

# Mathematics

NANCY drew this picture as part of a Parent And Child Together (P.A.C.T.) homework activity from her Family Literacy program. The topic of the activity was "Learning Numbers, Shapes, and Colors."

This artwork was created by Nancy Ramirez, age 5. Nancy was a student in Mary Gustin's class at J. B. Sutton Elementary School in Phoenix. This school is one of six Family Literacy sites operated through Literacy Volunteers of Maricopa County.



# MATHEMATICS

## **Rationale Statement:**

Mathematics is all around us in our natural world. Math is a lens through which the child can see concrete and abstract realities. It is both an art and a science that is beautiful in its constancy, orderliness, and simplicity. Math provides a way of thinking and problem-solving that can be done by all children without inherent biases, such as gender or race. Children use their senses to construct their knowledge of mathematical concepts through interactions with real objects and events. A child's learning is facilitated by emergent and planned math experiences that are developmentally appropriate and made meaningful through PLAY!

# CORRELATION TO K-12 MATHEMATICS

The Arizona Early Childhood Standards (ECE) are intended to provide a solid, coherent foundation of knowledge and skills to prepare children for kindergarten and the primary grades. As such, the skills and knowledge in the ECE standards were designed to correlate with the new grade specific drafts of Reading and Mathematics standards and the remaining Arizona Academic Readiness and Foundation Standards. The K-12 standard and related Performance Objective(s) that correlates can be found next to each ECE indicator in the following pages.

Samples:

*Citation of New Grade Specific K-12 Draft Standards:*

*K R&L 1-1 PO4 = K (Grade) R&L (Reading & Literature Standards) 1-1 (Strand-Concept) PO4*  
**1 M 3-2 PO1 = 1 (GRADE) M (MATHEMATICS STANDARDS) 3-2 (STRAND-CONCEPT) PO1**

Key to AZ K-12 Standards Correlated to Mathematics ECE Standards:

M (Mathematics)  
R&L (Reading & Literature)

### Context Statement for Math Standard One: Patterns/Relationships (Algebra)

Learning to use patterns to solve problems develops naturally through play. Mathematical exploration is promoted when children are in an environment in which math-related conversations with peers and adults are frequent and opportunities are provided to use manipulatives, puzzles, and repetitive sounds and movement.

## STANDARD 1. PATTERNS/RELATIONSHIPS (ALGEBRA)

**Children explore, model, and describe patterns and relationships in daily problem solving and play situations.**

### Benchmark 1.1. The child understands patterns and relationships.

Developmental Continuum			Examples That You May Observe	
P H A S E  3	P H A S E  2	P H A S E  1	<p>Phase 1</p> <p>a. Sorts, classifies, and orders objects by one attribute. (<i>K R&amp;L 1-4 PO2; K M 4-4 PO3; K M 5-2 PO1</i>)</p>	<p>Child sorts manipulatives and other objects by attribute (color, shape, size, function, etc.) and other common categories (clothes, animals, food, etc.).</p> <p>Child orders pumpkins by size.</p>
		<p>Phase 2</p> <p>b. Sorts and classifies objects by more than one attribute. (<i>K R&amp;L 1-4 PO2; K M 4-4 PO3; K M 5-2 PO1</i>)</p> <p>c. Recognizes a series and duplicates patterns through trial and error. (<i>K M 3-1 PO1, PO3</i>)</p>	<p>Child separates red vehicles with wheels from red vehicles without wheels from groups of assorted vehicles.</p> <p>Child chimes in on repetitive parts of a story, such as <i>Brown Bear, Brown Bear</i>.</p>	
	Phase 3		<p>d. Sorts, classifies, and orders objects and describes their relationships. (<i>K R&amp;L 1-4 PO2; K M 4-4 PO3; K M 5-2 PO1, K M 5-2 PO1</i>)</p> <p>e. Describes and extends a pattern and uses the pattern to make predictions about what comes next. (<i>K M 3-1 PO1, PO3; 1 M 3-4 PO2</i>)</p> <p>f. Translates a pattern from one representation to another. (<i>K M 3-1 PO3</i>)</p>	<p>Child uses snap blocks to duplicate a red-yellow-blue, red-yellow-blue pattern.</p> <p>After sorting a collection of hardware, child says, “These are plastic.”</p> <p>Child is making a blue-white-blue-white necklace. After stringing a white bead, she states, “Now, I need a blue one.”</p> <p>Child claps as adult points to the red card and stomps when adult points to the green card while playing a game.</p>

### Context Statement for Math Standard Two: Geometry

Learning geometric concepts begins when children manipulate, play with, replicate, and purposefully investigate geometric shapes and relationships to make connections. Children need to actively explore the size, shape, and spatial arrangement of real objects, as well as hear and use relevant mathematical vocabulary while interacting with peers and adults.

## STANDARD 2. GEOMETRY

Children observe, construct, describe, connect, analyze, and draw plane and solid objects.

### Benchmark 2.1. The child explores and discusses the properties and relationships of plane and solid shapes.

Developmental Continuum		Examples That You May Observe
P H A S E  2  3	P H A S E 1	Phase 1
		a. Constructs and sorts solid shapes and forms. <i>(1 M 4-1 PO5; K M 5-2 PO1)</i>
		b. Recognizes, constructs, and sorts plane shapes and forms. <i>(1 M 4-1 PO5; K M 5-2 PO1)</i>
	2	Phase 2
		c. Names common shapes (circle, square, rectangle, triangle). <i>(K M 4-1 PO1; 1 M 4-1 PO4)</i>
		d. Recognizes and represents geometric shapes, forms, and structures in the environment. <i>(K M 4-1 PO3)</i>
	3	Phase 3
e. Compares and describes attributes of plane and solid shapes and forms. <i>(K R&amp;L 1-4 PO3; K M 4-1 PO1)</i>		
f. Investigates and discovers the results of combining shapes and forms. <i>(2 M 4-1 PO2)</i>		
	g. Draws common shapes. <i>(1 M 4-1 PO5)</i>	

Child plays with parquetry pieces, pattern blocks, unit blocks, and attribute blocks.

Child uses paper shapes in the art center to make a picture.

Child points to a round clock when asked, “Show me something in the room that is a circle.”

Child uses arms to form a circle representing the sun in “Itsy Bitsy Spider.”

Child says, “My block is longer” or “My tower is taller.”

Child puts two triangular blocks together to make a square.

Child uses finger to draw shapes in shaving cream, sand, etc

## Benchmark 2.2. The child understands and describes locations and spatial relationships.

Developmental Continuum		Examples That You May Observe	
P H A S E  P H A S E  3	P H A S E  1	<p>Phase 1</p> <p>a. Follows directions using positional terms, such as there/here; near/far; inside/outside; top/bottom; above/below; front/ back. <i>(K R&amp;L 3-2 PO1; K M 4-1 PO2)</i></p>	<p>Child puts hands above head in game of “Simon says.”</p>
	2	<p>Phase 2</p> <p>b. Uses positional terms to describe relationships among objects. <i>(K M 4-1 PO2)</i></p> <p>c. Recognizes when a position or orientation has changed. <i>(1 M 4-2 PO1)</i></p>	<p>Child says, “Susie is under the table.”</p> <p>Child says, “I drove the train between the trees.” Other positional terms include: here/there; near/far; inside/outside; top/bottom; above/below; front/back; over/under; in front of/behind; next to/away from; in/on; up/down; high/low.</p> <p>Child says, “Teacher, the book is upside down.”</p>
		<p>Phase 3</p> <p>d. Describes and interprets direction and distance while interacting with the environment. <i>(K M 4-1 PO2)</i></p> <p>e. Demonstrates an awareness of symmetry. <i>(1 M 4-1 PO6)</i></p>	<p>Child answers appropriately when asked, “Is it farther to the playground or your home?”</p> <p>Child says, “The water table is outside today.”</p> <p>Child creates symmetrical figures using Legos, pattern blocks, etc.</p>

### Context Statement for Math Standard 3: Measurement

Learning to understand and apply measurement attributes begins during play as children actively describe and compare real world objects. Children need opportunities to explore, discover, and discuss measurement relationships in everyday activities and interactions.

## STANDARD 3. MEASUREMENT

**Children use standard and non-standard measurement and develop estimation strategies to make and to describe comparisons in their environment.**

### Benchmark 3.1. The child understands measurable attributes of objects using units and processes of measurement.

Developmental Continuum		Examples That You May Observe
P H A S E  3	P H A S E 1	<p>Phase 1</p> <p>a. Explores the attributes of length, volume, weight, height, area, time, and temperature. <i>(KM 4-4 PO1, PO2)</i></p> <p>b. Covers an area with shapes. <i>(KM 4-4 PO1)</i></p>
	P H A S E 2	<p>Phase 2</p> <p>c. Explores and develops an awareness of seriation according to attributes such as length, width, height, size, color. <i>(KM 4-4 PO1, PO3)</i></p> <p>d. Uses standard and non-standard units of measurement in everyday situations. <i>(KM 4-4 PO2, 1 M 4-4 PO7)</i></p>
		<p>Phase 3</p> <p>e. Selects an appropriate standard or non-standard tool for the attribute being measured. <i>(KM 4-4 PO2, 1 M 4-4 PO7)</i></p> <p>f. Uses relative terms of measurement to compare and estimate for problem solving. <i>(1 R&amp;L 1-4 PO1; KM 4-4 PO1)</i></p>

### Benchmark 3.2. The child understands measurable attributes of time and sequence.

Developmental Continuum		Examples That You May Observe	
P H A S E  3	P H A S E  1	<p>Phase 1</p> <p>a. Explores and begins to recognize temporal relationships such as day/night; before/after; first/last; yesterday/today/ tomorrow; days/ weeks; sooner/later; morning/afternoon/evening; always/ never/sometimes; faster/slower. <i>(1 M 4-4 PO3, PO4, PO5, PO6)</i></p>	<p>Child responds appropriately when asked, “What did you do this morning?”</p>
	2	<p>Phase 2</p> <p>b. Associates events with periods of time. <i>(1 M 4-4 PO3, PO4, PO5, PO6)</i></p>	<p>Child says, “After music, we go outside.”</p>
		<p>Phase 3</p> <p>c. Follows, remembers, describes, and anticipates a sequence of events. <i>(K R&amp;L 3-2 PO1; 1 M 4-4 PO3, PO4, PO5, PO6)</i></p>	<p>Child relates sequence of events from a field trip.</p> <p>Child describes daily routine.</p> <p>Child anticipates what happens next in the daily schedule.</p>

### Context Statement for Math Standard 4: Numbers and Operations

Learning the meaning of a number begins with hands-on experiences using a variety of objects found in the home, the classroom, and nature. Children need opportunities to play, observe, and interact with peers and adults in order to discover number relationships and to develop a thinking process for problem solving.

## STANDARD 4. NUMBERS AND OPERATIONS

**Children demonstrate increasing interest and awareness of numbers in the environment, the relationships among numbers and quantities, and counting as a means for solving problems.**

**Benchmark 4.1. The child understands the meaning of numbers, ways of representing numbers, and the relationships among numbers.**

Developmental Continuum		Examples That You May Observe	
P H A S E  3	P H A S E 1	<p>Phase 1</p> <p>a. Explores numbers in a variety of settings. <i>(KM 1-3 PO1)</i></p> <p>b. Matches sets of objects. <i>(KM 2-3 PO1)</i></p> <p>Phase 2</p> <p>c. Develops a sense of whole numbers.</p> <ul style="list-style-type: none"> <li>• Understands that numbers represent quantities. <i>(KM 1-1 PO1)</i></li> <li>• Understands that numerals are symbols used to represent quantities. <i>(KM 1-1 PO1, PO2)</i></li> <li>• Represents and uses whole numbers in a variety of ways. <i>(KM 1-1 PO1, PO2)</i></li> <li>• Uses number words while counting, not necessarily assigning one number to one object. <i>(KM 1-1 PO2, PO3)</i></li> </ul>	<p>Child shows an interest in “reading” counting books, singing counting songs, and manipulating phones, calculators, and remote control devices in the dramatic play area.</p> <p>Child distributes one napkin and one snack to each child.</p> <p>Child says, “Two friends didn’t come today.”</p> <p>Child says, “I go home on bus number nine.”</p> <p>Child presses the numbers 911 on dramatic play phone.</p> <p>Child says, “Six, four, two, five,” when counting trucks.</p>

Developmental Continuum		Examples That You May Observe
P H A S E  2	<p>Phase 2 cont.</p> <p>d. Compares sets of objects (more than, less than, equal to). <i>(KM 1-1 PO6; KM 1-2 PO5)</i></p> <p>e. Demonstrates concepts of part and whole. <i>(IM 1-1 PO14)</i></p> <p>f. Explores the use of currency and coins. <i>(KM 1-1 PO10)</i></p> <p>g. Demonstrates one-to-one correspondence. <i>(KM 1-1 PO6, PO7)</i></p>	<p>Child says, “Hey, you have more blocks than me!”</p> <p>Child completes a picture puzzle.</p> <p>Child breaks off a piece of play dough to share with playmates.</p> <p>Child pretends to buy groceries with play money in the dramatic play area.</p> <p>Child touches or points to objects such as cookies while using phrase such as “One for mommy, one for daddy, one for me.”</p>
	<p>Phase 3</p> <p>h. Counts with understanding and recognizes “how many” are in sets of objects up to five. <i>(KM 1-1 PO4, PO9)</i></p> <p>i. Matches numerals zero to five (0-5) to the quantities they represent. <i>(KM 1-1 PO4, PO5, PO6)</i></p> <p>j. Uses ordinal number words to describe the position of objects. <i>(KM 1-1 PO8)</i></p> <p>k. Understands that numbers always represent the same quantity, regardless of the order or physical arrangement of the objects counted. <i>(KM 1-1 PO6)</i></p> <p>l. Uses one-to one correspondence as a way to compare two sets. <i>(KM 1-1 PO6, PO7)</i></p>	<p>Child counts out four eggs when mom says, “We need four eggs for the pumpkin pie.”</p> <p>Child works on puzzle matching the numerals on one piece to the numbers of objects on corresponding piece.</p> <p>Child says, “I’m first in line. He’s second.”</p> <p>Child states, “There are still four,” after teacher changes the order of the objects.</p> <p>Child puts one rider next to each horse and says, “There are enough horses for all of the cowboys.”</p>
P H A S E  3		

**Benchmark 4.2. The child understands beginning concepts of mathematical operations.**

Developmental Continuum			Examples That You May Observe	
P H A S E  3	P H A S E  2	P H A S E  1	<p>Phase 1</p> <p>a. Joins sets of objects. <i>(KM 1-2 PO1; KM 2-3 PO1)</i></p> <p>b. Separates sets of objects. <i>(KM 1-2 PO1; KM 2-3 PO1)</i></p> <p>Phase 2</p> <p>c. Participates in discussion of mathematical operations in daily activities. <i>(KM 1-2 PO1 PO2, PO3, PO4, PO5; KM 1-3 PO1)</i></p> <p>Phase 3</p> <p>d. Represents an understanding of mathematical operations in daily activities. <i>(KM 1-2 PO1, PO2, PO3, PO4, PO5; KM 1-3 PO1)</i></p>	<p>Child adds his blocks to his friend’s blocks and says, “Now we have more.”</p> <p>Child gives his friend the pigs and he keeps the horses while playing with farm animals.</p> <p>Group sings, “Five Little Ducks.” Group then discusses how many are left when one didn’t come back.</p> <p>Child says, “I have four grapes.” Child eats one grape and says, “Now I have three grapes.”</p>

### Context Statement for Math Standard 5: Data Analysis

Learning to analyze data begins with opportunities to observe, describe, organize, compare, and represent objects and information. Children need experiences collecting objects and information that are meaningful to them.

## STANDARD 5. DATA ANALYSIS

**Children collect, organize, and analyze data from everyday situations.**

**Benchmark 5.1. The child collects, organizes, and displays relevant data to make sense of the environment.**

Developmental Continuum		Examples That You May Observe	
P H A S E  3	P H A S E  1	Phase 1 a. Gathers data about self and the environment. <i>(KM 2-1 PO1)</i>	Child says, "I have a baby brother. Do you?"  Child collects rocks, bugs, sticks, cereal labels, cards, etc.
		Phase 2 b. Organizes and displays data on graphs using objects, pictures, and representations. <i>(KR&amp;L 1-4 PO2; 1 M 2-1 PO2)</i>  c. Reads and interprets displays of data using objects, pictures, and representations. <i>(KM 2-1 PO2, PO3, PO4)</i>  d. Makes predictions based on questions posed by adults. <i>(KM 2-1 PO4, PO5; 2 M 2-2 PO1, PO2)</i>	Child selects favorite fruit after tasting three different samples and places a sticker on the class graph indicating her selection.  Child examines the graph of favorites and discusses which category has the most, the least, etc.  During morning circle, the child predicts which group will be larger, the group with shoelaces or the group without shoelaces.
	Phase 3 e. Describes data using comparative words related to quantity, size, speed, and weight. <i>(KM 1-2 PO6)</i>  f. Forms logical conclusions about data. <i>(KM 2-1 PO2, PO3, PO5)</i>	Other comparative words include: all/none; more/less; most/least; many/few; equal; large/small; wide/narrow; big/little; empty/full; tall/short; long/short; thick/thin; heavy/light.  Child says, "If I put one more block on top, it will fall down."	