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Georgia Performance Standards Framework for Mathematics – Grade 1

Unit 2 Organizer: “ UNDERSTANDING OPERATIONS” **(6 weeks)**

OVERVIEW:

In this unit students will:

- construct a solid understanding of addition and subtraction situations and operations;
- cultivate an understanding of how addition and subtraction affect quantities and are related to each other;
- use multiple representations and strategies to create, describe, and solve story problems;
- compose and decompose numbers up to 10;
- know the addition and subtraction facts to 10;
- improve counting and number fact knowledge and fluency (up to 18);
- develop base ten understanding as a foundation for place value knowledge;
- develop informal strategies for sharing quantities fairly between two to five people; and
- use money (coins and bills) as a context for collecting, exchanging, and operating on quantities less than 50.

Although the units in this instructional framework emphasize key standards and big ideas at specific times of the year, routine topics such as counting, time, money, positional words, patterns and tallying should be addressed on an ongoing basis through the use of calendars, centers, and games.

To assure that this unit is taught with the appropriate emphasis, depth, and rigor, it is important that the tasks listed under “Evidence of Learning” be reviewed early in the planning process. A variety of resources should be utilized to supplement, but not completely replace, the textbook. Textbooks not only provide much needed content information, but excellent learning activities as well. The tasks in these units illustrate the types of learning activities that should be utilized from a variety of sources.

ENDURING UNDERSTANDINGS:

- When two quantities are joined, the result is more than either of the original quantities.
- When one quantity is separated from another, what is left is less than the original quantity.

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- Addition and subtraction are inverse operations.
- The sum of the parts is equal to the whole quantity.
- When one quantity is compared to another, the first quantity is either more than, less than, or equal to the second quantity.
- Groups of equal quantities can be counted.
- Quantities can be shared fairly between two to five people or sets.
- Problems can be solved in a variety of ways such as modeling, counting strategies, or numbers facts.
- Problems and solutions can use various representations, including concrete objects, pictures, number sentences, and words.
- When adding, the order of numbers does not change the answer, but the order of the numbers does change the answer when subtracting.
- Various combinations of numbers and operations can be used to represent the same quantity.
- The characteristics of coins and bills identify their values.

ESSENTIAL QUESTIONS:

- What happens when I join or separate two quantities?
- How can I find the total when I join two quantities?
- How can I find what is left when I separate one quantity from another?
- How can I compare one quantity to another?
- How are problem-solving strategies alike and different?
- How can I represent problem situations and problem-solving strategies?
- Can I change the order of numbers when I add (or subtract)? Why or why not?
- How can I use different combinations of numbers and operations to represent the same quantity?
- How can a quantity be equally shared among two to five people?
- How can I identify the values of various coins and bills?

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STANDARDS ADDRESSED IN THIS UNIT

KEY STANDARDS:

M1N1. Students will estimate, model, compare, order, and represent whole numbers up to 100.

- a. Represent numbers less than 100 using a variety of models, diagrams, and number sentences. Represent numbers larger than 10 in terms of tens and ones using counters and pictures.
- b. Correctly count and represent the number of objects in a set using numerals.
- c. Compare small sets using the terms greater than, less than, and equal to ($>$, $<$, $=$).
- e. Exchange equivalent quantities of coins by making fair trades involving combinations of pennies, nickels, dimes, and quarters, and count out a combination needed to purchase items less than a dollar.
- f. Identify bills (\$1, \$5, \$10, \$20) by name and value and exchange equivalent quantities by making fair trades involving combinations of bills and count out a combination of bills needed to purchase items less than twenty dollars.

M1N2. Understand place value notation for the numbers between 1 and 100. (Discussions may allude to 3-digit numbers to assist in understanding place value.)

- b. Represent collections of less than 30 objects with 2-digit numbers and understand the meaning of place value.
- c. Decompose numbers between 11 and 19 as one ten and the appropriate number of ones.

M1N3. Students will add and subtract numbers less than 100 as well as understand and use the inverse relationship between addition and subtraction.

- a. Identify one more than, one less than, 10 more than, and 10 less than a given number.
- b. Skip-count by 2's, 5's, and 10's forward and backwards – to and from numbers up to 100.
- c. Compose/decompose numbers up to 10 --“break numbers apart”, e.g., 8 is represented as $4 + 4$, $3 + 5$, $5 + 2 + 1$, and $10 - 2$).
- d. Understand a variety of situations to which subtraction may apply: taking away from a set, comparing two sets, and determining how many more or how many less.
- e. Understand addition and subtraction number combinations using strategies such as counting on, counting back, doubles and making tens.
- f. Know the single-digit addition facts to 18 and corresponding subtraction facts with understanding and fluency. (Use strategies such as relating to facts already known, applying the commutative property, and grouping facts into families.)

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- g. Apply addition and subtraction to 2 digit numbers without regrouping (e.g. $15 + 4$, $80-60$, $56 + 10$, $100-30$, $52 + 5$).
- h. Solve and create word problems involving addition and subtraction to 100 without regrouping. Use words, pictures and concrete models to interpret story problems and reflect the combining of sets as addition and taking away or comparing elements of sets as subtraction.

M1N4. Students will count collections of up to 100 objects by dividing them into equal parts and represent the results using words, pictures, or diagrams.

- a. Use informal strategies to share objects equally between two to five people.

RELATED STANDARDS:

M1N4. Students will count collections of up to 100 objects by dividing them into equal parts and represent the results using words, pictures, or diagrams.

- c. Identify, label, and relate fractions (halves, fourths) as equal parts of a whole using pictures and models.

M1P1. Students will solve problems (using appropriate technology).

- a. Build new mathematical knowledge through problem solving.
- b. Solve problems that arise in mathematics and in other contexts.
- c. Apply and adapt a variety of appropriate strategies to solve problems.
- d. Monitor and reflect on the process of mathematical problem solving.

M1P2. Students will reason and evaluate mathematical arguments.

- a. Recognize reasoning and proof as fundamental aspects of mathematics.
- b. Make and investigate mathematical conjectures.
- c. Develop and evaluate mathematical arguments and proofs.
- d. Select and use various types of reasoning and methods of proof.

M1P3. Students will communicate mathematically.

- a. Organize and consolidate their mathematical thinking through communication.
- b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.
- c. Analyze and evaluate the mathematical thinking and strategies of others.
- d. Use the language of mathematics to express mathematical ideas precisely.

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M1P4. Students will make connections among mathematical ideas and to other disciplines.

- a. Recognize and use connections among mathematical ideas.
- b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
- c. Recognize and apply mathematics in contexts outside of mathematics.

M1P5. Students will represent mathematics in multiple ways.

- a. Create and use representations to organize, record, and communicate mathematical ideas.
- b. Select, apply, and translate among mathematical representations to solve problems.
- c. Use representations to model and interpret physical, social, and mathematical phenomena.

CONCEPTS/SKILLS TO MAINTAIN:

- Counting to 30
- Patterning
- Sorting
- Number words through 10
- Writing numbers through 20
- Ordinal numbers (1st – 10th)
- Comparing sets of 1-10 objects (equal to, more than, or less than)
- One to one correspondence
- Equivalence
- Basic geometric shapes
- Spatial relationships – positional words
- Estimation using five or ten as a benchmark
- Modeling addition and subtraction
- Estimating using 10 as a benchmark
- Name and value of coins

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- Calendar time and daily schedule
- Measurement – comparing and ordering

SELECTED TERMS AND SYMBOLS:

The following terms and symbols are often misunderstood. These concepts are not an inclusive list and should not be taught in isolation. However, due to evidence of frequent difficulty and misunderstanding associated with these concepts, instructors should pay particular attention to them and how their students are able to explain and apply them.

The definitions below are for teacher reference only and are not to be memorized by the students. Teachers should present these concepts to students with models and real life examples. Students should understand the concepts involved and be able to recognize and/or demonstrate them with words, models, pictures, or numbers.

Combine: . Put together sets, join sets, add

Separating: Take away, remove, subtract

Comparing: Describe how sets relate to each other using terms like more, less, or equal, lighter/heavier

Counting strategy: A strategy that uses the counting sequence, by counting on from an initial quantity. Objects (fingers, counters, tally marks) may be used to keep track of the counts rather than represent the quantities given in the problem.

Recalling facts: The exact fact needed to solve the problem is known. For example, to solve a problem by adding 6 and 7, a child might say, “I know that 6 and 7 is 13.”

Doubles plus one: A strategy using a known fact that is close to what is needed to determine the exact fact that is needed. For example, to solve a problem by adding 6 and 7 without remembering the fact for $6 + 7$, a child might say, “The answer is 13 because 6 and 6 is 12, and 7 is one more than 6, so I need to add one more to 12.”

Estimating: Determining an approximate number or measure.

Quantity: the amount of objects.

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EVIDENCE OF LEARNING:

By the conclusion of this unit, students should be able to demonstrate the following competencies:

- Understand and use addition and subtraction in everyday situations.
- Compose and decompose numbers up to 10;
- Know the addition and subtraction facts to 10;
- Be fluent with counting and number fact knowledge (up to 12).
- Understand base ten as a foundation for place value.
- Use informal strategies for sharing quantities fairly between two to five people.
- Use money (coins and bills) as a context for collecting, exchanging, and operating on quantities less than 50.

The following tasks represent the level of depth, rigor, and complexity expected of all first grade students. These tasks or a task of similar depth and rigor should be used to demonstrate evidence of learning.

- Tiles in a Pile
- Musical Towers
- Restaurant
- Domino Fact Family
- 18 Golden Beans
- Ten in My Hands
- Group It and Move It
- Story Problems
- My Story Problem Book

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Culminating Activity: “My Story Problem Book”

Students will write and solve story problems involving a variety of situations, choosing favorite story problems from among joining, separating, part-part-whole, comparing, grouping, and sharing situations. Students will publish their problems and solutions in a personal problem-solving book to share with parents and others.

STRATEGIES FOR TEACHING AND LEARNING:

- Students should be actively engaged by developing their own understanding.
- Mathematics should be represented in as many ways as possible by using graphs, tables, pictures, symbols and words.
- Appropriate manipulatives and technology should be used to enhance student learning.
- Students should be given opportunities to revise their work based on teacher feedback, peer feedback, and metacognition which includes self-assessment and reflection.

Classroom Routines

The importance of continuing the established classroom routines cannot be overstated. Daily routines must include such obvious activities such as taking attendance, doing a lunch count, determining how many items are needed for snack, lining up in a variety of ways (by height, age, type of shoe, hair color, eye color, etc.), daily questions, 100s chart questions, and calendar activities. They should also include less obvious routines, such as how to select materials, how to use materials in a productive manner, how to put materials away, how to open and close a door, how to do just about everything! An additional routine is to allow plenty of time for children to explore new materials before attempting any directed activity with these new materials. The regular use of the routines are important to the development of students’ number sense, flexibility, and fluency, which will support students’ performances on the tasks in this unit. See unit 1 for suggestions concerning specific ideas for classroom routines.

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TASKS:

The collection of the following tasks represents the level of depth, rigor and complexity expected of all first grade students to demonstrate evidence of learning.

- **Tiles in a Pile**

Tiles in a Pile

- You will receive a bag of tiles.
- Empty your bag of tiles into a pile.
- Estimate the tiles in the pile. Using words, pictures, and numbers, record the number of tiles you estimated.
- Next, count the tiles in the pile. Using words, pictures, and numbers, record the number of tiles you counted.
- Be prepared to share how you counted and represented your tiles with the class.
- Now compare the number of tiles in your pile to the number to tiles in your partner’s pile.
- Write a number sentence representing the comparison using the terms greater than, less than, or equal to.

Discussion, Suggestions, Possible Solutions

Adjust the number of counters used in this task to the individual needs of your students. Early in first grade, you may need to use 40-50 1-inch tiles, Unifix cubes, 1-cm cubes or other counters. You may return to this task later in the year using 95-100 tiles.

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Observe students' strategies for completing the task. Attend to their counting (one-to-one correspondence and sequence of number names), keeping track, addition strategies (if used), and errors. Offer support to individual students as needed for both content and language development. Select students to share their strategies based on what you observed. Begin with students who used the most basic strategies (counting by ones) and progress to students who used more advanced/efficient counting strategies (skip counting, forming groups, using addition strategies, or using base-ten understanding).

As the students share ask questions like:

- *How did you count the tiles in your pile?*
- *How did you represent your work on the paper?*
- *How did you keep track of the tiles you had already counted and avoid mixing up the tiles you had already counted with the tiles you had not yet counted?*

Tiles In a Pile		
Estimated Number of Tiles	Counted Number of Tiles	
My Number of Tiles	<, >, or =	My Partner's Number of Tiles

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- **Musical Towers**

Musical Towers

- Choose a tower quickly from the box.
- Move to the specified side of the room.
- Following the directions, find a partner as the music plays.
- Be prepared to explain why you chose your partner.

Discussion, Suggestions, Possible Solutions

- *Prepare connecting cube towers made of 5 to 18 cubes. Make enough towers so that each student has a tower.*
- *Place the towers in a box and allow each child to reach in and choose a tower.*
- *Divide the children into two groups, one group on either side of the classroom.*
- *Give them verbal directions like, “Team one- Find a person on team two that has a number of cubes **less than** yours.”*
- *Play about 30 sec. of music quietly while they find an appropriate partner. When the music is over they must stop searching for a partner.*
- *Have partners take turns saying their comparison statements.
For example, “My tower of 17cubes is larger or has a number of cubes **greater than** her tower of 8.”*
- *If there were children that could not find a partner ask them to explain why they couldn’t.*
- *Have all children return their towers to the box and allow them to choose again.*
- *Ask the children to return to the side of the room where they were at the beginning of the game.*
- *Allow the other side to find a partner that has a tower with a number of cubes greater than the number of cubes in their tower.*

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- *Repeat the activity several times until you see children doing this very easily.*
- *You can end the game by asking all children to find a partner and share their cubes to make two towers that are the same size and have an **equal** number of cubes.*
- *Have partners share with the class how they made their towers the same or equal height.*
- *Have them share by making up their own word problems about their story problems.*
- *Ask if anyone had to try to find more than one partner and explain why.*
- *Have students write about what they experienced, enjoyed, or learned during this game in their math journals.*

- **Restaurant**

Restaurant

Take turns being the waiter / waitress or the customer. The customer will use the menu to order their meal. The waiter / waitress will take the order and then give the customer a bill for their meal. The customer must pay for the meal using the correct amount of coins.

Discussion, Suggestions, Possible Solutions

This activity may take a few days (1 day to make the menu and at least 1 day to play restaurant)

As a class, create several different menus with pictures of foods cut out of grocery store sale flyers. Once the pictures have been glued into the menus price each item on the menu with amounts appropriate for your class. Depending on the ability of your class, limit the number of choices and the prices on their menu items.

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Students will role-play ordering and taking orders from the menu. The waiter / waitress writes down the order on a notepad. After the student receives their meal they select the right amount of change needed to pay for the meal. The customers should have bags of change to use to pay for their meal. The waiter / waitress will need to see if the amount paid is correct. Have students switch roles and continue playing.

Variation: *Make new menus for items that all cost dollars. All menu item prices must be a multiple of a dollar and not include cents in the price. Play the game in the same way except that when the customer pays they must pay with combinations of bills.*

- **Domino Fact Family**

Domino Fact Families

Draw each domino in the bag. Label each picture with the fact family it represents. Be prepared to share how you made your fact family.

Discussion, Suggestions, Possible Solutions

Prepare baggies of dominos (no more than five dominos) for each child in the class. Draw several demonstration dominos on the board. Ask students to look at both halves of the domino and tell how many dots are in each square. Ask students what fact family could be represented by the domino. Write the fact family on the board under the domino to reflect their response. Repeat a few times. Then allow children to work independently to record the fact families that their dominos show. They will need to draw each domino and label it with their fact family. Observe the counting strategies that the children utilize. Notice if they are counting on, counting each individual dot, or recalling the answers because they know their addition and subtraction facts.

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- **18 Golden Beans**

18 Golden Beans

The rules for the game “18 Golden Beans” are shown below.

- Partner 1 will grab one part of a pile of 18 golden beans.
- Partner 2 takes the beans that are left in the pile.
- Both players will then count their beans secretly in the palm of their hands.
- Partner 1 will use knowledge of math facts to say how many golden beans must be in their partner's hand. ("I have 14 golden beans, so you must have 4 golden beans.")
- Partner 2 will then open their hands and show if Partner 1 was correct.

Discussion, Suggestions, Possible Solutions

Spray paint Lima beans on both sides using gold spray paint (or you may use other manipulatives if you wish). Allow enough for each group of partners to have 18 beans to share. As the children play the game walk around to make sure they are saying the math talk about their golden beans. The faster they are able to play the better they know their facts.

The number of golden beans may be changed to practice addition for other numbers, just be sure to let the children know that the total number of beans they are working with has changed. You may allow the children to keep score. If Partner 1 is correct about Partner 2's number of beans they may get a point. Scoring will continue when Partner 2 says the math talk as well.

Suggestion:

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Diffy is a subtraction task located at http://nlvm.usu.edu/en/nav/frames_asid_326_g_1_t_1.html . The students can work independent tasks or create their own. Students may work in pairs and as a whole class, discussing the solutions and problems as they work. This sight requires Java.

• Ten in My Hands

Ten in My Hands

- In assigned groups play the game “Ten in My Hands”.
- Each player will receive 5 cards.
- The extra cards will be put in the middle of the group as the draw pile.
- Using the cards you have try, to make a total of ten, for example (5 plus 2 plus 3).
- If you are able to combine the cards to make a ten then lay the used cards face up in front of you.
- If you cannot make a ten, draw a new card from the card pile to add to your hand.
- The winner is the first to use all of their cards.

Discussion, Suggestions, Possible Solutions

Remove the face cards from several decks of playing cards. Leave aces in the pile because they will be worth 1. If you prefer, you may use index cards and make sets of cards with 0 – 10 on them (number, dots, pictures, or words). Group children into groups of 4. The dealer will give each child five cards. The child to the right of the dealer will go first. The object of the game is to make a 10 by adding 2 or more cards in their hand. If the child can make a ten the cards are laid down. Then it is the next player’s turn. If they are able to make a ten they lay their cards down, if they cannot then they draw the top card off of the pile in the middle. The game continues until there is a player who no longer has any cards or the card pile runs out.

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- **Group It and Move It**

Group It and Move It

- Your teacher is going to roll a die / draw number cards.
- Volunteers will be needed to represent those numbers on the place value board.
- Pay close attention to see if you can tell what happens when certain numbers are rolled or drawn.

Discussion, Suggestions, Possible Solutions

Create a large place value board on the floor (using butcher paper, masking tape, or you could even draw it on the sidewalk with chalk and play the game outside). Make sure that the area that you create for both the ones and tens columns can hold at least 9 students comfortably in each. With a large die, or a deck of cards with the numbers 1 – 9, roll / draw a number. Ask the class for volunteers and have that many students stand in the ones column.

Ask questions like:

- Why are you standing in the ones column?
- Is there room for any more students in your column?
- How many more students could join you in the ones column?

Roll / draw another number. Ask for more volunteers and add that many more students to the ones area. The area might be getting a little more crowded now.

Ask questions like:

- How many students are now in the ones column?
- Do we now have enough students to make a group of ten?
- What happens to the students that aren't linked with the group of ten?

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If the group consists of ten or more then have ten students link their arms and move to the tens place. If there are any extra students they will remain in the ones column.

Ask questions like:

- Why have we moved this group to the ten's place?
- What number is now represented on the place value board?
- Is that the same number of children standing who are standing on the place value board?

Continue with the game by rolling the die / drawing cards until all the students are standing on the board. Have students explain what is happening and why groups are moving. After they physically do this activity several times, try it as a class with rods, units, and place value boards.

Suggestion:

Read a story like A Fair Bear Share by Stuart J. Murphy to introduce the concept of place value.

The website below lets children work with place value on the computer (this sight requires Java).

<http://www.arcytech.org/java/b10blocks/b10blocks.html>

• Story Problems

Story Problems

Listen to your teacher tell a story. Imagine what is happening in that story. Think about how many things are in the story.

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Discussion, Suggestions, Possible Solutions

You should tell stories like:

- *There are 5 cats, 6 more cats came. How many cats were there? How do you know? Use manipulatives or pictures to show how you know.*
- *There are 13 pieces of paper. 5 got used, how many are left? How do you know? Use manipulatives or pictures to show how you know.*
- *There are 15 apples. If we eat 5, how many will be left?*

Continue telling stories and asking questions until students can explain and represent what is happening. This should be done over multiple days. Students should then begin to create, illustrate, and solve their own story problems. They can share with the class, with questioning and discussions.

• **Culminating Task:**

This culminating task represents the level of depth, rigor, and complexity expected of all first grade students to demonstrate evidence of learning.

Unit Two Task: “MY STORY PROBLEM BOOK”

Make, illustrate, and solve a story problem like the ones we have done in this unit. Be sure to use combining, separating, money, and numbers to 18 as you make your stories.

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Suggestions for Classroom Use

- Peer Review
- Display for parent night
- Place in portfolio
- Photographs

Discussion, Suggestions and Possible Solutions

In supporting the writing of story problems, encourage the inclusion of at least one of each of the various types of problems that have been explored and solved during this unit. If necessary, add additional problems to the book to insure that this variety is represented. Create a Grade 1 Problem-Solving Book for each student. You may want to extend this task by asking students to illustrate the problem. If so, when printing pages for the book, provide enough space for students to illustrate the problem as well as record their solution strategies.

While students are solving problems, you may wish to note what students are able to do on their own (without your support) before providing support needed for successful completion of the task (making personal notes about what support was needed by individual students).

After the peer review, ask the peers to share one of their partner's solutions, focusing on the type of problem selected, the solution strategy used, and the ways the solutions were represented. Ask students to comment on how problems are alike and different and how solutions are alike and different.

During the revision/improvement process, provide support to individual students as needed.