



CCGPS Frameworks Student Edition

Mathematics

Kindergarten Unit Six
Further Investigation of
Addition and Subtraction



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"Making Education Work for All Georgians"

Georgia Department of Education
 Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6
Unit 6: Further Investigation of Addition and Subtraction

TABLE OF CONTENTS

Critical Area and Overview	3
Number Sense Trajectory	4
Content Standards	5
Practice Standards	5
Problem Types	6
Enduring Understanding	7
Essential Questions	7
Concepts and Skills to Maintain	8
Selected Terms and Symbols	8
Strategies for Teaching and Learning.....	9
Common Misconceptions	9
Evidence of Learning.....	10
Tasks	11
Ten Flashing Fireflies	13
Got Your Number?	20
By the Riverside.....	24
Capturing Bears (5/10).....	28
Fishing Tale	38
Moving Day	44
How Many Ways to Get to 10	49
A Day at the Beach	54
At the Mechanics	58
Field Trip for Fives	64
The Magic Pot.....	69
Equally Balancing Numbers	77

CRITICAL AREA

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.

1. Representing, relating, and operating on whole numbers, initially with sets of objects. Students use numbers, including written numerals, to represent quantities and to solve quantitative problems, such as counting objects in a set; counting out a given number of objects; comparing sets or numerals; and modeling simple joining and separating situations with sets of objects, or eventually with equations such as $5 + 2 = 7$ and $7 - 2 = 5$. (*Kindergarten students should see addition and subtraction equations, and student writing of equations in kindergarten is encouraged, but it is not required.*) Students choose, combine, and apply effective strategies for answering quantitative questions, including quickly recognizing the cardinalities of small sets of objects, counting and producing sets of given sizes, counting the number of objects in combined sets, or counting the number of objects that remain in a set after some are taken away.

OVERVIEW

Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

For numbers 0 – 10, Kindergarten students choose, combine, and apply strategies for answering quantitative questions. This includes quickly recognizing the cardinalities of small sets of objects, counting and producing sets of given sizes, counting the number of objects in combined sets, or counting the number of objects that remain in a set after some are taken away. Objects, pictures, actions, and explanations are used to solve problems and represent thinking. Although CCGPS states, “*Kindergarten students should see addition and subtraction equations, and student writing of equations in kindergarten in encouraged, but it is not required*”, please note that it is not until First Grade that “Understand the meaning of the equal sign” is an expectation.

Mathematically proficient students communicate precisely by engaging in discussion about their reasoning using appropriate mathematical language. The terms students should learn to use with increasing precision with this cluster are: join, add, separate, subtract, and, same amount as, equal, less, more, compose, and decompose.

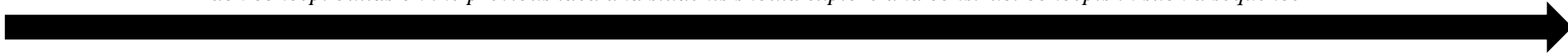
Fluency with basic addition and subtraction number combinations is a goal for the pre-K–2nd grade years. By *fluency* the National Council of Teachers of Mathematics states that students are able to compute efficiently and accurately with single-digit numbers. Teachers can help students increase their understanding and skill in single-digit addition and subtraction by providing tasks that (a) help them develop the relationships within subtraction and addition combinations and (b) elicit counting on for addition, and counting up for subtraction and unknown-addend situations. Teachers should also encourage students to share the strategies they develop in class discussions. Students can develop and refine strategies as they hear other students' descriptions of their thinking about number combinations (NCTM, 2012).

Georgia Department of Education
Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

Number Sense Trajectory –Putting It All Together

Trajectory	<u>Subitizing</u> Being able to visually recognize a quantity of 5 or less.	<u>Comparison</u> Being able to compare quantities by identifying which has more and which has less.	<u>Counting</u> Rote procedure of counting. The meaning attached to counting is developed through one-to-one correspondence.	<u>One-to-One Correspondence</u> Students can connect one number with one object and then count them with understanding.	<u>Cardinality</u> Tells how many things are in a set. When counting a set of objects, the last word in the counting sequence names the quantity for that set.	<u>Hierarchical Inclusion</u> Numbers are nested inside of each other and that the number grows by one each count. 9 is inside 10 or 10 is the same as $9 + 1$.	<u>Number Conservation</u> The number of objects remains the same when they are rearranged spatially. 5 is $4+1$ OR $3+2$.
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Each concept builds on the previous idea and students should explore and construct concepts in such a sequence



Number Relationships	<u>Spatial Relationship</u> <u>Patterned Set Recognition</u> Students can learn to recognize sets of objects in patterned arrangements and tell how many without counting.	<u>One and Two-More or Less</u> Students need to understand the relationship of number as it relates to +/- one or two. Here students should begin to see that 5 is 1 more than 4 and that it is also 2 less than 7.	<u>Understanding Anchors</u> Students need to see the relationship between numbers and how they relate to 5s and 10s. 3 is 2 away from 5 and 7 away from 10.	<u>Part-Part-Whole Relationship</u> Students begin to conceptualize a number as being made up from two or more parts.
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Addition and Subtraction Strategies

<u>One/Two More/Less</u> These facts are a direct application of the One/Two More/ Less than relationships	<u>Make a Ten</u> Use a quantity from one addend to give to another to make a ten then add the remainder. $9 + 7 = 10 + 6$	<u>Near Doubles</u> Using the doubles anchor and combining it with 1 and 2 more/less.
<u>Facts with Zero</u> Need to be introduced so that students don't overgeneralize that answers to addition are always bigger.	<u>Doubles</u> Many times students will use doubles as an anchor when adding and subtracting.	

STANDARDS FOR MATHEMATICAL CONTENT

Understand addition as putting together and adding to, and understand subtractions as taking apart and taking from

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

(Refer to grade level overview for unpacked standards)

STANDARDS FOR MATHEMATICAL PRACTICE

The standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education.

Students are expected to:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

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Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

Problem Types

	Result Unknown	Change Unknown	Start Unknown
Join/Combine	Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now? $2 + 3 = ?$	Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies. How many bunnies hopped over to the first two? $2 + ? = 5$	Some bunnies were sitting on the grass. Three more bunnies hopped there. Then there were five bunnies. How many bunnies were on the grass before? $? + 3 = 5$
Separate/Decompose	Five apples were on the table. I ate two apples. How many apples are on the table now? $5 - 2 = ?$	Five apples were on the table. I ate some apples. Then there were three apples. How many apples did I eat? $5 - ? = 3$	Some apples were on the table. I ate two apples. Then there were three apples. How many apples were on the table before? $? - 2 = 3$
	Total Unknown	Addend Unknown	Both Addends Unknown¹
Put Together / Take Apart²	Three red apples and two green apples are on the table. How many apples are on the table? $3 + 2 = ?$	Five apples are on the table. Three are red and the rest are green. How many apples are green? $3 + ? = 5, 5 - 3 = ?$	Grandma has five flowers. How many can she put in her red vase and how many in her blue vase? $5 = 0 + 5, 5 = 5 + 0$ $5 = 1 + 4, 5 = 4 + 1$ $5 = 2 + 3, 5 = 3 + 2$
	Difference Unknown	Bigger Unknown	Smaller Unknown
Compare³	(“How many more?” version): Lucy has two apples. Julie has five apples. How many more apples does Julie have than Lucy? (“How many fewer?” version): Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have than Julie? $2 + ? = 5, 5 - 2 = ?$	(Version with “more”): Julie has three more apples than Lucy. Lucy has two apples. How many apples does Julie have? (Version with “fewer”): Lucy has 3 fewer apples than Julie. Lucy has two apples. How many apples does Julie have? $2 + 3 = ?, 3 + 2 = ?$	(Version with “more”): Julie has three more apples than Lucy. Julie has five apples. How many apples does Lucy have? (Version with “fewer”): Lucy has 3 fewer apples than Julie. Julie has five apples. How many apples does Lucy have? $5 - 3 = ?, ? + 3 = 5$

¹Adapted from Box 2-4 of Mathematics Learning in Early Childhood, National Research Council (2009, pp. 32, 33).

ENDURING UNDERSTANDINGS

- Addition and subtraction problems are placed in four basic categories: *Joining* problems, *Separating* problems, *Part-Part Whole* problems, and *Comparing* problems.
- When elements are added to or *joined* to a set, there are three quantities involved: the starting amount, the change amount, and the resulting amount.
- A *separating* problem involves three quantities; the starting amount, the change amount (the amount being removed), and the resulting amount; however, the starting amount is the largest amount with the change amount being removed which leaves the resulting amount.
- *Part-Part-Whole* problems involve three quantities: two parts that are combined into one whole
- *Compare* problems involve the comparison between two different quantities. The third quantity does not actually exist but is the difference between the two quantities. When one quantity is compared to another, the first quantity is either more than, less than, or equal to the second quantity.
- Problems can be solved in different ways.
- Problems can be modeled using objects, pictures, and words.
- Various combinations of numbers can be used to represent the same quantity.
- (*see table on previous page for examples*)

ESSENTIAL QUESTIONS

- Can patterns be found in numbers?
- Can you describe the patterns you find?
- Are some patterns the same?
- How are the number patterns different?
- What is a pattern and where can you find patterns?
- Does the order of addends change the sum? Give examples to justify your thinking.
- How can I prove that groups are equal?
- How can I find the total when I put two quantities together?
- How can I find what is left over when I take one quantity away from another?
- How can I represent problems using objects, pictures, and numbers?
- How can I use different combinations of numbers to represent the same quantity?
- How can strategies help me when playing a math game?
- How can strategies help use solve problems?
- How can you model a math problem with objects or pictures?
- How do you know when your answer makes sense?
- What happens when I decompose a quantity?
- What happens when I join quantities together?
- What happens when some objects are taken away from a set of objects?
- What is a number relationship? How can they help me?
- What is a strategy?

MATHEMATICS • GRADE K • UNIT 6: Further Investigation of Addition and Subtraction

Georgia Department of Education

Dr. John D. Barge, State School Superintendent

May 2012 • Page 7 of 85

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Georgia Department of Education
Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

- What is the difference between addition and subtraction?
- What should I be doing when playing a math game?
- Why do we use mathematical symbols?
- Why is it important that I can build the number combinations for the number 5? 10?

CONCEPTS/SKILLS TO MAINTAIN

Although many students may have attended pre-school prior to entering kindergarten, this is the first year of school for some students. For that reason, no concepts/skills to maintain will be listed at this time. It is expected that teachers will differentiate to accommodate those students that may enter kindergarten with prior knowledge.

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

- **addends**
- **addition**
- **combinations**
- **combine**
- **compare**
- **compose**
- **decompose**
- **difference**
- **equal**
- **number relationships**
- **numeric pattern**
- **quantity**
- **separate**
- **strategies**
- **subtraction**
- **sum**
- **symbols**

STRATEGIES FOR TEACHING AND LEARNING

Provide contextual situations for addition and subtraction that relate to the everyday lives of kindergarteners. A variety of situations can be found in children’s literature books. Students then model the addition and subtraction using a variety of representations such as drawings, sounds, acting out situations, verbal explanations and numerical expressions. Manipulatives, like two-color counters, clothespins on hangers, connecting cubes, and stickers can also be used for modeling these operations. Kindergarten students should see addition and subtraction equations written by the teacher. Although students might have a difficult time at first, teachers should encourage them to try writing the equations. Students’ writing of equations in Kindergarten is encouraged, but it is not required.

Create written addition or subtraction problems with sums and differences less than or equal to 10 using the numbers 0 to 10. It is important to use a problem context that is relevant to kindergarteners. After the teacher reads the problem, students choose their own method to model the problem and find a solution. Students discuss their solution strategies while the teacher represents the situation with an equation written under the problem. The equation should be written by listing the numbers and symbols for the unknown quantities in the order that follows the meaning of the situation. The teacher and students should use the words *equal* and *is the same as* interchangeably.

Have students decompose numbers less than or equal to 5 during a variety of experiences to promote their fluency with sums and differences less than or equal to 5 that result from using the numbers 0 to 5. For example, ask students to use different models to decompose 5 and record their work with drawings or equations. Next, have students decompose 6, 7, 8, 9, and 10 in a similar fashion. As they come to understand the role and meaning of arithmetic operations in number systems, students gain computational fluency, using efficient and accurate methods for computing.

The teacher can use scaffolding to teach students who show a need for more help with counting. For instance, ask students to build a tower of 5 using 2 green and 3 blue linking cubes while you discuss composing and decomposing 5. Have them identify and compare other ways to make a tower of 5. Repeat the activity for towers of 6 through 10. Help students use counting as they explore ways to compose 6 through 10.

COMMON MISCONCEPTIONS

Students may over-generalize the vocabulary in word problems and think that certain words indicate solution strategies that must be used to find an answer. They might think that the word *more* always means to add and the words *take away* or *left* always means to subtract. When students use the words *take away* to refer to subtraction and its symbol, teachers need to repeat students’ ideas using the words *minus*, *subtract*, or *find the difference between*. For example, students use addition to solve this Take From/Start Unknown problem: Seth took the 8 stickers he no longer wanted and gave them to Anna. Now Seth has 11 stickers *left*. How many stickers did Seth have to begin with?

Georgia Department of Education
Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

If students progress from working with manipulatives to writing numerical expressions and equations, they skip using pictorial thinking. **Students will then be more likely to use finger counting and rote memorization for work with addition and subtraction.** Counting forward builds to the concept of addition while counting back leads to the concept of subtraction. However, counting is an inefficient strategy. **Teachers need to provide instructional experiences so that students progress from the concrete level, to the pictorial level, then to the abstract level when learning mathematics.**

EVIDENCE OF LEARNING

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

- Represent the combining of two sets
- Model and understand the concept of part-part whole addition
- Represent the difference between two sets
- Model problem situations using objects, pictures, words and numbers
- Represent number combinations up to 10
- Count one-to-one in counting order to 20
- Recognize number relationship to benchmark numbers of 5 and 10
- Group objects by 5's and 10's
- Identify numerical patterns
- Understand and model number relationships
- Identify more, less and equal to when comparing sets
- Model multiple representations of the same number
- Solve addition and subtraction word problems
- Decompose numbers less than or equal to 10
- Understand the relationship 0-10 number relationships

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Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

TASKS

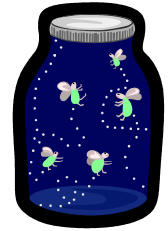
The following tasks represent the level of depth, rigor, and complexity expected of all Kindergarteners. These tasks or a task of similar depth and rigor should be used to demonstrate evidence of learning.

Scaffolding Task	Constructing Task	Practice Task	Performance Task
Tasks that build up to the constructing task.	Constructing understanding through deep/rich contextualized problem solving tasks	Games/ activities	Summative assessment for the unit

Task Name	Task Type/ Grouping Strategy	Content Addressed
Ten Flashing Fireflies	Constructing Task <i>Individual, Whole and Small Group</i>	Addition and subtraction through word problems
Got Your Number?	Practice Task <i>Individual or small Group</i>	Number relationships to 10
By The Riverside	Scaffolding Task <i>Individual, Whole or Small Group</i>	Modeling number combinations through problem solving
Capturing Bears (5/10)	Practice Task <i>Partners</i>	Number combinations to 5 and 10 and development of 8 SMPs
Fishing Tale	Scaffolding Task <i>Individual, Whole or Small Group</i>	Number combinations to 5 through problem solving
Moving Day	Constructing Task <i>Individual, Whole and Small Group</i>	Number relationships to 10
How Many Ways to get to 10?	Constructing Task <i>Individual, Whole and Small Group</i>	Making generalizations in number relationships to 10
A Day at the Beach	Practice Task <i>Individual, Whole or Small Group</i>	Modeling number combinations to 10 through problem solving
At the Mechanics	Constructing Task <i>Individual, Whole and Small Group</i>	Development with the understanding of equality and number relationships to 10
Field Trip for Fives	Practice Task <i>Individual, Whole or Small Group</i>	Number combinations to 5 through problem solving
The Magic Pot	Constructing Task <i>Individual, Whole and Small Group</i>	Making generalizations in number relationships to 10

Georgia Department of Education
Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

Equally Balancing Numbers	Culminating Task <i>Individual, Whole and Small Group</i>	Addition and subtraction through word problems
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CONSTRUCTING TASK: Ten Flashing Fireflies

Approximately 2-3 Days

STANDARDS FOR MATHEMATICAL CONTENT

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

As you tell the addition or subtraction stories, have children act out the stories using a variety of manipulatives to represent the fireflies. Once children are comfortable acting out the stories and demonstrate proficiency with acting them out, model for students how to record matching number sentences. Be sure to refer to the plus sign as “and”, the equal sign to “is the same as”, and the subtraction sign as “minus”. Students should understand the meaning of the symbols and how the symbols connect to the stories.

As you create word problems for your students, base them on people, animals, or objects that you are discussing in other content areas or that the students can connect with for other reasons.

Learning is tied to emotion and if students can connect with the problem, they are more likely to be engaged and therefore, learn through their experience.

ESSENTIAL QUESTIONS

- Does the order of addends change the sum? Give examples to justify your thinking.
- How can I find the total when I put two quantities together?
- What happens when some objects are taken away from a set of objects?
- How can I find what is left over when I take one quantity away from another?
- How can I represent problems using objects, pictures, and numbers?
- How can strategies help use solve problems?
- How do you know when your answer makes sense?
- What happens when I decompose a quantity?
- What happens when I join quantities together?
- What is a pattern and where can you find patterns?
- What is a strategy?
- What is the difference between addition and subtraction?

MATERIALS

- *Ten Flashing Fireflies*, by Philemon Sturges or similar book
- “Ten Flashing Fireflies” work mat
- “Ten Flashing Fireflies” recording sheet
- Flashlights
- 10 centimeter cubes

GROUPING

Whole, Individual, Small group

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION:

Comments

This task can be completed over a period of two to three days. The counting book, *Ten Flashing Fireflies*, by Philemon Sturges or a similar book, will set the stage for establishing the concept of number combinations. Each page of the story will introduce a different combination of 10.

Part I

Read the story to the students and have students act it out. Set the scene by dimming the lights and providing flashlights. Select 10 students and give each student a flashlight to shine on the wall to represent fireflies. Designate a spot on the wall as “the jar” and the rest of the wall is “the night sky”. As students model the story with flashlights, have them share the strategy they are using. As you read the story, have students take turns modeling the bugs with the flashlights.

Part II

After modeling the story with flashlights, gather students to a meeting area and ensure each student has (10) centimeter cubes and the *Ten Flashing Fireflies* work mat. During this *solve and share* session it is important that students respect each other's think time. Choosing problems from the *Ten Flashing Fireflies* problems type chart, ask students to solve and model the problem using their work mat.

Comment: The problem types provided incorporate numbers to 10. Using a different total number of "fireflies" (or cubes) for each problem will increase the problem solving strategies that are required of students. This task can be modified to match part-part-whole for just the number 10 for students to work with specific number relationships.

Part III

Distribute 10 centimeter cubes (or other counting objects) to represent fireflies and *Ten Flashing Fireflies* work mat to each student or small group of students. Begin by reading the first couple of pages of *Ten Flashing Fireflies* by Philemon Sturges or similar book to the class. As the story begins, pause at each page and allow students to represent the action using the cubes on the work mat. Allow students the opportunity to discuss the strategies they are using to solve the problem the first couple of pages.

After students have discovered two possible combinations of fireflies in the jar and night sky, present students the *Ten Flashing Fireflies* task sheet: *There are 10 fireflies flying around. How many fireflies could be in the jar, and how many could be in the night sky? Find all of the possible combination of fireflies that could be in the jar or in the night sky. Record and explain your thinking using a table.* Have students work through the task that identifies how many fireflies could be in the jar or in the night sky. Once students have completed the task, finish reading *Ten Flashing Fireflies* so that students can verify their combinations and share the strategies they used to solve the task.

Possible questions that engage students:

- What counting strategies are students using as they separate (or add) information?
- Can students separate objects from a larger set of objects?
- Are students able to explain what happens when some objects are removed from a set of objects? Added to a set of objects?
- Can students explain how to find out what is left when one quantity is removed from another?
- Can students explain patterns as the story develops?

Have students write in their math journal about what was easy and what was difficult for them during today's problem solving. As you read (or listen to what they dictate), take note of *what* they write, not *how* they write it (Burns 2006).

FORMATIVE ASSESSMENT QUESTIONS

- What strategy did you use?
- Did you think of the words “more” or “less”? How?
- Is there another way you could have solved the problem?
- Were there more in the jar or night sky?
- What would you have to do to make the night sky and jar equal?

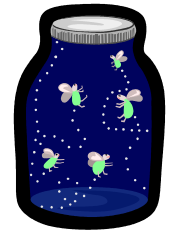
DIFFERENTIATION

Extension

- As students develop proficiency with solving each type of addition and subtraction structure, have them write their own problems for others to solve.
- Exploring number relationships to 20 can also be used to extend this task. The same concept can be used, but students would model part-whole using 20 counting objects.

Intervention

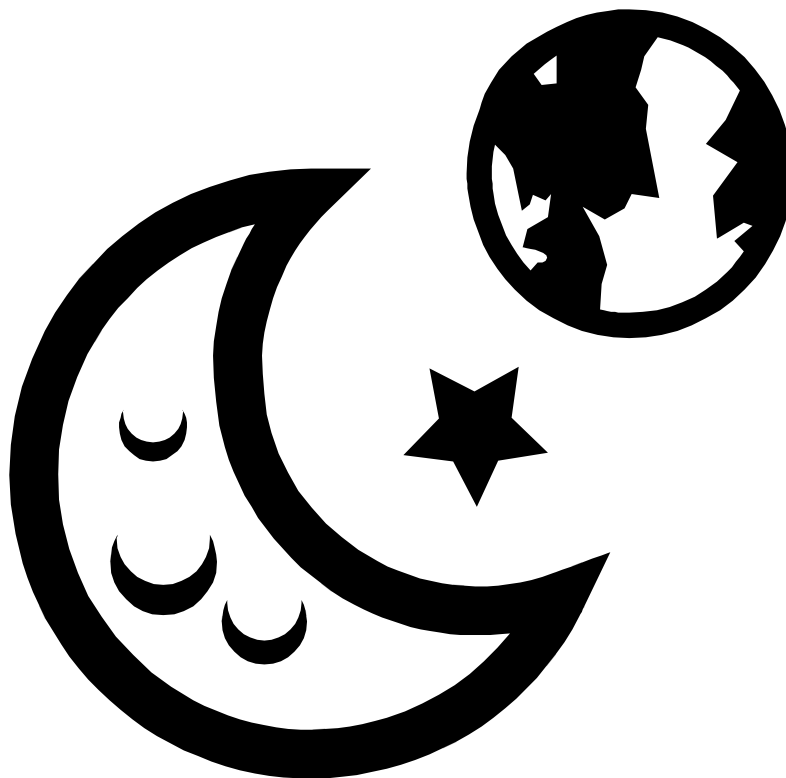
- Allow students to work with smaller numbers within 5 so that they can practice using efficient strategies to solve the problems. Counting strategies are efficient at this stage, but will become inefficient and distracting as numbers get larger. As students begin to understand the relationships among numbers, they will begin learning number facts at a recall level (Carpenter et al. 1999).



Ten Flashing Fireflies

There are 10 fireflies flying around. How many fireflies could be in the jar, and how many could be in the night sky? Find all of the possible combinations of fireflies that could be in the jar or in the night sky. Record and explain your thinking using a table.

Ten Flashing Fireflies



In the Night Sky



In the jar

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 Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6
Ten Flashing Fireflies Solve and Share Problems

Join/Combine	<p>3 Fireflies were in the jar. 6 more fireflies flew into the jar. How many fireflies are now in the jar?</p> $3 + 6 = ?$	<p>In the jar there were 5 fireflies. Some more fireflies flew into the jar. There are now 8 fireflies in the jar. How many fireflies flew into the jar?</p> $5 + ? = 8$	<p>There were some fireflies in the jar. 4 more flew into the jar. There are now 7 fireflies in the jar. How many fireflies were in the jar to start?</p> $? + 4 = 7$
Separate/Decompose	<p>There were 9 fireflies in the jar. 3 fireflies got out of the jar. How many fireflies were left in the jar?</p> $9 - 3 = ?$	<p>There were 6 fireflies in the jar. Some fireflies flew out of the jar. There were 2 fireflies left in the jar. How many fireflies flew out of the jar?</p> $6 - ? = 2$	<p>There were some fireflies in the jar. 7 fireflies flew out of the jar. There were 2 fireflies left in the jar. How many fireflies flew out of the jar?</p> $? - 7 = 2$
	Total Unknown	Addend Unknown	Both Addends Unknown¹
Put Together / Take Apart²	<p>4 fireflies were in the jar and 4 fireflies were in the night sky. How many fireflies were there?</p> $4 + 4 = ?$	<p>There were 9 fireflies. 3 were in the jar and the rest were in the night sky. How many fireflies were in the night sky?</p> $9 - 3 = ?$	<p>There were 3 fireflies. How many were in the jar and how many were in the night sky?</p> $3 = 0 + 3, 3 = 3 + 0$ $3 = 1 + 2, 3 = 2 + 1$
	Difference Unknown	Bigger Unknown	Smaller Unknown
Compare³	<p>(“How many more?” version): 5 fireflies were in the jar. The night sky had 3. How many more fireflies were in the jar?</p> <p>(“How many fewer?” version): 9 fireflies were in the night sky. 3 fireflies were in the jar. How many fewer fireflies are in the jar?</p>	<p>(Version with “more”): There were 6 fireflies in the jar. The night sky had 2 more fireflies than the jar. How many fireflies were in the night sky?</p> <p>(Version with “fewer”): There were 6 fireflies in the jar. The night sky had 3 fewer fireflies than the jar. How many fireflies were in the night sky?</p>	<p>(Version with “more”): The jar had 8 fireflies. The jar had 7 more fireflies than the night sky. How many fireflies were in the night sky?</p> <p>(Version with “fewer”): The jar had 8 fireflies. The jar had 2 fewer fireflies than the night sky. How many fireflies were in the night sky?</p>



PRACTICE TASK: Got Your Number?

Approximately 1-2 days (Adapted from www.insidemathematics.org)

STANDARDS FOR MATHEMATICAL CONTENT

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Students in Kindergarten need to be provided a lot of time to explore number combinations to 5 and 10. Encourage discussions and exploration of “easy ways” to think about adding two single digit numbers. Some students will assume that number combinations less than 10 are always closer to 10 than numbers greater than 10. This is not the case, and students need to come to the realization that 12 is closer to 10 than it is to the number 7.

ESSENTIAL QUESTIONS

- How can strategies help me when playing a math game?

Georgia Department of Education
Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

- What happens when I decompose a quantity?
- What happens when some objects are taken away from a set of objects?
- What is the difference between addition and subtraction?
- What should I be doing when playing a math game?

MATERIALS

- A deck of playing cards (1-9 only and Ace=1)
- *Got Your Number* Task Sheet

GROUPING

Individual, Small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Tell the students that the teachers were playing this game at lunch and you have decided to share it with the students. They have a deck of 36 cards with just the numbers 1 through 9. After they mix up the cards, they put them into a pile. Below are the rules:

- Deal 3 number cards to each player.
- Use any two of your cards.
- Pick two numbers that add to a number near 10.
- Using the *Got Your Number* task sheet write a number sentence with your two cards and the total that is near 10.
- Find your score. Your score is the difference between your total and 10.
- For example you picked the cards 6, 9, 2, so $9 + 2 = 11$. So your total is 11. To find your score, find the difference between 10 and 11. $11 - 10 = 1$.
- Shuffle the cards and play another round.

Play the game eight times. At the end of the game, sum all eight scores for each player. The player with the lowest total is the winner.

FORMATIVE ASSESSMENT QUESTIONS

- What strategy can you use to make a ten?
- What are the 3 possible numbers you can make by combining 2 cards?
- How are you identifying which combination is closer to 10?

DIFFERENTIATION

Extension

- Students can play with 5 cards and pick the 3 cards that make the closest total to 20. (Example: if a students picked 4,6,7,1, and 6 cards from the pile and added $6+6+7=19$, their score would be 1, because $20-19=1$)

Intervention

- Have the students play with 3 cards but try to make a 5. Students can also use the cards from *Number, Pictures, Words* from Unit 5 or mini ten-frame cards that can be found in the Van de Walle blackline masters.
- Allow students to use a 5-frame, 10-frame, or double 10-frame to model the addition.

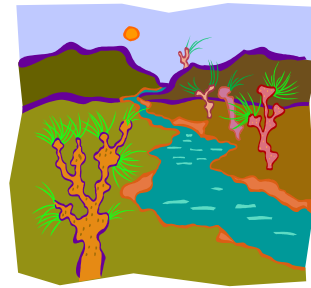


Got Your Number?

Name: _____

Write or draw a number sentence	How far away from 10?

Total



SCAFFOLDING TASK: By the Riverside Approximately 1-2 Days

STANDARDS FOR MATHEMATICAL CONTENT

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Students need to develop an understanding of part-whole relationships as they recognize that a set of objects (5) can be broken into smaller sub-sets (3 and 2) and still remain the total amount (5). In addition, this objective asks students to realize that a set of objects (5) can be broken in multiple ways (3 and 2; 4 and 1, $5+0$). Thus, when breaking apart a set (decomposing), students use the understanding that a smaller set of objects exists within that larger set (inclusion).

Commutative property might be identified during this task. Have students discuss whether or not to include commutative properties as possible combinations. There is no right or wrong answer, students should construct viable arguments and explain why their combination of eyes, legs and

tails is correct. In addition, students must be willing to analyze and critique the reasoning of others.

ESSENTIAL QUESTIONS

- How can I represent problems using objects, pictures, and numbers?
- How can strategies help us solve problems?
- How can you model a math problem with objects or pictures?
- How do you know when your answer makes sense?
- What is a number relationship? How can number relationships help me?

MATERIALS

- *By the Riverside* Recording sheet (optional)
- Accessible manipulatives

GROUPING

Whole/individual/small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

It is useful to think of problem-based lessons as consisting of three main parts: *before, during, and after*. If you allot time for each part, it is quite easy to devote a full period to one seemingly simple problem. (Van de Walle p.15-19)

The Before Phase: get students mentally prepared for the task, be sure the task is understood, and be certain that you have clearly established expectations beyond simply getting an answer.

The During Phase: the first and most important thing here is *let go and observe!* Give students a chance to work without your guidance. Give them an opportunity to use *their* ideas and not simply follow directions. Your second task is to listen. Find out how different children or groups are thinking, what ideas they are using, and how they are approaching the problem. In this phase hints may be provided but not solutions and students should be encouraged to test ideas.

The After Phase: this is often where some of the best learning takes place. During the after phase students share emerging ideas and the community of class learners is developed. This will not develop quickly or easily and will be developed over time.

(For a more detailed description of the three-phase problem-based learning model, see Van de Walle Teaching Student-Centered Mathematics K-3 pp 15-19)

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Begin by discussing water and where water can be found. Have the students share experience of their trips to a place with water. As students share experiences, have them include any animals

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Kindergarten Mathematics • Unit 6

they might see while on the trip. Set the scene by explaining to students about a time you went hiking to river and have them explore the possible animal combinations you may have seen.

By the riverside, a hiker saw 8 eyes and more than 9 legs. What animals could the hiker have possibly seen by the riverside?

Comment: Because this task has eyes AND legs, students need to be more organized with their thinking than with the *Old Farmer McDonald* task in a previous unit. When students are creating animal combinations allow them to be as creative as possible, as long as they can justify their answer. (Example: a student could see 2 eyes, 1 tail and no legs...if they saw a fish)

In closing, after students have explored the possible combinations and shared with classmates, ask them what the most legs the hikers could have seen might be? Have them explain their thinking.

FORMATIVE ASSESSMENT QUESTIONS

- What strategy did you use?
- What is the largest amount of animals the hiker could have seen?
- What is the smallest amount of animals the hiker could have seen?
- Could there be (1, 3, 5, 7, 9) legs seen during the hike?

DIFFERENTIATION

Extension

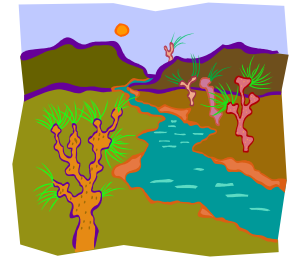
- Have students create a specific combination of animals by the riverside and play *Guess What's by the River*.
 - Example: The combination of animals by the riverside is one deer and a duck so I would tell my partner "I have 6 legs and 4 eyes by the riverside. What did I see?"
 - Example: The combination of animals by the riverside is three deer and two ducks so I would tell my partner "I have 16 legs and 10 eyes by the riverside. What did I see?" As students work through the extension ask them if they notice any patterns.

Intervention

- Print out pictures of forest animals or use animal figurines to manipulate while trying find out the correct combination of forest animals. You could also give students a specific number of animals seen on the hike which would limit the possible combinations.

By The Riverside

By the riverside, a hiker saw 8 eyes and more than 9 legs.
What animals could the hiker have possibly seen by the riverside?





PRACTICE TASK: Capturing Bears To 5&10

Time Frame: One day. However, it is strongly recommended that this activity be incorporated into center activities.

STANDARDS FOR MATHEMATICAL CONTENT

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Many games or other repeatable activities may not look like problems, but can be, nonetheless, problem-based. The determining factor is this: does this activity cause students to reflect about new or developing mathematical relationships? The following activity causes students to wrestle with the emerging idea of “*what if*”. A discussion with students who have been working with this game is just as important as the game itself. These discussions usually take place in small groups. You might sit down with a specific group to discuss what they’ve been doing, what strategies they’ve discovered or how they have approached the game in general. Try to identify the reasons behind what they are doing. These discussions can also take place during a whole

group discussion so that the class can learn from the most effective strategies. Students should journal as part of the closing to discuss their experience and how they think they played. Did they use a good strategy to play the game? (metacognition) (Van De Walle, p.26)

ESSENTIAL QUESTIONS

- How can strategies help me when playing a math game?
- What is a pattern and where can you find patterns?
- What is a strategy?
- What should I be doing when playing a math game?

MATERIALS

Game to 5

- 11 counting bears or counters
- Capturing Bears playing cards (7 cards per game)
- Capturing Bears game board

Game to 10

- 21 counting bears or counters
- Capturing Bears playing cards (1-6)
- Capturing Bears game board

GROUPING

Partners (2 players)

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I (playing with 5s)

- Place the playing cards face up in a pile, starting with 2 and alternating each card (2-1-2-1-2-1-2) Place the 11 counting bears in the mountains. Player one picks up the “2” card on the top of the pile and has the choice to either put 2 bears in their cage (5-frame) or give 2 bears to player two’s cage (5-frame).
- Player two then takes the next card on the top of the pile (#1 card) and has the choice of putting 1 bear in their cage or giving it to the other player’s cage.
- Once a player’s cage (5-frame) is full, all the bears in the full cage are cleared from the cage and moved to the van to be taken to the zoo. ***The bears in the van ARE NO LONGER IN PLAY!!!***
- The pattern continues until all 6 playing cards have been played and all 11 bears are in a cage or the van.
- The player with the most bears in their cage, not the van, after all the cards and bears have been played, is the winner.

Part II (playing with 10s)

- Place the playing cards in a pile from 1-6 with 6 being on the top. Place the 21 counting bears in the mountains. Player one picks up the number 6 card on the top of the pile and has the choice to either put 6 bears in their cage (10-frame) or give 6 bears to player two's cage (10-frame).
- Player two then takes the next card on the top of the pile (#5 card) and has the choice of putting 5 bears in their cage or giving it to their player one's cage.
- Once a player's cage (10-frame) is full, all the bears in the full cage are cleared from the cage and moved to the van to be taken to the zoo. ***The bears in the van ARE NO LONGER IN PLAY!!!***
- The pattern continues until all 6 playing cards have been played and all 21 bears are in a cage or the van.
- The player with the most bears in their cage, not the van, after all the cards and bears have been played is the winner.

Comment: In order to truly understand what strategies are required in this game, teachers are strongly encouraged to play this game with a colleague. At first this task may appear as only a counting game, however as students repeatedly engage in the task they begin to recognize that there is a great deal of strategy embedded within the activity. Students will begin to understand that whether they *take* or *give* bears, they need to continually recalculate how many bears are remaining, how many bears are still in play and how they can get close to 5 or 10 without reaching it.

Questions to engage students in the activity:

- How many bears do you need to make 5/10?
- Why did you decide to take/receive the bears? Why?
- Now that you know what you are doing this turn, what are you going to do on your next turn? Why?
- If you do give/take this turn, does that affect your next turn? How?

FORMATIVE ASSESSMENT QUESTIONS

- Why did you decide to put your bears that way?
- What were you doing while playing the game?
- Did you identify a pattern or strategy? Explain!

DIFFERENTIATION

Extension

- Mix the cards up and place them face down in an unknown order. Students will need to remember the card numbers that have been played and the number cards that are still in play and move accordingly to ensure that they have the most bears remaining in the 5/10 frame after all bears have been played.

MATHEMATICS • GRADE K • UNIT 6: Further Investigation of Addition and Subtraction

Georgia Department of Education

Dr. John D. Barge, State School Superintendent

May 2012 • Page 30 of 85

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Intervention

- The intervention in the task is in the game itself. The game demands that students use counting skills previously acquired in unit 1-4. However, within the game students will come to find that in order to consistently win they will need to add and subtract bears in advance of giving or receiving them. The game has repeated computation to calculate the future moves of the game. As an intervention, have students play in paired teams to discuss whether or not bears should be given or received.



Capturing Bears to 5

Materials:

11 counting bears or counters
Capturing bears playing cards (7 cards per game)
Capturing Bears game board

Objective: To have a greater number of bears in your 5-frame than your opponent after all 6 cards have been played.

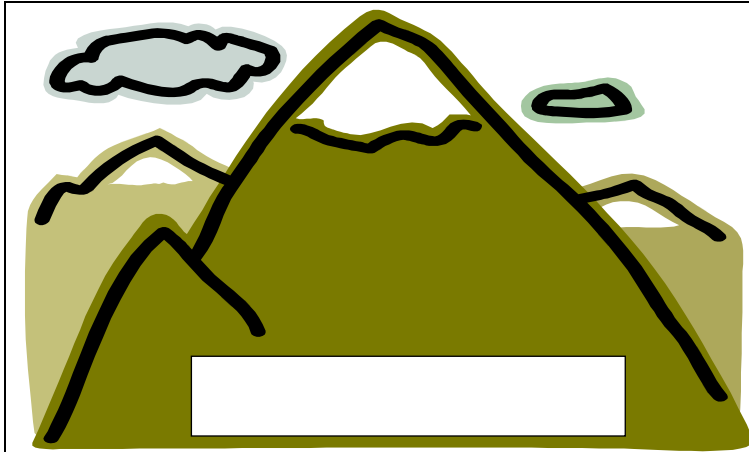
Directions:

1. Place the playing cards face up in a pile starting with 2 and alternating each card (2-1-2-1-2-1-2) Place the 11 counting bears in the mountains. Player one picks up the 2 card on the top of the pile and has the choice to either put 2 bears in their cage (5-frame) or give 2 bears to player two's cage (5-frame).
2. Player two then takes the next card on the top of the pile (#5 card) and has the choice of putting 1 bear in their cage or giving it to their player one's cage.
3. Once a player's cage (5-frame) is full, all the bears in the full cage are cleared from the cage and moved to the van to be taken to the zoo. ***The bears in the van ARE NO LONGER IN PLAY!!!***
4. The pattern continues until all 6 playing cards have been played and all 11 bears are in a cage or the van.
5. The player with the most bears in their cage after all the cards and bears have been played is the winner.

Capturing Bears to 5



Player 1 Cage	Player 2 Cage										
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Place cards here
in 2-1-2-1-2-1-2
order

2	2	2
2	2	2
1	1	1
1	1	1
2	2	2
2	2	2
1	1	1
1	1	1
2	2	2
2	2	2



Capturing Bears to 10

Materials:

21 counting bears or counters
Capturing bears playing cards (1-6)
Capturing Bears game board

Objective: To have a greater number of bears in your 10-frame than your opponent after all 6 cards have been played.

Directions:

1. Place the playing cards in a pile from 1-6 with 6 being on the top. Place the 21 counting bears in the mountains. Player one picks up the number 6 card on the top of the pile and has the choice to either put 6 bears in their cage (10-frame) or give 6 bears to player two's cage (10-frame).
2. Player two then takes the next card on the top of the pile (#5 card) and has the choice of putting 5 bears in their cage or giving it to their player one's cage.
3. Once a player's cage (10-frame) is full, all the bears in the full cage are cleared from the cage and moved to the van to be taken to the zoo. ***The bears in the van ARE NO LONGER IN PLAY!!!***
4. The pattern continues until all 6 playing cards have been played and all 21 bears are in a cage or the van.
5. The player with the most bears in their cage after all the cards and bears have been played is the winner.

Capturing Bears to 10

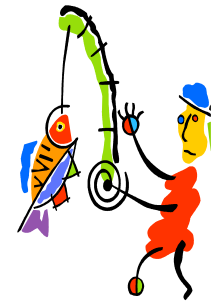


Player 1 Cage	Player 2 Cage				
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Place cards here.
6 is the top card,
counting backwards

1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6



SCAFFOLDING TASK: A Fishing Tale

Approximately 2-3 Days

STANDARDS FOR MATHEMATICAL CONTENT

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, and equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

It is extremely important to have students use story numbers, equations, drawings and models to represent their work. In the early years, story problems provide an excellent place to begin this habit. This is especially true before students have developed methods of computation. It is important to show students that explanations are needed, nearly always using words and numbers and often pictures as well. There is not a table designed for this task so that students can continue to plan and organize representations to show their work.

ESSENTIAL QUESTIONS

- How can I represent problems using objects, pictures, and numbers?
- How can I use different combinations of numbers to represent the same quantity?
- How can strategies help use solve problems?
- How can you model a math problem with objects or pictures?
- How do you know when your answer makes sense?
- What is a number relationship? How can number relationships help me?
- What happens when I decompose a quantity?

MATERIALS

- 10 connecting cubes (5 red/5 blue)
- Recording sheet

GROUPING

Whole/individual/small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I

Place the 10 connecting cubes in a bag and explain to students that you are pretending the cubes in the bag are fish and the bag is the lake. Ask for one volunteer to catch 3 fish from the bag. Ask students for their prediction as to what color fish will be caught. Have the volunteer “fish” out 3 cubes and ask the students if any of the predictions were accurate. Ask students how to show the combination of cubes using numbers, pictures, and words.

Part II

Present students with the connecting cubes and the story problem. Strongly encourage students to use numbers, pictures, and words to explain and represent their thinking. Once students have solved the problem, they should verify their combinations with another student to justify and explain their reasoning.

Comment: There are 3 different version of the task that can be presented to students. Each version of this task increases in complexity because number of people fishing increases which expands the possibilities. These story problems can also be used in sequence to scaffold learning.

Story Problem #1

Tony went fishing for redfish and bluefish. He caught a total of 5 fish. What are the possible combinations of fish that Tony could have caught? Show your thinking using numbers, pictures, and words.

Story Problem #2

Andrea and Tony went fishing for redfish and bluefish. They caught a total of 5 fish. What are the possible combinations of fish that Andrea and Tony could each have caught? Show your thinking using numbers, pictures, and words.

Story Problem #3

Shandra, Andrea, and Tony all went fishing. They caught a total of 5 fish. They caught 3 different types of fish (yellow tail tuna, bluefish and redfish). What are the possible combinations of fish that Shandra, Andrea, and Tony could have caught? Show your thinking using numbers, pictures, and words.

FORMATIVE ASSESSMENT QUESTIONS

- Are there more ways to decompose the number 5? How do you know?
- Why did you decide to do it this way?
- Are you sure that you have found them all? Why do you think so? How do you know?
- Did you develop a strategy to find your answers?
- Did you identify any patterns or rules? Explain!

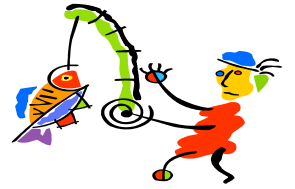
DIFFERENTIATION

Extension

- Story problem: *Shandra, Andrea, and Tony all went fishing and they each caught at least 1 fish. They caught a total of 5 fish. They caught 3 different types of fish (yellow tail tuna, bluefish and redfish). What did each of the 3 people catch?* (recording sheet included)

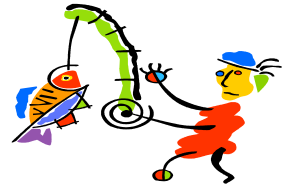
Intervention

- As intervention you could have only one person fishing and place 10 counters in a bag (5 of two different colors) and have the student “fish” them out of the bag. After the student has pulled 5 counters out of the bag, have them record their “catch”. (example: 3 blue and 2 red, or 1 blue and 4 red) Because the student is determining the different combination of 5 fish that can be caught, no combination can be repeated, however, this should be discovered and realized by the student through teacher questioning.



A Fishing Tale

Tony went fishing for redfish and bluefish. He caught a total of 5 fish. What are the possible combinations of fish that Tony could have caught? Show your thinking using numbers, pictures, and words.



A Fishing Tale

Andrea and Tony went fishing for redfish and bluefish. They caught a total of 5 fish. What are the possible combinations of fish that Andrea and Tony could each have caught? Show your thinking using numbers, pictures, and words.



A Fishing Tale

Shandra, Andrea, and Tony all went fishing. They caught a total of 5 fish. They caught 3 different types of fish (yellow tail tuna, bluefish and redfish). What are the possible combinations of fish that Shandra, Andrea, and Tony could have caught? Show your thinking using numbers, pictures, and words.



CONSTRUCTING TASK: Moving Day

Approximately 1-2 days

STANDARDS FOR MATHEMATICAL CONTENT

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Most part-part whole activities focus on a single number for the entire activity. Thus, a child or group of children working together might work on the number 7 throughout the activity. Either children build the designated quantity in two or more parts, using a wide variety of materials and formats, or else they start with the full amount and separate it into two or more parts (Van de Walle, p.48)

ESSENTIAL QUESTIONS

- Does the order of addends change the sum? Give examples to justify your thinking.

Georgia Department of Education
Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

- How can I find the total when I put two quantities together?
- How can I find what is left over when I take one quantity away from another?
- How can I represent problems using objects, pictures, and numbers?
- How can strategies help us solve problems?
- How do you know when your answer makes sense?
- What happens when I decompose a quantity?
- What happens when I join quantities together?
- What happens when some objects are taken away from a set of objects?
- What is a strategy?
- What is the difference between addition and subtraction?

MATERIALS

- *Moving Day* part-part whole mat
- Centimeter cubes another counting manipulative (quantity depends on focus number)
- Folder
- Blank white paper
- Colored pencils or crayons

GROUPING

Whole, Individual, Small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

This lesson focuses on the number *10*, however it could be repeated with every number 1-10.

Part I

Bring students to a meeting area and ask how many of them have moved or changed homes before. After allowing students to share their experiences, give each student a *Moving Day* part-part whole mat. Give each student 10 centimeter cubes. Allow the cubes to represent moving boxes for this task. Be sure that students are able to make the connection between moving boxes and the cubes and also the difference between the car and the trailer.

Ask the students some of the following questions and allow time for students to model and discuss what they did:

- *I was moving 10 boxes. I had 5 boxes in the car and the rest were in the trailer. How many were in the trailer?*
- *If I had 3 boxes in the trailer and 7 boxes in the car, how many boxes am I moving?*
- *I had 4 boxes in the trailer and I was moving 10 boxes in total. How many boxes were in the car?*
- *I was moving 10 boxes and none of them fit in the car. How many boxes were in the trailer?*

Georgia Department of Education

Common Core Georgia Performance Standards Framework

Kindergarten Mathematics • Unit 6

As students identify how many boxes there are, be sure that they explain their strategy of solving the problem (Example: counting up, subtracting from 10, etc...)

Part II

In pairs, have one student use the part-whole mat and create a situation that is shielded from the partner's view with the folder (example: 2 boxes in the car and 8 boxes in the trailer). The player then verbally shares part of the mat with the partner and the partner must identify the other part. (Example: One student says "*I have 2 boxes in the car, how many boxes are in the trailer?*" The other student then determines how many boxes are in the trailer). If the responding player identifies the correct amount of boxes, the roles change.

Part III

Give each student a piece of blank white paper and have them create a picture/situation that can be used as a part-whole mat. Have them create 3 questions to go along with their picture. They can use any accessible manipulative in the classroom in conjunction with their mat. After they have created the mat and 3 word problems, they partner with another student and share each other's mat. Each student must try and solve their partner's word problems using the mat. (Some mats can be laminated and saved as a center for ongoing practice).

FORMATIVE ASSESSMENT QUESTIONS

- Are there any more ways to decompose the number 10? How do you know?
- Why did you decide to do it this way?
- Are you sure that you have found them all? Why do you think so? How do you know?
- Did you develop a strategy to find your answers?
- Did you identify any patterns or rules? Explain!

DIFFERENTIATION

Extension

- Instead of using 10 counting objects as boxes, the students can explore number relationships to 20 by increasing the number of manipulatives.

Intervention

- Allow students to work with smaller numbers within 5 so that they can practice using efficient strategies to solve the problems. Counting strategies are efficient at this stage, but will become inefficient and distracting as numbers get larger. As students begin to understand the relationships among numbers, they will begin learning number facts at a recall level (Carpenter et al. 1999).

Moving Day

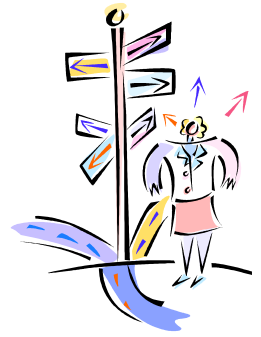




Moving Day

Name: _____

Boxes in the car	Boxes in the trailer	Boxes being moved



PRACTICE TASK: How Many Ways To Get To 10?

Approximately 2-3 days

STANDARDS FOR MATHEMATICAL CONTENT

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental image, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Reading and writing the combinations serve as a means of encouraging reflective thought focused on part whole relationship. Writing can be done in the form of drawings, numbers written in the blanks (____ and ____), or addition equations. There is a clear connection between part-part-whole concepts and addition and subtraction ideas.

ESSENTIAL QUESTIONS

- Can patterns be found in numbers?
- Can you describe the patterns you find?

Georgia Department of Education
Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

- Are some patterns the same?
- How are the number patterns different?
- How can I prove that groups are equal?
- How can I use different combinations of numbers to represent the same quantity?
- What is a number relationship? How can number relationships help me?
- What is a pattern and where can you find patterns?
- Why is it important that I can build the number combinations for the number 5? 10?

MATERIALS

- *12 Ways to Get to 11*, by Eve Merriam, or a similar book
- Eleven 2 colored (red/yellow) counters per student
- *How Many Ways to get to 10?* Recording sheet

GROUPING

Whole, Individual, Small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Comment: This task will take place over 2 days. Many students are unaware that the total number of paired combinations to make a number is one more than the number itself. *Example: there are 3 paired combinations to make the number 2 (0+2, 2+0, and 1+1) and 6 paired combinations for the number 5 (5+0, 0+5, 3+2, 2+3, 4+1, 1+4).* This task will allow students to develop this generalization for number combinations. It is extremely important that the students recognize this generalization and that it is not pointed out by the teacher.

Part I

Gather students together in a meeting place. Give each student 11 counters and begin reading the story, *12 Ways to Get to 11*, by Eve Merriam. As the story is read, have the students separate their counters into a model that reflects what is happening in the story. After each page, stop, discuss, and record the numerals for the combinations on chart paper or the board. (Example: if there were 9 pinecones and 2 acorns, the students would model a pile of 9 and 2. The teacher would record *9 and 2* on the chart paper after verifying that students were correct.

Comment: it is important to note that some combinations in the story will have greater than 2 addends which should be recorded as *3 and 3 and 3 and 1 and 1*. The important part is that students are able to recognize that 11 can be decomposed into smaller units.

Part II

From the 11 counters that students have, ask them to gather 10. In pairs, have students explore all the possible combinations of 2 numbers when combined to make 10. Have students record their responses on the *How Many Ways to Get to 10?* recording sheet.

Georgia Department of Education
Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

Comment: there are more squares than possible combinations. This is so students will need to justify and explain how they know they have found all of the possible combinations.

As students work through the task, observe the strategies they are using to find the combinations for 10. Once partners have justified that they have found all the possible combinations to 10, as a group, have students share their number combinations and the strategies they used.

Number combinations to 10:

0 and 10 10 and 0 1 and 9 9 and 1 8 and 2 2 and 8 3 and 7
7 and 3 6 and 4 4 and 6 5 and 5

Part III

In their math journal, have students explore and record all the number combinations for the numbers 1-10. As students explore and identify all the possible number combinations, have record them on the board or chart paper. At this point in the year, some students will be independently able to organize and complete Part III and all students should be encouraged to do so.

Number	1	2	3	4	5	6	7	8	9	10
Number Combinations	2	3	4	5	6	7	8	9	10	11

Have a discussion with students about the pattern they see between the number itself and the total number of combinations for that number. Ask why this information is important and how it can help them going forward.

FORMATIVE ASSESSMENT QUESTIONS

- Are there any more ways to decompose the number 10? How do you know?
- Why did you decide to do it this way?
- Are you sure that you have found them all? Why do you think so? How do you know?
- Did you develop a strategy to find your answers?
- Did you identify any patterns or rules? Explain!

DIFFERENTIATION

Extension

- Have students pick a number from 11-19 and test their generalization. Ask how many combinations of number pairs there are for 16, 19, and 100. Do the students immediately apply the generalization rule they just invented?

Intervention

- Give students a set of playing cards, Ace through 10, of two different colored suits. (hearts and spades, for example) Have them combine a red card with a black card to make the number 10. One a double ten frame, make one 10-frame represent the red cards and the other represent the black cards.



How Many Ways to get to 10?

Name: _____

_____ and _____

_____ and _____

_____ and _____

_____ and _____

_____ and _____

_____ and _____

_____ and _____

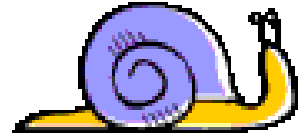
_____ and _____

_____ and _____

_____ and _____

_____ and _____

_____ and _____



PRACTICE TASK: A DAY AT THE BEACH Approximately 1-2 Days

STANDARDS FOR MATHEMATICAL CONTENT

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Reading and writing the combinations serve as a means of encouraging reflective thought focused on part-whole relationships. Writing can be done in the form of drawings, numbers written in the blanks (____ and ____), or addition equations. There is a clear connection between part-part-whole concepts and addition and subtraction ideas.

ESSENTIAL QUESTIONS

- Can patterns be found in numbers?
- Can you describe the patterns you find?

Georgia Department of Education
Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

- Are some patterns the same?
- How are the number patterns different?
- How can I prove that groups are equal?
- What is a number relationship? How can number relationships help me?
- What is a pattern and where can you find patterns?
- What is a strategy?
- Why do we use mathematical symbols?
- Why is it important that I can build the number combinations for the number 5? 10?

MATERIALS

- *One Is a Snail, Ten Is a Crab*, by April Pulley Sayre and Jeff Sayre, or similar book
- Recording sheet
- Accessible manipulatives

GROUPING

Whole group/Individual

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I

Gather the students together to read *One is a Snail, Ten is a Crab*, by April Pulley Sayre and Jeff Sayre. As you read the story, chart the different quantities of feet on each creature.

Part II

Using the chart created in Part I, allow students to explore the different combinations of creatures to find numbers to ten. Have the students record their findings on the recording sheet. Gather students together to chart all of their combinations to ten, finding all of the different combinations to ten.

Part III

Group the students in pairs to play the *A Day At The Beach* riddle game. Have player one describe a number by only naming the creatures. Player two then finds the total number of legs possible by listening to the names of the different types of creatures.

FORMATIVE ASSESSMENT QUESTIONS

- Are there any more ways to decompose the number 10? How do you know?
- Why did you decide to do it this way?
- Are you sure that you have found them all? Why do you think so? How do you know?
- Did you develop a shortcut to find your answers?
- Did you identify any patterns or rules? Explain!

- What is the most/fewest amount of creatures that could be on the beach?

DIFFERENTIATION

Extension

- Have students create several different combinations of creatures to represent a specific number.

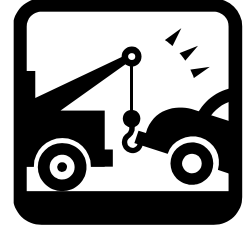
Intervention

- Print out pictures for the students to use and manipulate to find the correct combination of creatures.



A Day at the Beach

There were 10 feet at the beach. What creatures could have been at the beach?
Show your thinking using numerals, pictures, and words.



PRACTICE TASK: At the Mechanic

Approximately 1-2 days

STANDARDS FOR MATHEMATICAL CONTENT

- MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.
- MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.
- MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).
- MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.
- MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

In developing the meaning of operations, teachers should ensure that students repeatedly encounter situations in which the same numbers appear in different contexts. For example, the numbers 3, 4, and 7 may appear in problem-solving situations that could be represented by $4 + 3$, or $3 + 4$, or $7 - 3$, or $7 - 4$. Although different students may initially use quite different ways of thinking to solve problems, teachers should help students recognize that solving one kind of problem is related to solving another kind. Recognizing the inverse relationship between addition and subtraction can allow students to be flexible in using strategies to solve problems (NCTM Principles and Standards, 2012).

ESSENTIAL QUESTIONS

- Can patterns be found in numbers?
- Can you describe the patterns you find?

MATHEMATICS • GRADE K • UNIT 6: Further Investigation of Addition and Subtraction

Georgia Department of Education

Dr. John D. Barge, State School Superintendent

May 2012 • Page 59 of 85

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Georgia Department of Education
Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6

- Are some patterns the same?
- How are the number patterns different?
- How can I prove that groups are equal?
- What is a number relationship? How can number relationships help me?
- What is a pattern and where can you find patterns?
- What is a strategy?
- Why do we use mathematical symbols?
- Why is it important that I can build the number combinations for the number 5? 10?

MATERIALS

- *At the Mechanic* recording sheet
- *At the Mechanic* playing cards
- Index cards
- Ten-frame
- Red/Yellow counters
- Rekenrek

GROUPING

Individual, Small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I

Gather students in a meeting area to discuss cars and what happens to cars when they break down. Where do they go? Who fixes them? One at a time, share the following 3 equations with students:

$$4 = 2+1$$

$$3+1 = 1+3$$

$$2+3 = 5-1$$

With each number sentence, ask the students to share their observations. Is the number sentence correct? If not, what is wrong with it? What do we need to do to fix it?

PART II

In partners, students place all the cards in a pile, face down. Player 1 takes the top card from the pile and verifies whether the equation is correct and whether both sides are equal.

The player must first mentally state whether the equation is accurate and justify their reasoning. Player 1 verifies their prediction by using a ten frame with red/yellow counters or with the Rekenrek or another manipulative. If the equation is correct, the turn is over and the car doesn't need to be fixed. Player 2 turns over the top card and proceeds to fix the car if it is needed.

Georgia Department of Education

Common Core Georgia Performance Standards Framework

Kindergarten Mathematics • Unit 6

If the equation is inaccurate, then player 1 records the equation on the recording sheet and circles the side of the equation that they plan to fix. On the other side of the mechanic shop, player 1 must “fix” the broken car with a pictorial and numeral representation to make it work. **ONLY ONE NUMBER CAN BE FIXED ON THE CAR**, however, it doesn’t matter which one.

After player 1 has justified the answer and recorded it on the task sheet, Player 2 inspects the fixed car to make sure it is correct. If player 2 spots something wrong with the corrected car, they let the mechanic know, but don’t tell them what is wrong. Player 1 must attempt to fix the car again. Once the car is fixed, the roles are reversed and Player 2 pulls the top card.

The first mechanic to fix 5 cars wins.

PART III

Have the partners sort the cars into 2 piles: cars that are broken and cars that don’t need to be fixed. Next, have the students create 3 number sentences that are incorrect and trade them with their partner to fix.

FORMATIVE ASSESSMENT QUESTIONS

- What side of the car needed fixing? What was wrong with it? How do you plan to fix it?
- When you were inspecting the car, what were you looking for?
- Did you have a strategy for making the car balance?

DIFFERENTIATION

Extension

- Create equations with combinations to 10 (Example $8+1 = 9-2$) for students to repair. Do not tell students what side of the car to fix, but they must fix the side that has a lower total to match the side that has the greater total of the two sides.

Intervention

- Create equations where one side of the equation is only one number (Example $4 = 1+2$). This will allow the students to focus on the combinations from only one side.
- Allow the students to fix both numbers on one side of the equation, as long as it is not the exact same as the other side.

At the Mechanic

Broken Car → → → → →
$5+1 = 2+6$

The Mechanic



→ → → → → Repaired Car
● ● ● ● ● + ● = ● ● + ● ● ● ●

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Kindergarten Mathematics • Unit 6



$$3+2 = 4+0$$



$$3 = 2+1+1$$



$$5 = 4-1$$



$$4-2 = 1+3$$



$$4 = 4+0$$



$$1 = 4-3$$



$$3+2 = 2+1$$



$$3+2 = 2-1$$



$$3-2 = 2+0$$

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Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6



$$3-3 = 1+0$$



$$0+0 = 4-4$$



$$3+2 = 0+5$$



$$2+1 = 4+0$$



$$1+2 = 3+2$$



$$4 = 1+2$$



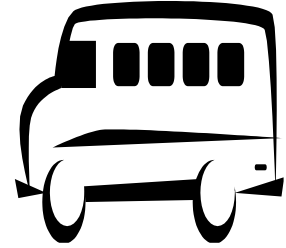
$$3+2 = 4+0$$



$$3+2 = 4+0$$



$$3+2 = 4+0$$



Constructing Task: Field Trip for Fives

Approximately 1 day

STANDARDS FOR MATHEMATICAL CONTENT

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Numbers are related to each other through a variety of number relationships. The number 7, for example, is 3 more than 4, two less than 9, composed of 3 and 4 as well as 2 and 5, is three away from 10, and can be quickly recognized in several patterned arrangements of dots. These ideas further extend to an understanding of 17, 99, and beyond. Number concepts are intimately tied to the world around us. Application of number relationships to the real world marks the beginning of making sense of the world in a mathematical manner (Van de Walle, 2010).

ESSENTIAL QUESTIONS

- How can I prove that groups are equal?
- How can you model a math problem?
- How can I use different combinations of numbers to represent the same quantity?
- What is a number relationship? How can number relationships help me?
- What is a strategy?
- Why do we use mathematical symbols?

MATERIALS

- *Field Trip for Fives* Recording Sheet
- *Field Trip for Fives* work mat
- Colored counters or linking cubes to match the teams

GROUPING

Whole group and partner task

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Part I

Bring the students to a meeting place. Ask the students to get themselves into groups of 3. Do not interfere with the process. After students have successfully arranged themselves into groups of 3, ask them how many full groups of just boys and just girls could be made. How many boys/girls are in a mixed group of boys and girls? Ask students for number sentences and record suggestions to on the board. (Example: a group of all girls would be 3 girls plus 0 boys is 3 students, $3+0=3$, or 2 girls and 1 boy would be represented as $2+1=3$). From groups of 3, ask the students to get into groups of 4 and repeat the same questions.

After students have acted out the problem, they can use colored cubes to represent the boys and girls in the classroom and have them represent the groups with cubes. For example, if there are 21 students (8 boys and 13 girls), have 8 blue cubes for boys and 13 yellow cubes for girls.

Part II

In partners, have students solve the *Field Trip for Fives* story problem. Ms. Redstone's kindergarten class was going on a field trip. She divided her students up into teams for the parent volunteers. Each parent can take no more than 5 students in their car, so Ms. Redstone needs to rearrange the students into groups of 5. Give each student the *Field Trip for Fives* recording sheet. Discuss the table and allow students to make observations and compare teams. Have students identify the correct number of students on each team and have them collect the corresponding number of counters. Using the work mat, students can manipulate their colored counters to solve the story problem. The recording sheet explains how many students are in each group.

FORMATIVE ASSESSMENT QUESTIONS

- How many from students from each team rode in each van?
- What strategy did you use to solve the problem?
- Were there any teams that didn't need to be split up?
- How many vans did you use? Could you have used less?
- How do you know that you counted correctly?

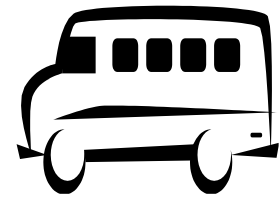
DIFFERENTIATION

Extension

- Have the students solve a new story problem with a different amount of students in each van. Example: The class has 24 students. How many vans would Ms. Redstone need if six students can fit on each van?

Intervention

- Have the students solve the problem using fewer teams, students and vans. Example: Ms. Redstone has 15 students, three vans and 4 teams. How many students can fit on each van? The blue team has 5 students, the red team has 3 students, the green team has 3 students, and the yellow team has 4 students.



Field Trip for Fives

Ms. Redstone's Class Teams									
Blue Team									
Red Team									
Green Team									
Yellow Team									
Purple Team									

If no more than 5 students can ride in a van, how could Ms. Redstone arrange her teams into groups of 5 for the van ride?

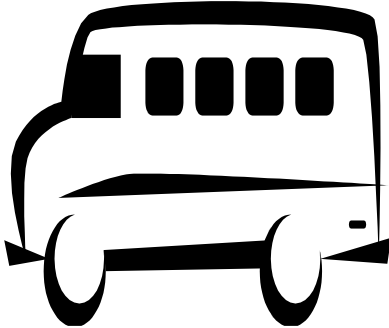
Option 1

	Blue	Red	Green	Yellow	Purple	Total
Van #1						
Van #2						
Van #3						
Van #4						
Van #5						

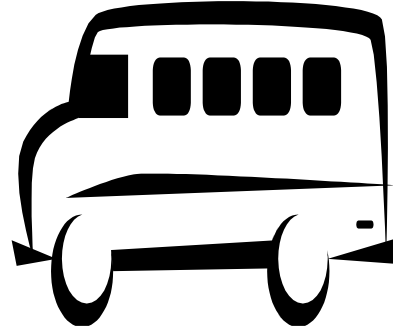
Option 2

	Blue	Red	Green	Yellow	Purple	Total
Van #1						
Van #2						
Van #3						
Van #4						
Van #5						

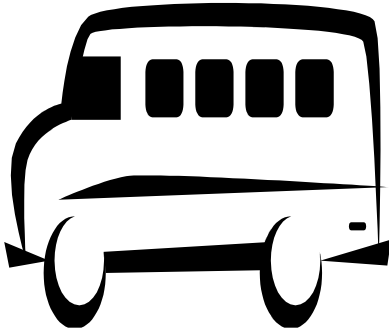
Field Trip for Fives Work Mat



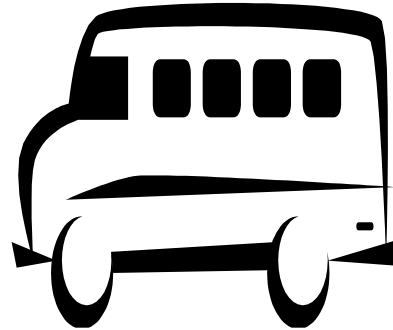
Van #1



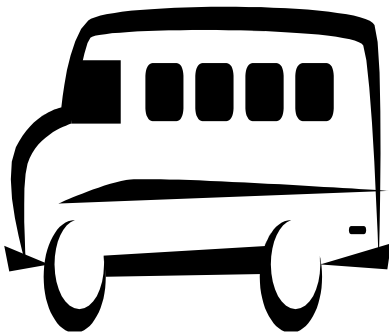
Van #2



Van #3



Van #4



Van #5

Assign each team member a van. There can be no more than 5 students in a van. Remember to keep the teams together as much as possible



PERFORMANCE TASK: The Magic Pot

Approximately 1-2 days

STANDARDS FOR MATHEMATICAL CONTENT

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Identifying and extending patterns is an important process in algebraic thinking. When possible, patterning activities should involve some form of physical concrete manipulative. ***When patterns are built with material and not on paper, children are able to test a hypothesis or the extension of the pattern and make changes without fear of being wrong.*** Using concrete manipulatives allows students to engage in growing patterns as opposed to just repeating patterns because testing is able to take place. (Van de Walle p. 276)

ESSENTIAL QUESTIONS

- Can patterns be found in numbers?
- Can you describe the patterns you find?
- Are some patterns the same?
- How are the number patterns different?
- How can I prove that groups are equal?
- How can you model a math problem?
- What is a number relationship? How can number relationships help me?
- What is a pattern and where can you find patterns?
- What is a strategy?
- Why do we use mathematical symbols?
- Why is it important that I can build the number combinations for the number 5? 10?

MATERIALS

- *The Magic Pot* work mat
- 20 counters per student
- Double ten-frame or Rekenrek
- 0-99 chart
- 10-sided dice or spinners (0-9)

GROUPING

Individual, Small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Comment: *Two of Everything*, is a story about an old couple that finds a magic pot. Everything that goes into the pot is doubled. Although the book is about doubling in particular, this task asks students to focus on the number relationship between what goes in the pot, and what comes out.

Part I

Come together at a meeting place and read *Two of Everything*, by Lil Toy Hong, or a similar book. As you are reading the story, have students make predictions about what will happen. Discuss/review the rule of doubling and what double means (if it hasn't already been discussed). Give students *The Magic Pot* work mat and double ten-frame and provide students an opportunity to explore doubling numbers 0-10. Allow students to time to share strategies for combining doubles.

Comment: Students can develop and refine strategies as they hear other students' descriptions of their thinking about number combinations. For example, a student might compute $8 + 8$ by

Georgia Department of Education

Common Core Georgia Performance Standards Framework

Kindergarten Mathematics • Unit 6

counting on from 8: "..., 9, 10, 11, 12, 13, 14, 15, 16." But during a class discussion of solutions for this problem, she might hear another student's strategy, in which he uses knowledge about 10; namely, 8 and 2 make 10, and 6 more is 16 (NCTM Principles and Standards, 2012).

Part II (Race to 100)

In partners, each player places a counter in the "0" square on the hundreds board. Students take turns rolling a ten-sided dice or spinner and doubling the amount. The students must mentally solve the addition sentence and share the answer with their partner. The partner verifies that the answer given is correct using the double ten-frame or Rekenrek. If the answer is correct, the player moves their chip that many spaces on the number board. If the player is incorrect, they do not move and lose their turn. The first player to go past 99 and off the board wins.

Part III

Be sure each student has their Magic Pot work mat. Present students with the following set of 3 numbers in sequence and have students model using the mat:

- Say "2 went in the pot and 4 came out of the pot. What's the rule?" (take and record suggestions)
 - Have students model using the mat. (initiate class discussion for students to share their predictions of the rule and they will almost immediately relate back to doubles)
- Say "4 went in the pot (take predictions) and 6 came out of the pot. What's the rule?" (take and record suggestions)
 - Have students model and discuss what they think the rule is based on the number relationships they see.
- Say "10 went in the pot and 12 came out of the pot. What's the rule?" (take and record suggestions)
 - Have students model and discuss what they think the rule is based on the number relationships they see.

Using the recording sheet, have students create an example of the rule being used and record it on their recording sheet. The student's example must be modeled with different combinations than those used on the *Magic Pot* card. There are only 7 (a- g) rows on the chart and 8 *Magic Pot* cards. Have students problem solve where they can record the 8th card (h). (back of sheet or journal)

The rule	In the pot	Out of the pot
2 more	6	6 and 2 more is 8 Or $6+2=8$

Georgia Department of Education

Common Core Georgia Performance Standards Framework

Kindergarten Mathematics • Unit 6

After students are familiar with identifying the magic pot's rule, place the Magic Pot playing cards around the classroom and have students identify the rule for the other pots and create an example of how it works.

Part IV (Race to 100 revisited)

The only difference from *Race to 100* in Part II is that students get to choose the rule for moving (doubles, plus 5, etc...) In partners, each player places a counter in the "0" square on the hundreds board. Students take turns rolling a ten-sided dice or spinner and using the rule they created. The students must mentally solve the addition sentence and share the answer with their partner. The partner verifies that the answer given is correct using the double ten-frame or Rekenrek. If the answer is correct the player moves their chip that many spaces on the number board. If the player is incorrect, they do not move and lose their turn. The first player to go past 99 and off the board wins.

FORMATIVE ASSESSMENT QUESTIONS

- What strategy are you using to solve the problem?
- How are you comparing numbers?
- Can you suggest some numbers that could be included in this pot?
- According to your rule, if I put ____ in, what would come out of the pot?
- According to your rule, if I took ____ out of the pot, what did I put in the pot?

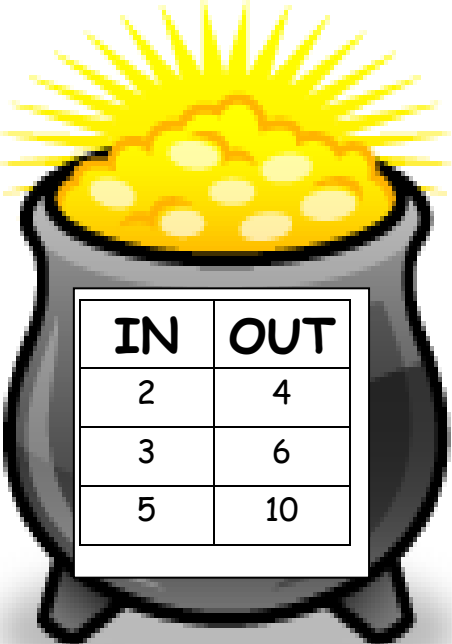
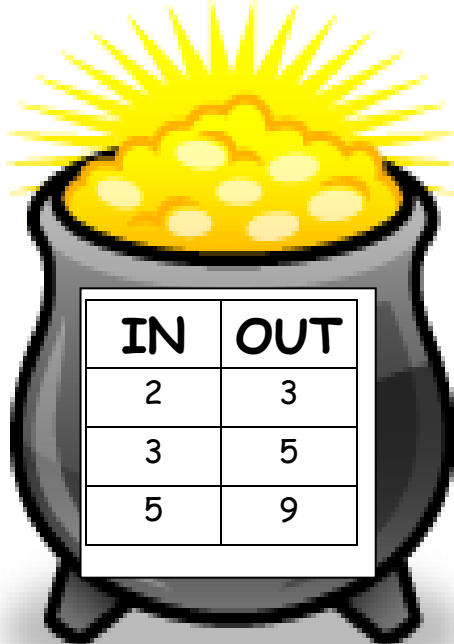
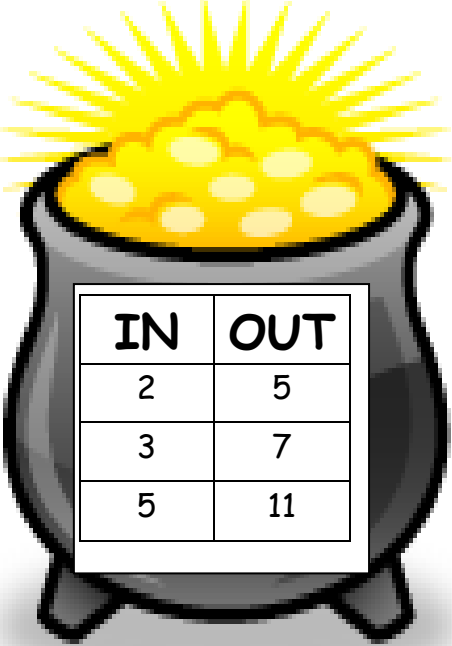
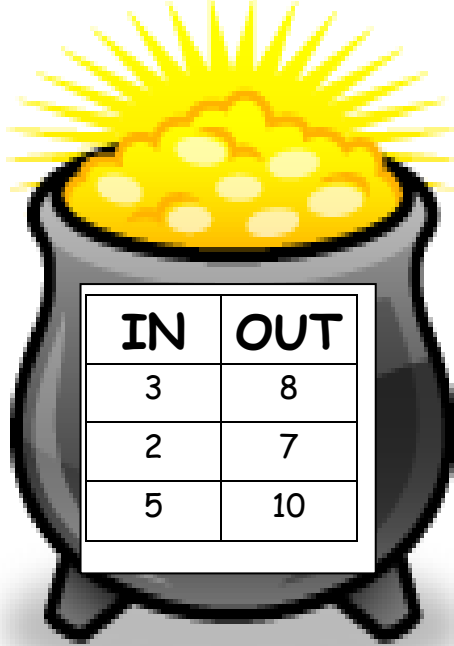
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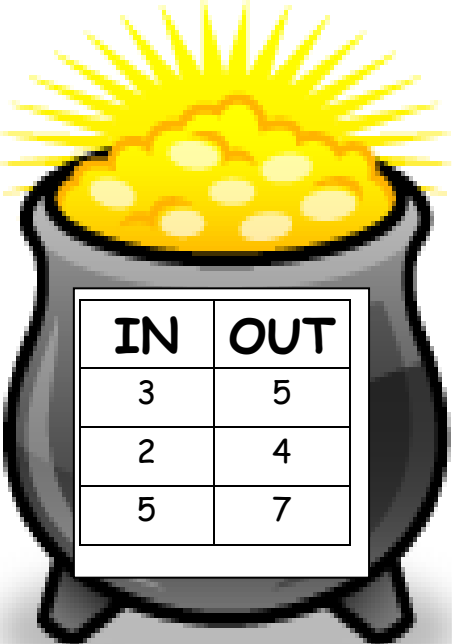
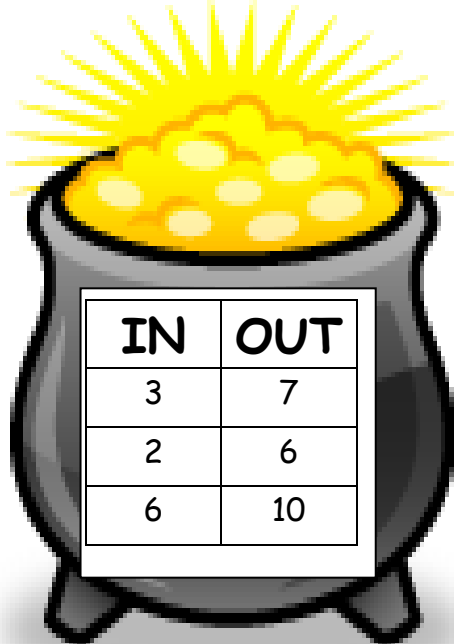
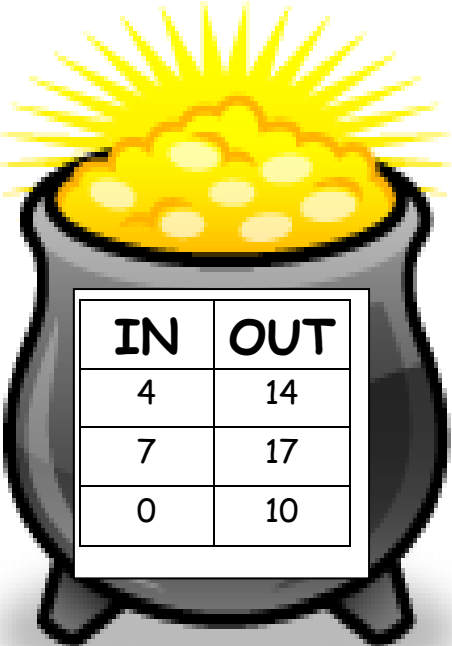
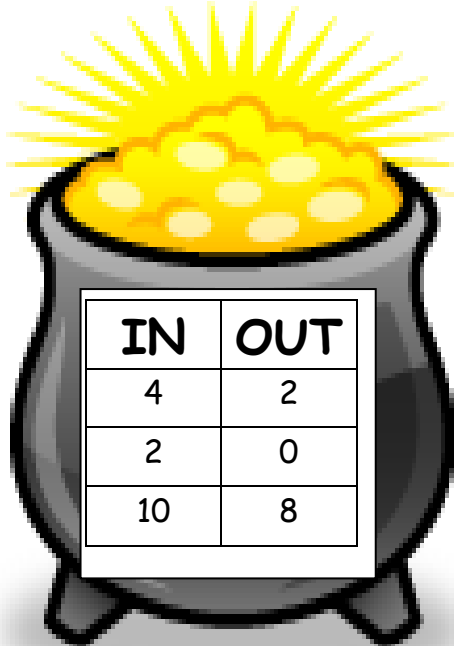
Extension

- Create Magic Pots where the number relationship between the *in* and *out* rule are greater in difference and more algebraic. Be sure that students have continued access to manipulatives to model the relationship.

Intervention

- In both versions of *Race to 100*, students can play *Race to 50* and use a 6-sided die for the applied rule.
- If the student is having difficulty navigating the 0-99 chart, cut the 0-99 chart up into strips by the rows of 10 and glue them together to make a straight number line.

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Georgia Department of Education
Common Core Georgia Performance Standards Framework
Kindergarten Mathematics • Unit 6
The Magic Pot

Put into the pot	Take out of the pot
	
	
	



The Magic Pot

Name: _____

	The rule	In the pot	Out of the pot
	1 more	4	$4 + 1 = 5$
a			
b			
c			
d			
e			
f			
g			



PERFORMANCE TASK: Equally Balancing Numbers

Approximately 2-3 days

STANDARDS FOR MATHEMATICAL CONTENT

MCCK.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

MCCK.OA.5 Fluently add and subtract within 5

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Numbers are related to each other through a variety of number relationships. The number 7, for example, is 3 more than 4, two less than 9, composed of 3 and 4 as well as 2 and 5, is three away from 10, and can be quickly recognized in several patterned arrangements of dots. These ideas further extend to an understanding of 17, 99, and beyond. Number concepts are intimately tied to the world around us. Application of number relationships to the real world marks the beginning of making sense of the world in a mathematical manner (Van de Walle, 2010).

ESSENTIAL QUESTIONS

- Can patterns be found in numbers?
- Can you describe the patterns you find?
- Are some patterns the same?
- How are the number patterns different?
- How can I prove that groups are equal?
- How can I use different combinations of numbers to represent the same quantity?
- How can strategies help me when playing a math game?
- What is a number relationship? How can number relationships help me?
- What is a pattern and where can you find patterns?
- What is a strategy?
- What should I be doing when playing a math game?
- Why do we use mathematical symbols?
- Why is it important that I can build the number combinations for the number 5? 10?

MATERIALS

- Pattern blocks
- *Shaping 10* recording sheet
Balancing Act Work Mat
- *Equally Balancing Numbers* recording sheet.
- *Shaping 5* recording sheet

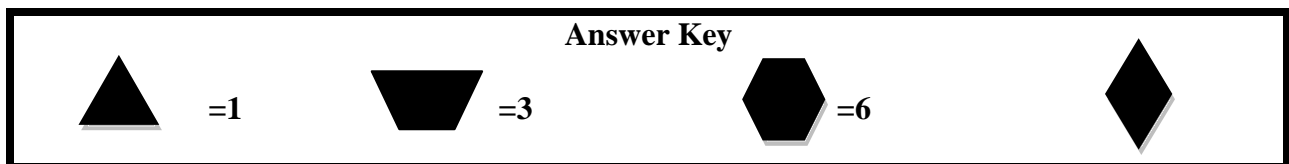
GROUPING

Individual, Small group task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I

Give each student some pattern blocks and pose the question “if a triangle is the same as 1, what are all the other pieces equal to? Be sure to use the terms “*equal*” and “*the same as*” interchangeably so that students can continue to build meaning of the *equal* symbol. Record the value of the triangle, along with a picture of a triangle, on chart paper. Have students explore the value of each shape and record a value key for students to refer to throughout the remaining part of the task. As students identify the value of each shape, have students justify their reasoning for each value.



Part II

After students have assigned the values to each shape, have students identify all of the possible ways a value of 6 can be represented. As students work through this part of the task, observe how students verify their combinations.

Possible combinations of how six can be modeled:

$\triangle\triangle\triangle\triangle\triangle\triangle=6$	$\diamond\diamond\diamond=6$	$6= \triangle\diamond \square$
$\triangle\triangle\diamond\diamond=6$	$6=\square\square$	$6= \text{hexagon}$

Part III (Shaping 10)

Ask students how they could model the number “8” using their pattern blocks. As students identify the possible combinations of pattern blocks that are equal to 8, have them justify and share their combination using a number sentence. (Example: the student that made 8 using $\triangle\triangle\diamond\diamond$ would say “ I used 2 triangles and 3 rhombi to make 8 so I know that $8 = 1+1+2+2+2$ ”. Be sure to use equals and the same as interchangeably.

Hand out the *Shaping 10* recording sheet to students. Have them make the number 10 with the pattern blocks and record 4 ways they made a 10 on their recording sheet. Students must also identify the fewest number of blocks that could be used to make 10.

Part IV

Provide the students with the *Balancing Act* work mat and explain that each side of the balance needs to be *the same as* or *equal* to one another. Continue to use “*the same as*” and “*equal*” interchangeably throughout the lesson. Place a hexagon on side “A” and ask the students to identify all the pattern block combinations for side “B” that could make the balance equal. Allow students time to explore the balance. Give the students suggestions or increase the difficulty by narrowing down the possibilities. Example: Side “A” is a hexagon and side “B” has three pieces with one being a trapezoid.

- *What two shapes are missing from side “B” to make the balance equal?*
- *What if there was only 1 rhombus on side B? What could it look like?*
- *What is the most or least number of shapes you could use?*

Give the students another number to explore using the balance. After students have had ample time exploring the balance, provide the students with the *Equally Balancing Numbers* recording sheet. Have students individually work through the task and verify their thinking on the balance. Students should draw the missing shape(s) in the side “B” square and use numerals to show their thinking.

After students have solved the Balancing 10 task, have them create a balance riddle on the back of their recording form and share it with a partner.

Part V

Refer students back to the value of each shape and present students with the *Shaping 5* task.

Raul wanted to use the pattern blocks to show all the combinations of 2 numbers that could be used to make the number 5.

1. Can Raul show all the different combinations of 2 numbers that make 5 with the pattern blocks?
2. What combinations can Raul show using the pattern blocks?
3. Which combinations can Raul not make with pattern blocks?
4. Invent any new pattern blocks that could represent the numbers Raul would need to show all the combinations to 5. Invent and trace your shape below.

In this task students will be asked to identify the paired combinations of blocks that when combined make 5. The only two combinations are 3&2 and 2&3. Students will need to recognize that a pattern block with a value of 4 and 5 are missing to make all of the facts. Students must invent two pattern blocks (one with a value of 4 and the other a value of 5).

Have the students share their pattern block invention and the combinations of smaller shapes they used to compose a larger shape. As class vote on the class' favorite and graph the data. Create and laminate multiple copies of the new shape that can be used as a center and extension.

FORMATIVE ASSESSMENT QUESTIONS

- How can you verify that the shapes are equal?
- Is there another word we can use for “equal”?
- Is there another word we can use for “the same as”?
- What is your strategy to make combinations to ____?
- Why could you not use this shape? (pick up a shape they are not using)
- How do you know we have found all the combinations to 6/10/5?
- How can you justify what block could be missing?
- How can you identify what combinations are missing?
- What do you know about a pattern block you are creating?

DIFFERENTIATION

Extension

- Tell students that the value of the triangle is now 2 and see how they go about changing their answers. Were the students able to identify a strategy to efficiently increase the value of the triangle to 2?

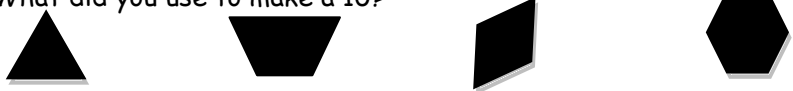
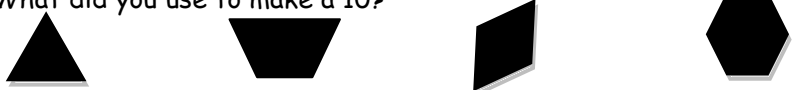
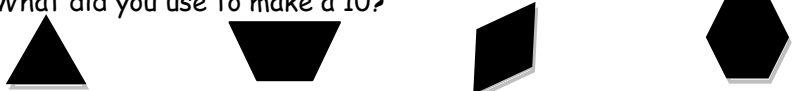
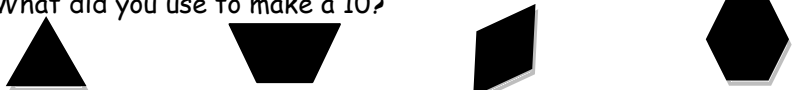
Intervention

- With tape and a marker, identify the value of each pattern block by writing it on the tape and sticking it to the block. Dots or numerals can be recorded on the pattern blocks to identify its value.

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 Kindergarten Mathematics • Unit 6

Shaping 10

name: _____

<p>What did you use to make a 10?</p>  <p>_____</p>	<p>Show your thinking with numerals...</p>
<p>What did you use to make a 10?</p>  <p>_____</p>	<p>Show your thinking with numerals...</p>
<p>What did you use to make a 10?</p>  <p>_____</p>	<p>Show your thinking with numerals...</p>
<p>What did you use to make a 10?</p>  <p>_____</p>	<p>Show your thinking with numerals...</p>

What is the fewest blocks that can be used to make a 10? Explain your thinking by using pictures AND numerals.
You may use the back of this paper to show your thinking.

Balancing Act Work Mat

Verify that both sides of the balance scale are equal. Side "A" and "B" need to be the same as each other.

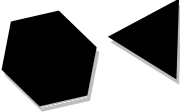
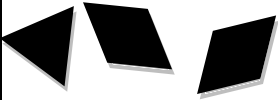
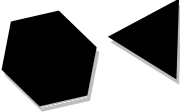
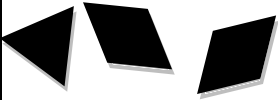
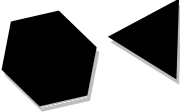
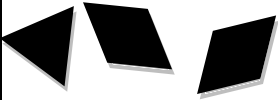






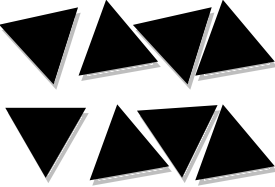

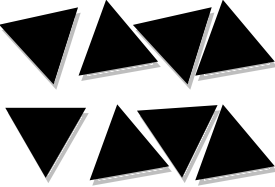



Side A

Side B



Equally Balancing Numbers

Draw the missing shape(s) in side "B" to make both sides equal	Justify with numerals				
<p>Add the shape that is missing from side "B"</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; padding: 5px;">Side A</th> <th style="width: 50%; padding: 5px;">Side B</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 10px;">  </td> <td style="text-align: center; padding: 10px;">  </td> </tr> </tbody> </table>	Side A	Side B			
Side A	Side B				
					
<p>Add the 5 shapes to side B. 4 shapes are equal</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; padding: 5px;">Side A</th> <th style="width: 50%; padding: 5px;">Side B</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 10px;">  </td> <td style="text-align: center; padding: 10px;"></td> </tr> </tbody> </table>	Side A	Side B			
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<p>Side "B" has NO triangles</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; padding: 5px;">Side A</th> <th style="width: 50%; padding: 5px;">Side B</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 10px;">  </td> <td style="text-align: center; padding: 10px;"></td> </tr> </tbody> </table>	Side A	Side B			
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