

FIVE EASY PRINCIPLES FOR MORE AND BETTER PRESCHOOL MATH  
 PRESCHOOL TEACHERS ADVENTURE CONFERENCE  
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Principle 1.  
 Recognize Everyday Math Moments



Where is the math in the...

\*Block center?

Geometry, spatial reasoning, algebra and patterning.

\*Dramatic play center or on the playground?

Reasoning, problem solving, connecting to the real world/math world, communication about mathematical ideas.

\*Kitchen center?

Measurement, representations of number, and number concepts such as counting, sharing equally, and addition and subtraction.

Children find mathematics interesting. They build mathematical ideas through spontaneous, meaningful contexts of early childhood. They have many sources of informal mathematical knowledge (National Council of Teachers of Mathematics, *Principles and Standards for School Mathematics*, 2000).

**Table 1.** Typical Mathematics Learning Progress for Children Ages 3 to 6. Adapted from NAEYC & NCTM, 2002.

Content Standard	Around Age 3		By Age 6
<b>Number and Operations</b>	Counts 1 to 4 items and begins to understand that the last counting word indicates "how many."		Counts up to 100 using groups of 10.
	Adds and subtracts nonverbally when numbers are very low.		Adds or subtracts using counting-based strategies such as counting on.
<b>Geometry</b>	Matches names to 2-D and 3-D shapes.		Describes basic features of shapes.
	Uses shapes separately to create pictures.		Makes a picture by combining shapes.
<b>Measurement</b>	Recognizes and labels concrete attributes. ("I need a long string." "This is heavy.")		Tries out various processes and units for measurement.
	Compares and sorts objects according to observable attributes.		Uses nonstandard measurement units and tools.

<b>Algebra</b>	Recognizes and copies simple repeating patterns.	Recognizes patterns in counting and arithmetic.
<b>Data Analysis and Probability</b>	Helps to make simple graphs using actual objects (apples) or pictures of objects (apple stickers or drawings).	Makes simple bar graphs to represent data.

Principle 2.

Ask Questions to Extend Math Understandings



- Example: Manuel sorts the letters in the post office center according to the color of the envelopes. Then he begins a new sorting process using the size of the envelopes. Follow up and extend Manuel's thinking by asking:  
I can see here that you used color to sort the envelopes. How are you deciding how to sort them now? Could you sort them another way?
- Example: Olivia dresses up as the mother in the dramatic play center. She makes a grocery list and goes to the grocery center where she counts aloud as she places items in her bag. She hands the cashier \$20 and asks for \$7 in change. Follow up and extend Olivia's thinking by asking:  
How many items did you buy? Which item did you buy the most of? How did you know to give the cashier \$20? How did you know to ask for \$7 in change?



Use questions that begin with: How did you...? Why did you...? What if...?



Principle 3.

Keep Written Records of Math Learning



Portfolios

- Cereal boxes work well to store student work.
- Take digital photos of hard-to-store projects.
- Ask students to explain their thinking about the task. Write on the back or attach a note to the task to document.

Anecdotal records

- Use sticky notes to record students' mathematical behaviors.  
Example:  
Observed Behavior: Melanie created a symmetrical design with pattern blocks. When it was time to clean up, she removed one block from each side of the design until all the blocks were put away.  
Interpretation: Melanie is aware of symmetry, can create symmetrical designs, and can maintain symmetry in the process of changing an original design.
- Use record sheet format to make ongoing observations.

Students	Date	Activity	Observation
Trey	9/24/07	Cooking center	"Measured" 4 cups accurately using the one-cup measure.
Juanita	9/30/07	Writing center	Wrote " $\frac{1}{2}$ and $\frac{1}{2}$ makes a hol" [whole] in story about sharing cookies.
Devin	10/11/07	Mail center	Wrote numerals 3, 7, and 0 correctly on letter he was addressing to grandma.

Student	Date	Activity	Observation
Felice	12/24/07	Cooking center	"Read" a recipe aloud correctly naming numerals 1, 2, and 3 and wrote an original recipe including $\frac{1}{2}$ and $\frac{1}{3}$ .
	1/4/08	Block center	Used reasoning to divide blocks among four friends by dealing out the blocks one at a time.
	3/14/08	Mail center	Sorted envelopes according to color.

Principle 4.

Use Math-Themed Books to Promote Progress



MATHEMATICS LESSON IDEAS USING PICTURE BOOKS

BOOK TITLE	AUTHOR	LESSON IDEA
<b>NUMBER AND OPERATIONS</b>		
EGGS FOR TEA	JAN PIENKOWSKI	Act out the book using handmade monster puppets or masks. Talk about the relationship between addition and subtraction. Then act out the story in reverse.
WHAT COMES IN 2s, 3s, & 4s?	SUZANNE AKER	Make a poster for things that come in 2s. Cut out pictures from magazines and glue them to the poster. Do the same for 3s & 4s.

**ALGEBRA**

<b>Sorting/Classifying</b>		
A HOUSE IS A HOUSE FOR ME	MARY ANN HOBERMAN	Group similar types of houses (i.e. dens, caves, and burrows) and discuss the types of animals that live in them. Why do certain houses work best for certain animals? Make a chart or table.
FROG AND TOAD ARE FRIENDS	ARNOLD LOBEL	Make a MISSING poster for Frog's button. Describe it/draw it using as much detail as possible.
<b>Patterns</b>		
ROUND TRIP	ANN JONAS	Discuss symmetry in nature and use pattern blocks to construct symmetrical designs.
CAPS FOR SALE	ESPHYR SLOBODKINA	Can you see a pattern in this book? How many baseball caps can your classmates balance on their heads? Make an estimate first.

**DATA ANALYSIS AND PROBABILITY**

<b>Graphing</b>		
CLOUDY WITH A CHANCE OF MEATBALLS	JUDI BARRETT	Take a survey. What is the class's favorite breakfast? lunch? dinner? Record the results on a graph.
<b>Probability</b>		
LIZARD'S HOME	GEORGE SHANNON	Act out the part of the story where lizard chooses a stone from the bag. Talk about the probability of choosing a black stone or a white stone. Change the color of the stones to make up a new ending for the book.

**MEASUREMENT**

<b>Time</b>		
A SECOND IS A HICCUP	HAZEL HUTCHINS	How long would it take to cough once, make cookies and bake them, write your name fifteen times? Do an experiment to find other tasks that take a second, a minute, or an hour.
THE GROUCHY LADYBUG	ERIC CARLE	When a student "catches" the clock on the hour, he/she may wear a ladybug hat and read from the book about who the ladybug is fighting at that hour.
<b>Weight, length, area</b>		
ARE WE THERE YET, DADDY?	VIRGINIA WALTERS	Use the map to follow the action of the story. Create your own map of the school. Label landmarks and count the number of steps between them. Label the distances on the map.
<b>Money</b>		
ALEXANDER, WHO USED TO BE RICH LAST SUNDAY	JUDITH VIORST	Use pennies to follow the action of the story.

**GEOMETRY**

LOOK-ALIKES	JOAN STEINER	Go on a Shape Walk, recording the basic geometrical shape of everyday things. Give ideas about why things are certain shapes.
SHAPES FOR LUNCH!	CHARLES REASONER	Before reading the book, brainstorm about the shapes of foods. Give ideas about why foods are a certain shape. For instance, why is pizza round?

**DISCUSSION OR MATH JOURNAL ITEMS FROM CHILDREN'S LITERATURE**

1. In *The Three Billy Goats Gruff*, there were three goats. How many legs did they have all together? Draw your answer.
2. Before they got to the other side of the bridge to eat the sweet green grass, the billy goats were forced to eat garbage. The largest goat ate 4 tin cans, the smallest goat ate three cans, and the medium sized goat ate two cans. How many cans did they eat all together? Draw your answer.
3. One day the old woman who swallowed a fly decided to eat only desserts. She really was not a very healthy eater. First, she ate a cake. Then, she ate a candybar. Finally, she ate an ice cream cone. Draw the desserts she ate in the correct order.
4. The gingerbread man met a cow and a fox. Which one of these animals is larger? Draw your answer.
5. The old woman baked the gingerbread man at 350 degrees. What do you think would have happened if she baked him at 500 degrees? Draw your idea of what might happen.
6. One *Snowy Day* Peter went out to play in the snow. He made a snowball and left it in his pocket. The snowball slowly melted. Draw four pictures to show how the snowball looked as it slowly melted.
7. One day the little red hen baked a cake for her 8 chicks. She sliced the cake into 8 pieces. Her chicks each got a piece. Draw what this looked like.



8. One day the little red hen baked a loaf of bread for herself and 3 chicks. She sliced the bread into 3 pieces. Her chicks each got a piece, but the little red hen didn't get any! How could she slice the bread so that everyone would get a piece? Draw what the bread would look like.
9. How many mittens did the three little kittens have total? Draw a picture of the three pairs. Then write the number to show how many mittens there are.
10. Oh, no! The three little kittens are having trouble with their mittens again! They went outside and one of the kittens got his mittens all muddy. Draw a picture to show how many clean mittens were left.
11. The spider frightened Miss Muffet, and she dropped her bowl of curds. She had only eaten half the bowl. Draw a picture to show how much she had left.
12. Jack is ten years old. Jill is eight years old. Who is younger? Draw your answer.
13. The first little pig built his house to be five feet tall. The second little pig built his house ten feet tall. The third little pig built his house 20 feet tall. Draw a picture of what their houses looked like. Label the pictures.
14. Snow White's hair is five inches long. Rapunzel's hair is 50 feet long. Draw a picture of what they look like. Who has longer hair? Label your drawing with their names.
15. Draw a picture of the big bad wolf. Use only shapes. Use a circle for the head. Use triangles for the ears and teeth. Use a rectangle for a snout.
16. The five little monkeys were getting ready for bed. Two of them already had their pajamas on. How many monkeys still needed to get their pajamas on? Draw your answer.
17. In the treasure cave Aladdin found some beautiful jewels. He found a ruby that was shaped like a circle, a sapphire shaped like a square, and an emerald that was shaped like an oval. Draw a picture of Aladdin's treasures.
18. Aladdin lined up his jewels to make an ABC pattern of ruby, emerald, sapphire, ruby, emerald, \_\_\_\_\_. What jewel does he need next to complete his pattern? Draw it.



## Principle 5.

### Make Math Moments Playful



#### PATTERNING CENTERS

Formalize patterning tasks by having children create a permanent record of any original pattern by recording it on graph paper, with shapes, or other drawings. Work with children to identify the core of the pattern using symbols such as A, B, C, and D.



#### Tissue Box Train

Need: empty tissue box, linker cubes

Cut a hole in each end of a tissue box. Hide a stick of linker cubes inside. Slowly pull the stick out and have students predict what the next color will be. Have students recreate the pattern using sounds, physical movements, or other concrete objects.



#### Patterns in Stories

Have students identify patterns in books such as: *The Three Little Pigs*, *The Three Billy Goats Gruff*, *The Very Busy Spider*, and *There was an Old Lady Who Swallowed a Fly*. Use symbols or simple pictures to recreate the repetitious patterns in these books.

## SHAPE CENTERS



### Cookie Cutter Halves

Need: cookie cutters (shapes that contain a line of symmetry make this task easier), playdough, plastic knives

Have children flatten playdough and cut out shapes using cookie cutters. Have students make a sketch of their shape on a sheet of paper. Using the plastic knife students should cut the playdough shape into two equal parts. Next, have students draw a line on their drawing to show where they cut the shape into two equal parts.



### Letter Symmetry "Workbooks"

Need: cutout (or diecut) uppercase letters, mirrors, type paper, scissors, glue

Have students explore the uppercase letters for symmetry. Discuss that a line of symmetry divides a letter exactly in half so that each half is identical. First have students use a mirror to explore. Next have students fold letters to look for a line of symmetry. When students have found a line of symmetry, have them cut the letter into two equal parts along the line of symmetry. Students should then glue the parts onto separate sheets of paper. Bind several sheets together to make a workbook that students can trade with a friend. The friend uses a crayon to draw the missing half of the letter. When the workbook is completed, the child returns it to the friend who created it. The creator then "corrects" the workbook.

## NUMBER CENTERS

### If That's Half, What's the Whole?

Need: grocery bag labeled "whole" and containing a cookie, Hershey bar, graham cracker, sandwich, sheet of paper, circle; grocery bag labeled "half" and containing half of each of the items listed above (half sheet of paper, half of the cracker, etc.)



Show children the items from the bag labeled "Half." Ask if students can tell what an object is just by looking at a small part of it. Have students draw a picture of what they think the whole object looks like. Do this for each object. Show students the items in the bag labeled "Whole." Compare the whole object to what the students have drawn. How are the drawings similar or different from the actual object? Challenge students to you stump a friend. Have them draw a picture of a shape or object then cover up half of it and show half of the picture to a friend. See if the friend can guess what is shown in the picture.

### Cupcake Tin Counting

Need: baking cups, 6-cup muffin tin, counters

Number the inside bottoms of six paper baking cups from 1 to 6. Place the baking cups in a 6-cup muffin tin. Give a child a box containing 21 identical counters (pennies, small buttons, beans, etc.). Have the child identify the numerals in the bottoms of the paper baking cups and drop in the corresponding numbers of counters.



### Clothespin Counting

Need: paper plates, clothespins

Divide a paper plate into six equal sections and label the sections from one to six by drawing on sets of dots. Write a numeral from 1 to 6 on each of six spring-type clothespins. Let the children take turns clipping the clothespins to the matching numbered sections on the circle.

## GRAPHING CENTERS

Real graphs use the actual object. E.g. favorite types of apples set in columns on the floor.

Pictorial graphs use a picture to represent the object. E.g. children draw a picture of their favorite apple and glue to a laminated picture graph poster.

Symbolic graphs use a symbol to represent the object. E.g. children sign their name under the appropriate column, affix a clothespin with their name on it to one side of the graph, or paste a photocopied picture of him or herself on a graph in scatter form.



Ask many questions as students analyze data, share their findings, and perform other tasks related to statistics:

1. Does the data make sense?
  2. How can this data be used?
  3. Could you display this data in a different way? If so, how?
  4. What patterns do you see in this data?
- Encourage students to share information with each other. Plan group work.
  - Include estimation as a part of data analysis and discussion about graphs.
  - Provide adequate time and space for students to gather data, to organize and display it, and to do extension activities which grow out of data analysis.

<u>Ideas for <i>two</i> category graphs</u> (as well as any YES or NO question)	<u>Ideas for <i>three</i> category graphs</u>
<ul style="list-style-type: none"> <li>• Which of these two colors is your favorite?</li> <li>• Are you wearing a sweater or jacket today?</li> <li>• Toss a penny. Did it land on heads or tails?</li> <li>• Does your first name have an E, yes or no?</li> <li>• How do you feel today, happy or sad?</li> <li>• Which flavor of gum do you like better, grape or strawberry?</li> </ul>	<ul style="list-style-type: none"> <li>• Would you rather drink apple, orange, or grape juice?</li> <li>• Are you wearing pants, shorts, or a skirt?</li> <li>• Are your shoes fastened with velcro, laces or nothing?</li> <li>• Do you like your potatoes mashed, fried, or baked?</li> <li>• Do you like books about animals, kids, or aliens?</li> <li>• Do you like strawberry, chocolate, or vanilla ice cream best?</li> </ul>

## MEASUREMENT CENTERS

### Shoe Comparisons

Need: children's shoes

Have each child take off one shoe. Children work independently or with a partner to find one thing in the room that is shorter than the shoe. Join as a group and use formal vocabulary such as length, shorter, longer, measure to discuss the objects the children found. Repeat the task with children finding one object that is longer than the shoe.

### Table Mat Measurement



Need: plastic tablecloth, shower curtain, or tablecloth with stickers placed in random arrangement, small paper clips, large paper clips, 1-in. square tiles, craft sticks, other nonstandard units as desired

Randomly place stickers on a cloth, placemat, or curtain. Use a straight edge to draw lines between some of the stickers. Provide students with various nonstandard units and have them measure the distance between stickers.

### Wiki Stix Shapes

Need: color tiles, Wiki Stix (pipe cleaners also work well)

Have child join the ends of four Wiki Stix to create a loop. Make a shape with the loop and guess how many tiles will fit inside of it. Fill the shape with tiles and compare the guess with the actual number of tiles that fit inside the shape. Make a new shape and repeat the process.

### Clay Worm Comparisons

Need: playdough or modeling clay, paper

Roll the clay into worms. Lay a clay worm on top of each of the drawings. Take the clay worms off the drawings. Lay the worms on the sheet of paper in order from shortest to longest. Trace around your worms to make a permanent record of your results. Label one end of the paper SHORTEST. Label the other end of the paper LONGEST.

