Second 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:

1. Build on children's growing numeracy and computation foundations while fostering flexible thinking.
2. Strengthen learning behaviors such as perseverance, organization, and productive struggle to support mathematical growth.
3. Ensure instruction is sequenced in a coherent, learning progression across the early elementary grades.
4. Provide sustained opportunities for reasoning, problem-solving, and mathematical discourse.
5. Integrate mathematics with other content areas and in meaningful real-world contexts.
6. Offer adequate time, appropriate materials, and support for students to engage with math concepts in hands-on, exploratory, and structured ways.
7. Use a variety of teaching approaches to introduce, reinforce, and extend mathematical thinking.
8. Implement targeted intervention when needed, ensuring sufficient intensity and dosage for student success.
9. Employ ongoing formative assessment to adjust instruction and support individualized learning needs.
10. 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.

Second Grade Mathematical Domains

- **Operations and Algebraic Thinking:** represent and solve addition and subtraction problems within 20; work with equal groups of objects to gain foundations for multiplication
- **Numbers and Operations in Base Ten:** use place value understandings and properties of operations to add and subtract

- **Measurement and Data:** measure and estimate lengths in standard units; relate addition and subtraction to length; work with time and money; represent and interpret data
- **Geometry:** reason with shapes and their attributes

Second Grade Critical Areas of Focus (What Students Learn)

In second grade, emphasis should be on extending students' understanding of base-ten notation, strengthening fluency with addition and subtraction, deepening concepts of measurement, and expanding geometric reasoning. Students build on their first-grade foundation by exploring multi-digit numbers up to 1,000. They count in structured units and recognize how place value relationships support efficient computation. They deepen their understanding of addition and subtraction strategies to solve real-world problems involving data, time, and money. Students learn to use standard units and tools to measure length and other real-world quantities. As they describe, analyze, compose, and decompose shapes, students are introduced to foundational geometric ideas that connect to later concepts such as area and volume.

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 second grade, instruction should focus on four critical areas.

- Extending understanding of base-ten notation.
- Building fluency with addition and subtraction.
- Using standard units of measure.
- Describing and analyzing shapes

Critical Area 1: Extending understanding of base-ten notation.

Students extend their understanding of the base-ten system. This includes ideas of counting in fives, tens, and multiples of hundreds, tens, and ones, as well as number relationships involving these units, including comparing. Students understand multi-digit numbers (up to 1000) written in base-ten notation, recognizing that the digits in each place represent amounts of thousands, hundreds, tens, or ones, e.g., 853 is 8 hundreds + 5 tens + 3 ones.

Critical Area 1: Connections to First Grade

- Extend the counting sequence (1.NBT.1)
- Understand place value (1.NBT.2-3)

Critical Area 2: Building fluency with addition and subtraction

Students use their understanding of addition to develop fluency with addition and subtraction within 100. They solve problems within 1000 by applying their understanding of models for addition and subtraction, and they develop, discuss, and use efficient, accurate, and

generalizable methods to compute sums and differences of whole numbers in base-ten notation, using their understanding of place value and the properties of operations. They select and accurately apply methods that are appropriate for the context and the numbers involved to mentally calculate sums and differences for numbers with only tens or only hundreds. They apply their understanding of addition and subtraction to data represented in the picture and bar graphs.

Critical Area 2: Connections to First Grade

- Use place value understanding and properties of operations to add and subtract (1.NBT.4-6)
- Represent and solve problems involving addition and subtraction (1.OA.1-2)
- Understand and apply properties of operations and the relationship between addition and subtraction (1.OA.3-4)
- Add and subtract within 20 (1.OA.5-6)
- Work with addition and subtraction equations (1.OA.7-8)
- Work with time and money (1.MD.3)
- Represent and interpret data (1.MD.4)

Critical Area 3: Using standard units of measure.

Students recognize the need for standard units of measure (centimeter and inch), and they use rulers and other measurement tools with the understanding that linear measure involves an iteration of units. They recognize that the smaller the unit, the more iterations they need to cover a given length. They also apply number concepts solving real-world problems.

Critical Areas 3: Connections to First Grade

- Measure lengths indirectly and by iterating length units (1.MD.1-2)
- Work with time and money (1.MD.3)
- Represent and interpret data (1.MD.4)

Critical Area 4: Describing and analyzing shapes

Students describe and analyze shapes by examining their sides and angles. Students investigate, describe, and reason about decomposing and combining shapes to make other shapes. Through building, drawing, and analyzing two and three-dimensional shapes, students develop a foundation for understanding area, volume, congruence, similarity, and symmetry in later grades. They apply number concepts in real-world problems.

Critical Area 4: Connections to First Grade

- Reason with shapes and their attributes (1.G.1-3)
- Represent and solve problems involving addition and subtraction (1.OA.1-2)
- Understand and apply properties of operations and the relationship between addition and subtraction (1.OA.3-4)
- Add and subtract within 20 (1.OA.5-6)
- Work with addition and subtraction equations (1.OA.7-8)

Examples of Mathematical Learning and Development in Second Grade

Instructional Activities to Support Learning in Operations and Algebraic Thinking

Operations and Algebraic Thinking - Students demonstrate understanding of addition and subtraction up to 100 in a variety of problem situations.

- **Story Problems on the Move –** Create simple addition and subtraction story problems (within 20) and place them around the room. Students rotate with clipboards, read each problem, draw a representation, and solve. For example, "There are 9 apples in the basket. A classmate adds 6 more. How many apples now?"
- **Build and Break –** Give students connecting cubes or counters. Call out a number within 20 and have students build that number. Then say, "Break it!" and ask them to decompose the number in as many ways as possible (e.g., 14 can be 10 + 4, 6 + 8, 2 + 12). Students record an equation for each decomposition.
- **Equal Groups Grab –** Provide small containers filled with counters. Students grab a handful and sort them into equal groups. For example, a student grabs 12 counters and groups them into 3s to see that there are 4 groups. They draw the groups and write a repeated-addition sentence (3 + 3 + 3 + 3 = 12).
- **Number Line Hops –** Using a large floor number line or a drawn number line at desks, students solve addition and subtraction problems within 20 by "hopping" forward or backward. For example, to solve 17 – 9, students hop back 9 spaces and record the answer on a dry-erase board.
- **Equation Match-Up –** Create cards showing picture models (objects, tallies, or groups), matching equations, and missing-number equations. Students sort and match sets that show the same mathematical idea. *Optional Extension:* Students create their own equation cards and trade with a partner.

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

Number and Operations in Base Ten – Place value understanding extends to include a group of 10 tens or one group of 100. Students continue to use models, strategies, and properties to perform addition and subtraction in a variety of situations. They build addition and subtraction fluency up to 100 while extending their understanding of these operations with numbers up to 1,000.

- **Place Value Build –** Provide students with base-ten blocks. Call out a two- or three-digit number (e.g., 245). Students build the number using hundreds, tens, and ones. *Optional Extension:* Students draw their model and label each part.
- **Expanded Form Flip –** Create cards showing standard forms (e.g., 382) and matching expanded forms (300 + 80 + 2). Students flip two cards at a time to find matches. *Optional Extension: Students write the number in word form after finding a match.*
- **Race to 100 (or 1,000) –** Pairs of students roll dice and add the rolled amount to their running total using base-ten blocks or place-value mats. Players record each step and

see who reaches 100 (or 1,000) first. Emphasize regrouping when 10 ones make ten or 10 tens make a hundred.

- **Mystery Number Clues –** The teacher gives clues about a number: "My number has 4 tens," "My number has 7 ones," "My number is greater than 45 but less than 60." Students build or write the number and explain how they know.
- **Bundle and Unbundle –** Students receive a pile of popsicle sticks or straws. They bundle groups of ten using rubber bands. Practice regrouping by composing tens from ones and decomposing tens back into ones. For example, if a student has 23 sticks, they make two bundles of 10 and leave 3 single sticks.
- **Compare and Order Challenge –** Students draw number cards and use <, >, or = to compare them. Then place 3–4 numbers in order from least to greatest. Encourage students to justify using place-value language such as "Both numbers have 4 tens, but this one has more ones."
- **Break It Down Boards –** Students write a two- or three-digit number at the top of a whiteboard. Below it, students draw or write as many representations as possible: base-ten model, expanded form, number line location, and tens/ones/hundreds descriptions.
- **Expanded-Form Card Sort** Students sort cards showing standard form (e.g., 156), expanded form (100 + 50 + 6), hundreds/tens/ones descriptions ("1 hundred, 5 tens, and 6 ones"), models (rod-and-dot sketches). Have students match sets and explain how each representation shows hundreds, tens, and ones.

Instructional Activities to Support Learning in Measurement and Data

Measurement and Data – Second graders learn to measure with standardized units. They estimate and measure using a variety of units and tools. Measurement concepts are related to addition and subtraction. Telling time is extended to the nearest 5-minutes and previous work with data is expanded to include situations with grade-level appropriate numbers. [1]

- **Ruler Round-Up–** Provide a variety of classroom objects and rulers. Students measure each object in inches or centimeters, record the length, and sort the objects from shortest to longest.
- **Estimate and Measure–** Set up stations with items of different sizes. Students estimate each item's length first, then measure using a standard tool (ruler, measuring tape). Record both the estimate and actual length. *Optional Extension:* Find the difference between the estimate and actual.
- **Time Match Cards–** Create cards showing clock faces and matching digital times (to the nearest 5 minutes). Students play a matching game or memory game to pair analog and digital times.
- **Coin Count Mix-Up–** Give students a small pile of coins. Students count the collection and record the total value. *Optional Extension:* Students create different coin combinations that equal the same total amount.
- **Bar Graph Builders–** Students collect data on a class topic (favorite recess activity, pet type, snack choice). Students represent results using picture or bar graphs and answer questions about the data.

- **Measurement Scavenger Hunt–** Students search the room for items that meet specific measurement criteria. For example, “Find something that is about 10 inches long.” Record findings and compare with classmates.
- **Weigh and Compare–** Using a balance scale and a set of standard weights, students estimate and then measure the weight of classroom objects. Students determine which objects are heavier, lighter, or equal.

Instructional Activities to Support Learning in Geometry

Geometry – Second graders think about, describe, and analyze shapes based on their sides and angles. They build, draw, describe, decompose, and combine shapes to make other shapes. [1]

- **Shape Sort and Describe –** Provide a mix of cut-out shapes. Students sort them into groups based on attributes (number of sides, angles, curved vs. straight lines). Students explain their reasoning using precise vocabulary. *Optional Extension:* Students create labels for each category.
- **Build-a-Shape –** Using materials such as toothpicks, sticks, straws, or playdough, students build two-dimensional shapes. Encourage them to create shapes with different numbers of sides and compare how they are alike or different. For example, build a shape with four sides that is not a square.
- **Shape Transformations –** Give students a shape card and ask them to change one attribute (e.g., add a side, remove a corner, stretch it). Students draw the transformed shape and describe what changed. Reinforces analysis of defining characteristics.
- **Compose and Decompose Pictures –** Provide shape tiles or pattern blocks. Students create pictures (animals, buildings, designs) and then identify which shapes were used. Students also decompose a larger shape into smaller shapes. For example, “My house is made of two rectangles and a triangle.”
- **Shape Hunt Tags –** Place shape tags around the classroom (triangles, hexagons, rectangles, circles, etc.). Students move around the room finding examples of each shape in the real world—windows, books, floor tiles, signs—and record or sketch their findings.
- **Guess My Shape –** One student secretly picks a shape card and describes it using attributes (“It has four sides, but not all sides are equal”). Partners guess the shape, then switch roles. Encourages precise language and reasoning.
- **Tangram Challenge –** Students use tangram pieces to build given outlines. They describe which shapes they used and how the pieces fit together. *Optional Extension:* Students design their own outline for a partner to solve.

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.

Operations and Algebraic Thinking

Two of Everything by Lily Toy Hong

The Napping House by Audrey Wood and Don Wood

Counting Crocodiles by Judy Sierra

Night Noises by Mem Fox

The Shopping Basket by John Burningham

My Little Sister Ate One Hare by Bill Grossman

Even Steven and Odd Todd by Katryn Cristaldi

Stacks of Trouble by Martha F. Brenner

Geometry and Measurement

Give Me Half! By Stuart Murphy

Eating Fractions by Bruce McMillan

My Half Day by Doris Fisher

The Greedy Triangle by Marilyn Burns

How Big is a Foot? by Rolf Myller

Inch by Inch by Leo Lionni.

Jim and the Beanstalk by Raymond Briggs

It's About Time! By Stuart J. Murphy

Bunny Money by Rosemary Wells.

Number and Operations

Two Ways to Count to Ten by Ruby Dee

The Great Tattle Battle by Anne Bowen

Additional Content/Informational Resources

- Grade 2 Mathematics Standards - Provide learning outcomes for the end of the Grade 1 academic year.
- Grade 2 Model Curriculum – Provides content elaborations for the grade level standards and the expectations for learning for all students.
- Grade 2 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

- Fraction Talks – Fraction images that open up a world of mathematical understanding based on the relationship between a numerator/denominator while the students are quantifying the value the entire time.
- 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

DiPerna, J. C., Lei, P. W., & Reid, E. E. (2007). Kindergarten predictors of mathematical growth in the primary grades: An investigation using the Early Childhood Longitudinal Study–Kindergarten cohort. *Journal of Educational Psychology, 99*(2), 369–379. https://doi.org/10.1037/0022-0663.99.2.369

[1]Gojak, Linda M., and Ruth Harbin Miles. *The Common Core Mathematics Companion the Standards Decoded, Grades K-2; What They Say, What They Mean, How to Teach Them*, Corwin Mathematics, Thousand Oaks, CA, 2015, pp. 2, 22, 74, 120, 164.

Kiss, A. J., Nelson, G., & Christ, T. J. (2019). Predicting third-grade mathematics achievement: A longitudinal investigation of the role of early numeracy skills. *Learning Disability Quarterly, 42*(3), 161–174. https://doi.org/10.1177/0731948718823083