First Grade Math Instruction Guide

Early mathematics proficiency plays a pivotal role in shaping children's long-term academic success. Demonstrating proficiency with mathematical understandings such as numeracy and computation in the early grades continues to serve as a predictor of later mathematics outcomes (Kiss et al., 2019; DiPerna et al., 2007). During these early years, students deepen their understanding of foundational concepts introduced in kindergarten and expand their capacity to reason, problem-solve, and apply mathematical ideas in increasingly flexible ways.

In alignment with these findings, mathematics instruction in the elementary grades should focus on the following research-based practices:

- Build on children's growing numeracy and computation foundations while fostering flexible thinking.
- Strengthen learning behaviors such as perseverance, organization, and productive struggle to support mathematical growth.
- Ensure instruction is sequenced in a coherent, learning progression across the early elementary grades.
- Provide sustained opportunities for reasoning, problem-solving, and mathematical discourse.
- Integrate mathematics with other content areas and in meaningful real-world contexts.
- Offer adequate time, appropriate materials, and support for students to engage with math concepts in hands-on, exploratory, and structured ways.
- Use a variety of teaching approaches to introduce, reinforce, and extend mathematical thinking.
- Implement targeted intervention when needed, ensuring sufficient intensity and dosage for student success.
- Employ ongoing formative assessment to adjust instruction and support individualized learning needs.
- Cultivate a positive, engaging learning environment that nurtures students' curiosity, confidence, and sense-making in mathematics.

By prioritizing these research-aligned approaches, educators can create a robust, coherent math learning foundation that empowers students not only in elementary school but throughout their academic journey.

First Grade Mathematical Domain

- **Operations and Algebraic Thinking:** represent and solve addition and subtraction problems within 20 using properties of operations and the relationship between addition and subtraction
- **Numbers and Operations in Base Ten:** use place value understanding and apply properties of operations to add and subtract within 100
- **Measurement and Data:** measure lengths indirectly and by iterating units, work with time and money, and represent and interpret data.

- **Geometry:** reason with shapes and their attributes

First Grade Critical Areas of Focus (What Students Learn)

In first grade, emphasis should be on developing a deep understanding of addition and subtraction, whole number relationships, place value, measurement, and geometric reasoning. Students build on their kindergarten experiences by extending their number sense by working with numbers up to 100 and exploring how tens and ones form the basis of our number system. They strengthen computational strategies through hands-on models, number patterns, and meaningful problem-solving. Through repeated opportunities to reason, compare, measure, and compose shapes, students learn how mathematical ideas connect and grow. These experiences support flexible thinking, encourage mathematical discourse, and lay the groundwork for success in later grades.

Critical Areas of Focus

Ohio's Learning Standards for Mathematics include critical areas for instruction in the introduction to each grade, kindergarten through grade 8. The critical areas are designed to bring focus to the standards at each grade by describing the big ideas that educators can use to build their curriculum and to guide instruction.

In first grade, instruction should focus on four critical areas.

- Developing understanding of addition, subtraction, and strategies for addition and subtraction within 20
- Developing understanding of whole number relationships and place value, including grouping in tens and ones
- Developing understanding of linear measurement and measuring lengths as iterating length units
- Reasoning about attributes of, and composing and decomposing geometric shapes

Critical Area 1: Developing understanding of addition, subtraction, and strategies for addition and subtraction within 20

Students develop strategies for adding and subtracting whole numbers based on their prior work with small numbers. They use a variety of models, including discrete objects and length-based models, e.g., cubes connected to form lengths, to model add-to, take-from, put-together, take-apart, and compare situations to develop meaning for the operations of addition and subtraction, and to develop strategies to solve arithmetic problems with these operations. Students understand connections between counting and addition and subtraction, e.g., adding two is the same as counting on two. They use properties of addition to add whole numbers and to create and use increasingly sophisticated strategies based on these properties, e.g., "making tens", to solve addition and subtraction problems within 20. By comparing a variety of solution strategies, children build their understanding of the relationship between addition and subtraction.

Critical Area 1: Connections to Kindergarten

- Understanding addition as putting together and adding to and understand subtraction as taking apart and taking from (K.OA.1-5)
- Work with numbers 11-19 to gain foundations for place value (K.NBT.1)

Critical Area 2: Developing understanding of whole number relationships and place value, including grouping in tens and ones

Students develop, discuss, and use efficient, accurate, and generalizable methods to add within 100 and subtract multiples of 10. They compare whole numbers (at least to 100) to develop understanding of and solve problems involving their relative sizes. They think of whole numbers between 10 and 100 in terms of tens and ones (especially recognizing the numbers 11 to 19 as composed of a ten and some more ones). Through activities that build number sense, they understand the order of the counting numbers and their relative magnitudes. Students use money as a tool to reinforce concepts of place value using pennies (ones) and dimes (tens).

Critical Area 2: Connections to Kindergarten

- Work with numbers 11-19 to gain foundations for place value (K.NBT.1)
- Classify objects and count the number of objects in each category (K.MD.3)

Critical Area 3: Developing understanding of linear measurement and measuring lengths as iterating length units

Students develop an understanding of the meaning and processes of measurement, including underlying concepts such as iterating (the mental activity of building up the length of an object with equal-sized units) and the transitivity principle for indirect measurement.

Critical Area 3: Connections to Kindergarten

- Identify, describe measurable attributes (K.MD.1-2)
- Classify objects and count the number of objects in each category (K.MD.3)

Critical Area 4: Reasoning about attributes of, and composing and decomposing geometric shapes

Students compose and decompose plane or solid figures, e.g., put two triangles together to make a quadrilateral, and build understanding of part-whole relationships as well as the properties of the original and composite shapes. As they combine shapes, they recognize them from different perspectives and orientations, describe their geometric attributes, and determine how they are alike and different, to develop the background for measurement and for initial understandings of properties such as congruence and symmetry.

Critical Area 4: Connections to Kindergarten

- Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres) (K.G.1-3)
- Describe, compare, create, and compose shapes (K.G.4-6)

Instructional Activities to Support Learning in Grade 1

Instructional Activities to Support Learning in Operations and Algebraic Thinking

Operations and Algebraic Thinking – Students continue to develop fluency with addition and subtraction. Problem-solving with addition and subtraction provides an opportunity for them to make sense of these operations using various situations and contexts.[1]

- **Make-Ten Treasure Hunt** – Use sticky notes or playing cards labeled 0–10. Hand a card out to participants. Ask the students to find a partner whose number on their card adds to 10. For example, a student with the number 3 looks for a student with the number 7. This game can be extended to within 20 by writing problems like "8 + __ = 14" and prompting, *how far to 10?* Then *how far to 14?* After the game, conduct a math talk with students to discuss their problem-solving strategies from the game.
- **Fact-Families Triangles**– Using a paper triangle, write a number from 0 to 20 at the top of the triangle (i.e., 11). This number will be the total. Put two numbers that can be added together that equal the total number at the top of the triangle (i.e., 11, 8, and 3). Have your students write four related equations using each number from the corners of the triangle only once: 8 + 3 = 11, 3 + 8 = 11, 11 – 8 = 3, 11 – 3 = 8. Ask your students questions about their fact family triangle, like *which two equations contain subtraction? How do you know these three numbers belong in the same fact family?*
- **Doubles and Near-Doubles Snap** - Use dominoes or dot cards with up to 20 dots per card. Have students sort the dominoes or dot cards to look for examples of doubles (e.g., 7 + 7). Ask them to create near doubles (7 + 8 = 7 + 7 + 1) from the pairs of doubles they find. Have students explain to a partner how using a known double can be used to help solve addition and subtraction problems within 20.
- **Missing-Addend Mystery Cups** – Using two small cups (Cup A and Cup B) and up to 20 small objects that can all fit into a single cup. Secretly place some beans in Cup A, and the rest in Cup B. Reveal the total and Cup A's amount; ask, *How many are in Cup B? How do you know?* Record student responses as ☐ + a = total and as total − a = ☐.
- **Number-Line Hops** – Create a number line from 0 to 20. Have a student start at 9 on the number line and ask them to *hop forward 5*. Ask the class where they *think* their classmate will stop on the number line. Record the action as an addition equation. Ask the class if their classmate is at 14, on the number line, how many hops backwards will it take for them to return to 9? Record the action as a subtraction equation. Discuss how the student counts their hops back to 9 on the number line.

Instructional Activities to Support Learning with Numbers and Operations in Base Ten

Number and Operations in Base Ten – First graders begin to think of ten ones as a unit of ten. They work with sums up to 100 using models and strategies. Subtraction with two-digit numbers includes differences with multiples of 10, where students are not asked to exchange one group of ten for ten ones.[1]

- **Build-A-Ten Towers** - Students compose and decompose units by bundling or stacking ten ones into a "tower of ten". As students create multiple towers, they can skip count by ten to identify the total number of units.
- **Mystery Number Match** – Create a set of "Tens Cards" (e.g., "2 tens," "5 tens") and "Ones Cards." Ask students draw one of each and combine them to form a number, then model it with cubes or drawn place-value pictures. Have the students explain, "I have __ tens and __ ones, which makes __."
- **Roll, Build, Compare** - Students roll a tens die (0–9 tens), and a ones die (0–9 ones). Have them build the two-digit number based on their rolls of the dice using base-ten blocks. Allow students to compare their number of base-ten blocks with a partner's number. Ask students to justify which number is greater by referring to tens first, then ones.
- **Tens-and-Ones Counting Collections -** Students count a collection of 30–90 items. Ask them to create groups of ten. Record how many tens and ones there are from the number of items in their collection. *Possible extension:* Ask students to write an equation showing decomposition (e.g., 68 = 6 tens + 8 ones) and describe how they grouped them together.
- **Number Line Jumps of Ten –** Create an open or labeled number line. Give students a starting two-digit number on the number line. Ask them to make "big jumps" of 10 forward or backward based on task cards ("Jump forward 20," "Jump back 10"). Have students record the resulting numbers and explain the pattern they notice.
- **Tens-Only Subtraction Stories** - Pose simple contextual subtraction problems containing the subtraction of multiples of 10 from two-digit numbers without regrouping. For example, "There are 53 stickers. You give away 30. How many are left?" Allow students to use models and strategies to perform the subtraction in the problem. Ask students to explain their problem-solving approach. Possible extension: Allow students to come up with their own ten-only subtraction stories.
- **"What Could It Be?" Tens-and-Ones Riddles** – Present students with mental math problem-solving riddles, like, "I have 4 tens. I have more than 3 ones but fewer than 8 ones. What number could it be?" "I am between 50 and 60. I have 2 ones. What could it be?" Allow students to explain their mathematical thinking, reasoning, and strategies to solve each riddle.
- **Build to 100 Race (Tens Track)** - Using a number chart and a pair of dice. Assign one die to be a "tens die," and the other die to be a "ones die". After rolling both dice, have the class skip count by tens and ones on the number chart to the number on the chart that is equivalent to the dice roll (ten, twenty, thirty, forty, forty-one, forty-two, forty-three).

- **Ten-More, Ten-Less Flip Cards** - Using small two-digit number cards, students flip a card and write the numbers that are ten more and ten less. Have students check their reasoning using base-ten blocks: “If I add a ten, I add another stick; if I subtract a ten, I remove one stick.”

Instructional Activities to Support Learning in Measurement and Data

Measurement and Data – First graders learn what measurement is, how to measure with non-standardized units, and how to align objects for comparison. Grade-level measurement work extends to include indirect measurements and iterations of units. Students learn to tell time to the nearest hour and half hour. They begin to collect, interpret, analyze, and ask questions about their own data.[1]

- **Paperclip Measure and Compare** – Give students a set of identical paperclips. Ask them to measure classroom objects (pencil, book, glue stick) by aligning paperclips end-to-end with no gaps or overlaps. Record the counts and compare items using “longer than,” “shorter than,” and “about the same.” *Possible extension:* Have students explain why using bigger or smaller clips changes the count and why the unit must be the same to compare.
- **Unifix Train Iteration –** Provide linking cubes and a “mystery object.” Students build a cube train starting at one end and iterating the unit until they reach the other end. Discuss what to do if the train doesn’t fit exactly (stop when the next cube goes past the end). Record the length in “cubes.” *Possible extension:* Ask students to predict first, then check by measuring.
- **String and Strip Indirect Measurement –** Cut a string the exact length of a “reference hallway tile.” Use the string to compare the lengths of objects that are hard to align directly (a round table edge, a backpack strap). Students state their comparisons: “The strap is longer than the tile string; the book spine is shorter.” *Possible extension:* Invite students to find classroom places where the string fits “about” two or three times to practice iteration.
- **Line-Up Length Lab –** Place two pencils so their erasers are aligned. Ask, “Which is longer?” Model how misaligned starts can trick our eyes. Students practice aligning starting points, then decide which is longer and explain their reasoning. *Possible extension:* Try with markers, crayons, or craft sticks and justify comparisons with drawings and words.
- **Footstep Rulers –** Trace one student’s shoe on cardstock to make a “footstep unit.” Students measure floor distances (door to desk, rug to shelf) by placing footprints heel-to-toe without gaps/overlaps. Record totals as “footsteps.” *Possible extension:* Compare the counts using different students’ footprints and discuss why different-sized units yield different numbers.
- **Hour and Half-Hour Time Match –** Provide analog clock cards showing times to the hour and half hour and matching digital cards. Students match pairs, say the time aloud, and place each card under “Morning,” “Afternoon,” or “Evening.” *Possible extension:* Build a simple class schedule line and place matched times where they belong.

- **Schedule Sort and Say –** Give students picture cards of common classroom events (arrival, snack, art, recess). Add times (to the hour/half hour) on sticky notes. Students sort events in time order, read each time, and explain what comes "before" and "after." *Possible extension:* Ask, "What happens in one half hour?" and have students estimate what they can do in that span.
- **Classroom Coin Counts –** Set up stations with piles of pennies, nickels, and dimes. Students sort coins, skip-count values, and show different ways to make the same amount (e.g., 20¢ with two dimes or one dime + two nickels). *Possible extension:* Connect to time by asking, "If recess starts at 1:30, how many half-hours until 2:30?" Then relate "half" to five nickels = twenty-five cents.
- **Favorite Fruit Tally and Bar Graph –** Students vote for a favorite fruit using tally marks (apple, banana, grapes). As a class, build a simple bar graph, then ask and answer questions: "Which has the most?" "How many more apples than grapes?" "How many in all?" *Possible extension:* Have students write two new questions a classmate can answer from the graph.
- **Measure and Graph Station –** At one station, students measure the length of crayons in cubes; at another, they measure the height of towers in craft sticks. Combine results to make a class chart. Students interpret the data by describing which category is "most," "least," and "about the same." *Possible extension:* Ask students to justify conclusions using the numbers on the chart.

Instructional Activities to Support Learning in Geometry

Geometry – Geometry focuses on the study of shapes and their attributes. Students distinguish between defining and non-defining attributes by sorting, analyzing, comparing, and creating shapes and figures. Shape exploration introduces early fraction concepts like halves, fourths, and quarters.[1]

- **Shape Attribute Sort –** Provide a variety of shape cards (triangles, rectangles, circles, hexagons). Ask students to sort the shapes by defining attributes such as number of sides or number of vertices. Facilitate a discussion about which attributes matter when naming a shape and which do not (size, color, rotation).
- **Build-A-Shape Station –** Offer materials like craft sticks, straws, pipe cleaners, or playdough. Have students build two-dimensional shapes and describe them using precise vocabulary (straight sides, corners, equal lengths). *Possible extension:* Ask students to change one attribute and explain how the shape changes.
- **Three-Dimensional Shape Mystery Bags –** Place common three-dimensional objects (sphere, cylinder, cube, rectangular prism) in small bags. Students reach in, feel the object, and describe its attributes (flat faces, curved surface, edges). They guess the object before revealing it.
- **Flat vs. Solid Sort –** Place mixed picture cards of two-dimensional shapes and three-dimensional figures on the table. Students sort them into "flat shapes" and "solid shapes" and justify their sort with shape vocabulary.
- **Shape Hunt Around the Room –** Have students look for real-world examples of two-dimensional shapes and three-dimensional figures in the classroom (books =

rectangles, clock = circle, tissue box = rectangular prism). Students sketch or list the shapes they find and explain how they know the item matches that shape.

- **Fraction Shape Puzzles –** Provide cut-out shapes partitioned into halves or fourths. Students match whole shapes to their fraction pieces and talk about how equal shares matter. *Possible extension:* Ask students to create their own "fraction creature" by combining fractional pieces to make a whole.
- **Guess My Shape (Verbal Clues) –** One student selects a shape card and describes it using mathematical attributes ("I have three sides," "All my sides are equal length"). The class guesses which shape is being described.

Books that Promote Mathematical Thinking

The following list of books addresses grade-level-appropriate mathematics topics. These can be checked out from the local community or school libraries. They offer early literacy opportunities for students while integrating mathematics.

Number and Operations

Centipede's 100 Shoes by Toni Ross

Just Enough Carrots by Stuart J. Murphy

The King's Commissioners by Aileen Friedman

Operations and Algebraic Thinking

A Pocket for Corduroy by Don Freeman

Ten Apples on Top by Dr. Seuss

Caps for Sale by Esphyr Slobodkina

Sheep in a Jeep by Nancy Shaw

Geometry and Measurement

Exactly the Opposite by Tana Hoban

A Pair of Socks by Stuart J. Murphy

Opuestos/Opposites by Cynthia Weill

Five Creatures by Emily Jenkins

Is it Red? Is it Yellow? Is it Blue? by Tana Hoban

A Pair of Socks by Stuart J. Murphy

The Greedy Triangle by Marilyn Burns and Gordon Silveria

Captain Invincible and the Space Shapes by Stuart J. Murphy

Give Me Half! by Stuart Murphy

Eating Fractions by Bruce McMillan

Mouse Shapes by Ellen Stoll Walsh

Corduroy by Don Freeman

Additional Content/Informational Resources

- Grade 1 Mathematics Standards - Provide learning outcomes for the end of the Grade 1 academic year.
- Grade 1 Model Curriculum – Provides content elaborations for the grade level standards and the expectations for learning for all students.
- Grade 1 Standards for Mathematical Practice – These describe the skills that mathematics educators should seek to develop in their students.
- Color Coded K-5 Learning Progressions – Identifies the learning progression of mathematical content across K-5.

- Achieve the Core - These guides will help educators understand and implement the mathematics standards. They can use the guides as they observe teachers giving instruction and provide them with feedback that supports their planning and reflection.
    - K - 8 Content Emphases
    - K - 8 Instructional Practice Guide
- Arizona Progressions - These narrative documents by the University of Arizona describe the typical learning progression of a topic, informed by both research on children's cognitive development and the logical structure of mathematics.
- Illustrative Mathematics – Showcases the range and types of mathematical work that students should experience as teachers use Ohio's Learning Standards in Mathematics. It also presents other tools supporting standards-based instruction.
- Progression Videos of "How" students build math knowledge

Instructional Resources

- Erikson Institute Early Math Collaborative - Developmentally aligned information and instructional activities.
- Teaching Channel - Provides guiding questions to use during planning and instruction. Classroom videos model best practices. Learning activities showcase rigorous problems that deepen conceptual understanding.
- YouCubed – Showcases research-based teaching methods, mathematics tasks, videos, and ideas on how to bring about high levels of student engagement.
- National Library of Virtual Manipulatives - The site contains manipulatives and concept tutorials across the grade bands.
- Learning Trajectories – Discover how children develop their mathematical thinking and learning skills.
- Inside Mathematics - Educators can find exemplary standards-based lesson ideas, as well as classroom videos. Teachers interested in the lessons can search under "performance task" for lesson ideas organized by grade and course.
- Illuminations - This project by the National Council of Teachers of Mathematics provides quality lessons and interactive resources for teaching and learning mathematics.
- Resources for 3-Act Math Class (Choose appropriateness for your grade level. These are tasks that foster mathematical modeling.)

Dan Meyer	Graham Fletcher	Robert Kaplinsky
Andrew Stadel	John Stevens	Michael Fenton
Geoff Krall	Jon Orr	Kyle Pearce

- Steve Wyborney -Contains popular instructional activities such as Splat, Hundred Maze, Subitizing, Fraction Splat, Primary Tile, Tile Area, and Esti mystery.
- MCTM Collection of Cognitively Demanding Tasks – A collection of resources for finding those rich multidimensional math tasks.

- Number Talks-provide video resources about how to engage students in mathematical conversation using mental math to solve problems.
    - Building Number Sense (Jo Boaler, Ruth Parker, Sherry Parrish)
    - Inside Mathematics Number Talks
- Visual Patterns - great site for students to think algebraically and build expressions to model the world with mathematics.
- Clothesline Math – Mathematical tasks using a clothesline as an interactive number line.
- Which One Does Not Belong- Contains many low-floor and high-ceiling tasks. These are excellent for getting all students to contribute during mathematical discourse.

References

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