ingredients to school to add to the pot of soup. The whole is the sum of all its delicious parts!

Activity 96, Balloon Sets 93

Children hear an imaginative story that develops the concept of how joining sets can be useful.

Follow-Up, Raisin Sets 94

Children join sets of raisins before eating the combined set!

Activity 97, Peanut Addition 94

Children make peanut butter by joining sets of peanuts.

Activity 98, Jollypops! 95

Children join sets of green grapes and red grapes on lollipop sticks.

Activity 99, Picks and Cubes 96

Children join sets of toothpicks stuck into Styrofoam cubes.

Activity 100, It's the Tops! 97

Children join sets of smooth-edged bottle tops.

Follow-Up, Dot Addition 97

Children join sets of dots, created by pressing pencil erasers on stamp pads and then stamping with the erasers.

Activity 101, Marble Math 97

Children join sets of marbles in numbered baby food jars.

Activity 102, People Addition 98

Children join sets of classmates.

Activity 103, Animal Subtraction 99

Children separate sets to see how the stuffed animal stock in a "pet store" decreases as animals are "purchased" and how the animal cracker stock decreases as children eat these!

Activity 104, Tasty Subtraction! 100

Children make an edible "counter" of celery, cream cheese, and pretzel sticks and subtract by eating pretzels!

Activity 105, Lost Gold 101

Children enjoy separating sets of "gold" nuggets (spray painted lima beans).

Follow-Up, Disappearing Act! 101

Children separate sets of rabbits by removing some with white shoe polish.

Activity 106, Cotton Subtraction 101

Children separate sets of cotton balls, using tweezers, tongs, or clothespins to grasp the cotton, to add to the challenge.

Activity 107, Cheerios Abacus 102

Children make their own adding and subtracting machines with pipe cleaners, Styrofoam cubes, and Cheerios.

Exploring Tools of Measurement 104

Activity 108, Timed Sharing! 105

Children learn about time and sharing as they take turns with toys. Their turns are timed with a timer.

Follow-Up, Timed Marble Roll Painting 106

Children make interesting designs with marbles dipped in paint. A timer tells them how long to let the marbles roll.

Activity 109, Finding Time 106

Children search for a hidden timer, listening for its ticks and hurrying to beat its ring.

Activity 110, Using Clocks 106

Children explore clocks, dramatizing a "pretend" day from hour to hour.

Follow-Up, Mock Clocks 108

Children make their own clocks with movable hands.

Activity 111, Time It! 108

Children make their own butter in a cooperative, timed effort.

Activity 112, Heavy or Light 109

Children predict which of two things is heavier, then test predictions with a balance scale.

Follow-Up, Heavier and Lighter 110

Children sort items into "heavier" and "lighter" columns.

Activity 113, Sorting Coins 110

Children separate coins into bowls of pennies, nickels, dimes, quarters, and half dollars.

Activity 114, Coin Rubbings 111

Children become more aware of coin characteristics as they create coin rubbings with pencil and tracing paper.

Activity 115, Treat Shop 111

Children prepare frozen pudding popsicles, then "buy" them for nickels or 5 pennies.

Activity 116, Piggy Banks 112

Children make their own piggy banks, in which coins saved can be seen through clear plastic snouts.

Activity 117, Using Rulers 115

Children use cardboard rulers to help measure and then decorate a tablecloth for snacktime.

Activity 118, Measured Lines 116

Children try using rulers to create lines of varying lengths.

Follow-Up, Line Art 116

Children use rulers and pencils to create their own designs.

Activity 119, Measuring Cups and Spoons 117

Children explore the capacities of measuring cups and spoons by playing with water and then rice.

Follow-Up, Sand Painting 117

Children use measuring cups and spoons to make colored sand and then create colorful sand paintings.

Activity 120, Individual Gelatin 118

Each child prepares a serving of gelatin, using measuring spoons.

Activity 121, Measure Up! 119

Children use measuring cups in the preparation of bird feeders.

Parent Notes 120

Playsheets 123

INTRODUCTION

The world of mathematics for young children can and should be a world of inquiry, exploration, and discovery. When early childhood teachers excite young children about mathematics, they can provide more than a good foundation for future mathematical understanding. They can inspire lifelong positive feelings about mathematics.

Hands-On Math is based on these beliefs:

- There is a lot more to early childhood math than counting and recognizing numerals.
- Young children learn best through manipulation of materials and employment of all the senses.
- Concrete activity should precede abstract, pencil-and-paper activity.
- Most early childhood teachers prefer challenging, hands-on math experiences to rote drill and stifling worksheets, but they need a resource to help them provide affordable, easily prepared activities.
- Early childhood education is soundest when it includes parental support and involvement; teachers need ways to communicate with parents about hands-on experience and learning.

How Can This Book Help You?

If you are a teacher of children 3 to 6 years of age, or if you teach remedial math, or if you work with children with special needs, this book has much to offer.

Hands-On Math

1. Provides teachers with math concepts appropriate for children 3 to 6 years of age and with enjoyable, manipulative activities that allow children to discover these concepts.
2. Provides teachers with follow-up ideas that reinforce the concepts presented, result in take-home materials that communicate learning to parents, and provide a transition from the concrete activities in this book to the more abstract activities that will come at later levels. Many follow-ups are in the form of reproducible playsheets.
3. Takes into account time and budget constraints faced by teachers and provides easily prepared activities that require inexpensive (or free) materials, commonly found around the home or classroom.
4. Takes into consideration the needs and abilities of young children, providing activities that are age-appropriate. Motor development, attention span, safety factors, and even nutritional needs have shaped the activities.
5. Combines many areas of the early childhood curriculum with mathematics. Cooking, art, music, large and small motor skills, games, perception,

imagination and creativity, language, science, and social skills are included.

6. Provides methods for communicating with parents about hands-on math activities.

How Should This Book Be Used?

This book can be used as *the* math curriculum for the early years or as a resource book to provide basic math understanding in a fun, hands-on way.

Primarily, the activities are designed for children 3 to 6 years of age. When an activity is best suited to a narrower age group, that age group is indicated at the top of the activity. The entire section, "Joining and Separating Sets," is intended for 5s and 6s and is inappropriate for most younger children.

Activities involving numbers and numerals (the symbols that represent numbers) can be tailored to fit particular children's needs. For the most part, 3s would be working with numbers through five, 4s with numbers through ten, and 5s and 6s through ten and beyond.

The main activities in this book, numbered 1 through 121, are concrete; they are designed to precede the follow-ups, which are slightly more abstract. Teachers may choose to use only the concrete activities, omitting the follow-ups. However, follow-ups should *never* be used alone, without engaging in the concrete activities that precede them. This would defeat the purpose of providing hands-on experience before making a transition to a slightly more symbolic activity.

Follow-ups are sometimes in the form of the playsheets found in the back of this book. Playsheets differ from traditional worksheets by allowing for creativity, involving manipulation of materials, and providing a transitional step between strictly concrete and strictly abstract mathematics. Each playsheet may be used as is or modified, according to the needs of a particular class. For example, Playsheet 8 calls for cutting; if your class of 3s finds cutting difficult, do the cutting ahead of time or use a shortened version of the playsheet to require less cutting. Playsheet 3 asks children to glue a reinforcement, a margarine tub lid, a popsicle stick, and a paper clip on top of their tracings; if you cannot collect these items, then, using the idea behind the playsheet, collect and trace more accessible items.

Generally speaking, the activities are best presented in the order in which they appear. The sections on "Shapes" and "Sizes" contain activities that can be interspersed with activities from other

sections. The section, "One-to-One Correspondence," must precede "Counting with Understanding," and both of these, along with "Recognizing and Ordering Numerals" and "Parts and Wholes," must precede "Joining and Separating Sets," since learning is cumulative.

The concrete activities may be used with entire classes or at smaller, teacher-directed centers. Smaller groups are especially recommended for remedial groups, special education, and whenever activities call for taking turns. Follow-ups may be completed at centers or individually.

Following the "To Do" section of each main activity, the benefits to be gained from engaging in the activity are listed. Young children are growing in many areas at once, and the activities contribute not only to understanding math concepts, but to many other areas of development as well. Many activities combine music, art, science, social skills, imagination and creativity, perception and language, or motor skills with math, making the activities part of a total early childhood program instead of isolated events. The "To Be Gained" section indicates areas enhanced by the activity, as well as specific skills to be gained from the activity.

The "To Discuss" section provides suggested questions for discussion. Most are open-ended questions for which there are no right or wrong answers. Children's enthusiasm for discussion is directly related to the teacher's acceptance of their ideas. Positive teacher responses such as eye contact, nodding, and comments (i.e., "Interesting idea!") keep children thinking, imagining, suggesting, and participating.

Communicating with Parents

Because parents can play an important role in the full use of this book, much thought has been given to communicating with them about the book's activities. Parents can help supply materials, reinforce concepts by becoming involved with the products and activities children bring home, listen to children who are excited about the classroom activities, and expand on learning through questions and discussions.

For many activities, the book suggests labeling a child's paper in a particular way. Such labels tell the parents the process used by the children and can initiate parent-child discussions regarding the activities. When a paper is labeled "Timed Marble Roll Painting," for example, parents are inspired to ask how a marble was used and how long a time it required. Without the label, discussion about the activity could be limited or it might never occur.

For some activities, it is suggested that parents be asked to send in materials ahead of time. This is

helpful to the teacher and lets parents participate in the activities. They become interested in how the materials are used and engage in more positive dialogue with their children concerning mathematical activity.

The directions found on the playsheets, in most cases, are too difficult for the children to read, but they are provided to help teachers give oral directions and inform parents about how each playsheet was approached.

For some activities, Parent Notes are provided in the back of this book. Directions for activities indicate when these should be sent home. Parent Notes provide parents with information concerning math activities and usually suggest ways to expand learning at home.

Needed Materials

Most of the materials needed for the activities in this book are found or collected easily or purchased inexpensively. Many items are already in your classroom or home or even on the playground. Because the activities encourage learning through manipulation of materials, the materials list is extensive, however:

1. The more you encourage parents to help collect items, the more they will become involved with the activities.

2. You may not need all the materials listed because some activities may not be appropriate for your particular class, or you may use the alternative materials suggested in certain activities.

3. Some materials, such as the Big and Small Bag, the Bag of Halves, and the Bag of Parts, can be prepared by one teacher and then circulated among many classrooms, avoiding duplication of efforts.

4. Some materials are used for more than one activity; for example, gift boxes and lids are used for printing rectangles and squares, for matching lids to boxes, for nesting and ordering by size, and for enclosing matching-sized "gifts." If possible, save collected materials that are reusable.

5. Most activities that require food conclude with using the food for snack or lunch. This allows the food to be purchased within the snack and meal budget.

All of the materials you will need to complete the activities in this book follow, with two exceptions: ingredients for recipes that can be found within each "cooking" activity and some items that you will select (suggestions are given within the individual activities) and that will vary from classroom to classroom. You may want to start gathering materials now or, if storage is a problem, prepare for just one or two activities at a time. With each activity's directions is a list of materials needed for that particular activity.

Cross-Curriculum Areas Index

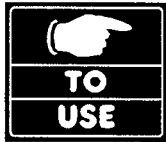
The activities in this book extend beyond mathematics, involving and overlapping many other areas of the early childhood curriculum. The following index can be used as an aid to planning. It indicates curriculum areas, aside from mathematics, that each activity includes.

| ACTIVITY | small motor | large motor | language/perception | art | music | cooking | social skills | science | imagination and creativity |
|----------|-------------|-------------|---------------------|-----|-------|---------|---------------|---------|----------------------------|
| 1 | | X | X | | X | | | | X |
| 2 | X | | X | | | | | | X |
| 3 | X | | X | | | | | | X |
| 4 | X | | X | X | | X | X | | X |
| 5 | X | | X | X | | | X | | X |
| 6 | X | | X | | | | | | X |
| 7 | | | X | | | | | | |
| 8 | X | | X | | | | | | |
| 9 | X | | X | X | | X | | | |
| 10 | X | X | X | | | | X | | |
| 11 | X | | X | | | | X | | |
| 12 | | X | X | | | | X | | X |
| 13 | X | | X | X | | | | X | X |
| 14 | X | X | X | | | X | | X | X |
| 15 | X | | X | | | | X | | X |
| 16 | X | | X | X | | | | X | |
| 17 | X | | X | | | | | | |
| 18 | X | | X | X | | | X | | |
| 19 | X | | X | X | | | | | |
| 20 | X | | X | | | X | | X | |
| 21 | X | X | X | | | | X | X | |
| 22 | X | | X | | | | | X | |
| 23 | X | | X | X | | X | | X | |
| 24 | X | | X | | | | | X | |
| 25 | X | | X | | | | | X | |
| 26 | X | | X | | | | | X | |
| 27 | X | | X | | | | | X | |
| 28 | X | | X | | | | | | |
| 29 | X | X | X | | | X | | | |
| 30 | X | X | X | | | | | | |
| 31 | X | | X | | | | | | |
| 32 | X | X | X | | | | X | X | |
| 33 | X | | X | | | X | | X | |
| 34 | X | | X | | | X | | | |
| 35 | X | | X | | | X | | X | |
| 36 | X | | X | | | | X | X | |
| 37 | X | | X | | | | | | |
| 38 | X | | X | | | | | | |
| 39 | X | | X | | | | | | |
| 40 | X | | X | | | | | | |
| 41 | X | | X | | | | | | |
| 42 | | X | | | X | | X | | X |
| 43 | X | | X | | | | | | |
| 44 | X | X | X | | | | | | |
| 45 | X | | | | | X | | X | |
| 46 | X | | X | | | | | | |
| 47 | X | | X | | | | | | |
| 48 | X | X | | | | X | | | |
| 49 | X | | X | | | | | | |
| 50 | X | | X | | | | | X | |
| 51 | | X | | | X | | X | | |
| 52 | X | X | X | | | | | | |
| 53 | X | X | X | | | | | | |
| 54 | X | | X | X | | | | X | |
| 55 | X | | X | | | X | | | |

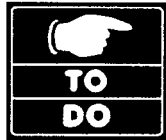
| ACTIVITY | small motor | large motor | language/perception | art | music | cooking | social skills | science | imagination and creativity |
|----------|-------------|-------------|---------------------|-----|-------|---------|---------------|---------|----------------------------|
| 56 | X | | X | | | | | | |
| 57 | X | | X | | | | | | X |
| 58 | X | | X | X | | | | | |
| 59 | X | | X | | | | X | | |
| 60 | X | | X | | | X | | | |
| 61 | X | | X | | | X | | X | |
| 62 | X | | X | | | | X | | X |
| 63 | X | | X | | | | | X | |
| 64 | X | | X | | | | | | |
| 65 | | X | X | | | | X | | |
| 66 | | X | X | | | | | | |
| 67 | X | | X | | | | | | |
| 68 | X | X | X | | | | | | |
| 69 | X | | X | | | | | | |
| 70 | X | | X | | | | | | |
| 71 | X | | X | X | | | | X | X |
| 72 | X | | X | | | X | | X | |
| 73 | X | | X | X | | | | | X |
| 74 | X | | X | | | | | | |
| 75 | X | | X | | | | | | |
| 76 | | X | X | | | | X | | |
| 77 | | | X | | X | | X | | X |
| 78 | X | | X | X | | | | | X |
| 79 | X | X | X | | X | | X | | |
| 80 | X | | X | | | | | | |
| 81 | X | | X | X | | | | | X |
| 82 | X | | X | | | | | | |
| 83 | | | X | | | | X | | |
| 84 | X | | X | | | | | | |
| 85 | X | | X | | | | | | |
| 86 | | X | X | | | | X | | |
| 87 | X | | X | | | | X | X | |
| 88 | X | | X | | | X | | X | X |
| 89 | X | | X | | | | | | |
| 90 | X | | X | | | | | | |
| 91 | X | | X | | | | | | |
| 92 | X | | X | | | | | | |
| 93 | X | | X | | | | | | |
| 94 | X | | X | | | | | | |
| 95 | | | | | | X | X | X | |
| 96 | | | | | | | | | X |
| 97 | X | | X | | | X | | X | |
| 98 | X | | X | | | | | | |
| 99 | X | | X | | | | | | |
| 100 | X | | X | | | | | | |
| 101 | X | | X | | | | | | |
| 102 | | X | X | | | | X | | |
| 103 | X | | X | | | | | | |
| 104 | X | | X | | | X | | | |
| 105 | X | | X | | | | | | |
| 106 | X | | X | | | | | | |
| 107 | X | | X | | | | | | |
| 108 | | | X | | | | X | | |
| 109 | | X | X | | | | X | | |
| 110 | X | X | X | | | | | | X |
| 111 | X | | X | | | X | | X | |
| 112 | X | | X | | | | | | X |
| 113 | X | | X | | | | | | |
| 114 | X | | X | | | | | | |
| 115 | X | | X | | | X | | X | |
| 116 | X | | X | X | | | | | |
| 117 | X | | X | X | | | X | | X |
| 118 | X | | X | | | | | | |
| 119 | X | | X | | | | X | X | |
| 120 | X | | X | | | X | | X | |
| 121 | X | | X | | | | X | X | |

Activity 6

Stick Shapes (for 4s, 5s, and 6s)



Dark poster board, 1 sheet
17 popsicle sticks, plus 6 additional sticks for each child
Glue



Cut the poster board into fourths, one for each shape poster. On one fourth, make a square with 4 popsicle sticks and glue. On another fourth, make a triangle with 3 sticks and glue. On another fourth, make a diamond with 4 sticks and glue. On the last fourth, make a rectangle with 6 sticks and glue.

Give each child at least 6 popsicle sticks. Let children make their own designs and shapes for a while.

Hold up the square poster you have made. Let the children observe it and try to make a similar square with some of their sticks on the table. Have the children count to see how many sides their squares have.

Show the triangle poster. Have the children manipulate their sticks to try to duplicate it. Have everyone count the number of sticks in the triangles.

Continue the same procedure with the diamond and the rectangle. Let the children share sticks and work together to make stars, doors, tables, and any other shapes and pictures they want.



Children become familiar with the square, rectangle, diamond, and triangle.

They see that straight lines are needed to create each shape.

Children see some limitations of working with only straight lines and see positive aspects of sharing.



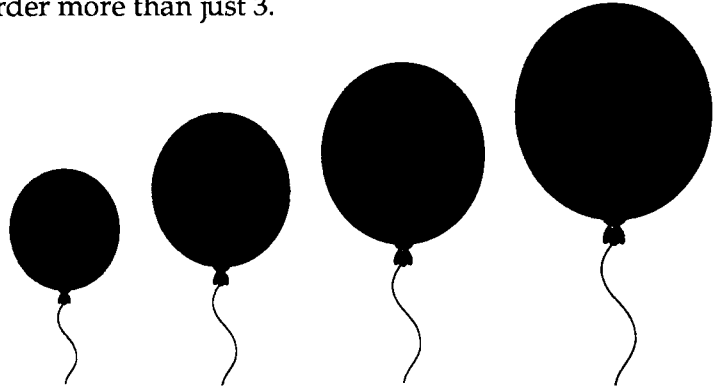
Why did the rectangle need more sticks than the square, when they both have only 4 sides?

Why is it hard to make a heart shape with our sticks?

Follow-Up

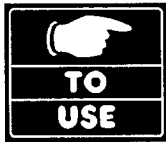
Ordering Paper Balloons

Cut balloons out of construction paper that are small, bigger, and biggest. Have 3 sizes for each child. Have the children place them in size order and paste them to a paper labeled, "I order balloons by size!" The 5s and 6s may wish to cut out the paper balloons for you and to order more than just 3.

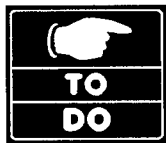


Activity 25

Boxes and Lids



Many assorted-size gift boxes and their lids (ask parents to save them for you)



Remove the lids from the boxes and scramble the boxes and lids on the floor. Let the children try to put the right lid on each box. Children discover that paying attention to the sizes of the boxes and the lids aids in matching.

Select some boxes that will nest inside each other and scramble them. Let the children try to nest them or line them up in increasing or decreasing size order.



Children realize that boxes come in many sizes.

They learn that size plays an important part in matching lids to boxes.



Which box would you most like to get a present in? Why?

Can something good come in a very small box?

Name some small things you would like to give or get as a gift.

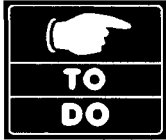
Activity 46

Matching One-to-One



Wallpaper sample books (ask for free books of discontinued patterns at paint or wallpaper stores)

Scissors



Cut a number of pages from wallpaper sample books; select varied designs, colors, and textures. Cut each page in half. Line up one set of halves across the table. Make a pile of their matching halves and give them to the children. Ask each child to feel and look at the wallpaper design he has received and find a matching design on the table. Each child places his design with its mate.



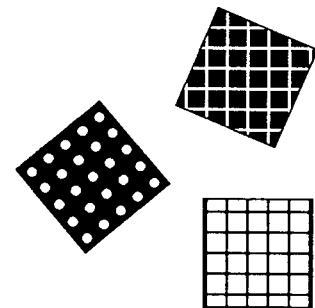
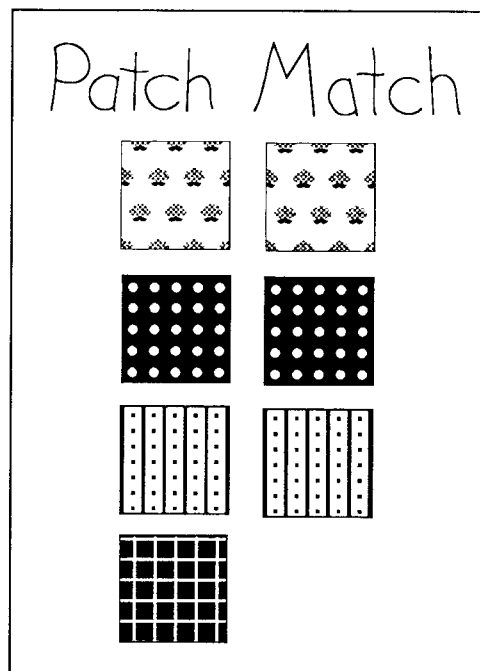
Children discover that each design has one identical mate and one only.

They gain experience in one-to-one matching, noting similarities and differences, and using visual and tactile clues.

Follow-Up

Patch Match

Cut many wallpaper samples from Activity 46 into small pieces (about 1-inch square). Glue at least four wallpaper pieces down the side of each child's paper. Spread the remaining pieces on a table. Have children examine the pieces glued on their papers, and then look for identical mates for each on the table. Have children glue matching wallpaper designs next to each piece on their papers.



Playsheet

5 Cutters and Cookies

Cut out each cookie at the bottom of this paper. Paste each next to the cutter that could have made it!

