Grade 4 Operations and Algebraic Thinking Unit of Instruction

This is a progressive unit of instruction using the Concrete-Representational-Abstract (CRA) Instructional Model. CRA is a three-part instructional model that begins by using concrete materials, then progresses to representational pictures, and finally abstract notation. This unit is not intended to replace your district's curriculum, but rather it serves to support the teaching and learning of the fourth grade operations and algebraic thinking standards. In this unit, students will begin by investigating the standards while using manipulatives to explore the concepts. Then, students will represent their learning through pictures, visuals and drawings. Finally, students will demonstrate their understanding through abstract notation and algorithms. This unit of study will cover the following standards MAFS.4.OA.1.1, MAFS.4.OA.1.2, MAFS.4.OA.1.3, MAFS.4.OA.1.a, MAFS.4.OA.1.b, MAFS.4.OA.2.4 and MAFS.4.OA.3.5.

The unit begins with a list of resources and tools to assist in teaching operations and algebraic thinking. Then, each of the grade four operations and algebraic thinking standards is listed along with aligned instructional resources and formative assessments. The component of CRA is identified for each of the resources and formative assessments. The resources presented in this document may only cover portions of the aligned standard and represent a small sample of those available on CPALMS.

The Mathematical Practices are habits of mind that describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. The Mathematical Practices should be infused during the course and will be assessed throughout the Grade 4 Mathematics FSA. More information about each Mathematical Practice can be found by clicking on the links below.

MAFS.K12.MP.1.1 Make sense of problems and persevere in solving them.
MAFS.K12.MP.2.1 Reason abstractly and quantitatively.
MAFS.K12.MP.3.1 Construct viable arguments and critique the reasoning of others.
MAFS.K12.MP.4.1 Model with mathematics.
MAFS.K12.MP.5.1 Use appropriate tools strategically.
MAFS.K12.MP.6.1 Attend to precision.
MAFS.K12.MP.7.1 Look for and make use of structure.
MAFS.K12.MP.8.1 Look for and express regularity in repeated reasoning.

Operations and Algebraic Thinking

A bibliography of children's literature with a focus on operations and algebraic thinking is provided. These books can be integrated into the lessons to connect mathematics and literature.	1. *The Best of Times,* Greg Tang 2. *Counting on Frank,* Rod Clement 3. *Divide and Ride,* Stuart Murphy 4. *Great Estimations,* Bruce Goldstone 5. *Math Attack!,* Joan Horton & Krysten Brooker 6. *One Hundred Hungry Ants,* Elinor J. Pinczes 7. *A Remainder of One,* Elinor J. Pinczes 8. *Ten Times Better,* Richard Michelson 9. *7 x 9 = Trouble,* Claudia Mills
4th Grade Mathematics Course Description	Course descriptions provide an overview for a course and designate which standards are in that course. The course description includes resources for all 44 standards within the 4th grade mathematics course.
Hip, Hip, Array! Let's Multiply Using Groups and Arrays Giddy Up, Round Up: Relating Division to Multiplication Unknowns with Multiplication and Division Equations *Lesson Plans* Concrete-Representational-Abstract	This sequence of four lessons is designed to guide students through an introduction to multiplication and division. Students will gain conceptual understanding of multiplication and division through multiple representations.
Test Item Specifications	The Test Item Specifications indicate the alignment of items with the Florida Standards. Assessment limits are included in the specifications, which define the range of content knowledge in the assessment items for the standard. Sample items for each standard are also included in the specifications document.
Test Design Summary and Blueprint	The Test Design Summary and Blueprint shows the reporting categories with a corresponding weight for the 4th Grade Mathematics FSA.
Florida Students	Resources specifically designed with students in mind are available on Florida Students. Florida Students is an interactive site that provides educational resources aligned to the Florida Standards.
4th Grade Mathematics Parent Guide	The parent guide will support parents and families with children in Grade 4 Mathematics.

Instructional Resources

MAFS.4.OA.1.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

Great Estimations! *Lesson Plan* Representational-Abstract	In this lesson, students will strengthen their skills of estimation by using a benchmark number to aid in more accurate estimations. They will use problem-solving skills to identify relationships between given factors and products, i.e. 6 x 4 = 24 specifically means that 24 is 6 times as large as 4.
Comparing Growth *Problem-Solving Task* Abstract	The purpose of this task is to assess students' understanding of multiplicative and additive reasoning. Students will be able to identify that Student A is looking at how many feet are being added on, while Student B is comparing how much the snakes grew to how long they were to begin with.

Formative Assessments

Kate and Her Doll Representational-Abstract	Students are given a context for a multiplicative comparison and asked to explain the comparison.
Animal Photographs Abstract	Students read a multiplicative comparison word problem and are asked to write an equation that matches the problem.
Pet Snakes Abstract	Students discuss the relationship between the lengths of two snakes in a multiplicative comparison problem that includes an equation.
Writing an Equation to Match a Word Problem Abstract	Students write an equation to match a given word problem.

Instructional Resources

MAFS.4.OA.1.2 Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.

Bar Model Math *Lesson Plan* Representational-Abstract	In this lesson students will solve real world problems that have multiplicative comparisons in them. They will use the strategy of bar models to solve the problems.
Comparing Money Raised *Problem-Solving Task* Abstract	The purpose of this task is to give students a better understanding of using the four operations to solve problems.

Formative Assessments

Books and Yarn Abstract	Students are asked to write equations to represent two multiplicative comparison problems and then solve the problems.
Dogs as Pets Abstract	Students are asked to write equations to represent two multiplicative comparison problems and then solve the problems.
Making Necklaces Abstract	Students are asked to solve a multiplicative comparison word problem comparing 6 inches of string to 24 inches of string.
Throwing Footballs Abstract	Students are asked to write equations to represent two multiplicative comparison problems and then solve the problems.

Instructional Resources

MAFS.4.OA.1.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Rockin' Remainders *Lesson Plan* Representational-Abstract	This is a lesson designed to teach interpreting remainders in division based on the context of the word problem. Included with the lesson plan is a presentation for direct instruction, word problem scenarios for small group work, individual practice and student reflection forms.
I Love Leftovers! *Lesson Plan* Representational-Abstract	In the lesson, students will learn to interpret the remainder through collaborative problem solving. Students will explore situational problems that address the different ways to interpret the remainder.
Express Yourself with Math Story Chains *Lesson Plan* Abstract	Students work in small groups to write math story chains (multi-step real world problems) and write expressions or equations for their story chains.
Gimme Two Steps! *Lesson Plan* Abstract	In this lesson, students are provided with opportunities to use different strategies to solve multi-step, real world problems using thinking maps and cooperative learning activities.
One Step at a Time *Lesson Plan* Abstract	In this lesson, students will use the four operations to solve multistep word problems composed of whole numbers. Students will be asked to estimate, write equations, decide if their answers are reasonable, explain their decision and interpret the remainder (if necessary).

Formative Assessments

Estimating the Solution Abstract	Students are asked to use a mental estimation strategy to evaluate the solution of a multistep word problem.
Juice Boxes Abstract	Students are given a two-step word problem and are asked to solve the problem and write an equation with a letter representing the unknown in the equation.
Picking Strawberries Abstract	Students are asked to solve a three-step word problem.
Roller Coaster Rides Abstract	Students are given a multistep word problem to solve that requires interpreting remainders.

Instructional Resources

MAFS.4.OA.1.a Determine whether an equation is true or false by using comparative relational thinking. *For example, without adding 60 and 24, determine whether the equation 60 + 24 = 57 + 27 is true or false.*

Is My Equation True or False? *Lesson Plan* Concrete-Representational-Abstract	In this lesson, students will determine if equations are true or false and justify their reasoning using relational thinking.

Formative Assessments

Determining If an Equation is True Abstract	Students are asked to determine if each of two equations involving subtraction is true by comparing mathematical expressions and without actually carrying out the calculations.
True and False Division Equations Abstract	Students are asked to determine if each of two equations is true by comparing mathematical expressions and without actually carrying out the indicated calculations.
True and False Multiplication Equations Abstract	Students are asked to determine if each of two equations is true without performing any operations.

Instructional Resources

MAFS.4.OA.1.b Determine the unknown whole number in an equation relating four whole numbers using comparative relational thinking. *For example, solve 76 + 9 = n + 5 for n by arguing that nine is four more than five, so the unknown number must be four greater than 76.*

Can You Compare and Find the Missing Number? *Lesson Plan* Representational-Abstract	Students will be able to compare and solve equations using comparative relational thinking. Solving these equations will require the students to mentally evaluate to determine if it is true or false. The students will also determine the unknown number in some equations.

Formative Assessments

Comparative Relational Thinking in Division Abstract	Students are asked to use comparative relational thinking to determine the value of an unknown number.
Comparative Relational Thinking in Subtraction Abstract	Students use comparative relational thinking to determine the value of an unknown number.
Comparative Relational Thinking in Addition Abstract	Students use comparative relational thinking to determine the value of an unknown number.

Instructional Resources

MAFS.4.OA.2.4 Investigate factors and multiples.

a. Find all factor pairs for a whole number in the range 1–100.
b. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number.
c. Determine whether a given whole number in the range 1–100 is prime or composite.

Factor That! *Lesson Plan* Concrete-Representational	This is a foundational lesson in which the students will visually see the relationship between factors and multiples. As a result of this hands-on lesson and guided discussion, students will learn to identify the factors of a given number.
Fantastic Factors *Lesson Plan* Concrete-Representational	In this lesson, students will start out using manipulatives to create rectangles which will be used to find factor pairs. Students will move to using a T-Chart to determine the factor pairs of numbers. Students will then use their T-Charts to determine if a number is prime or composite.
Creating Factor Pair Trees *Lesson Plan* Representational-Abstract	In this lesson, students will practice identifying factor pairs of whole numbers. This lesson does not teach an understanding of factors or prime numbers, but it is a practice of the students' knowledge of these concepts.
Finding a Few Friendly Factors *Lesson Plan* Concrete-Representational-Abstract	Students will find factors for a given number 1-100. This activity should lead to prime and composite numbers. Students will have the option of using manipulatives.
Hooray for Arrays! *Lesson Plan* Concrete-Representational-Abstract	Students will learn to identify prime and composite numbers through arrays versus memorizing them. The goal is for the student to be able to identify numbers as being prime or composite by building factor pairs through arrays.
Using Rectangles to Find Prime and Composite Numbers *Lesson Plan* Concrete-Representational-Abstract	In this lesson, students will use rectangles to find prime and composite numbers. They will determine the factor pairs for each number in the given set and use them to discover the meaning of prime and composite numbers. Note: This lesson only addresses subparts a and c of the standard.

Formative Assessments

Factor Pairs Abstract	Students are asked to find the factor pairs of a given number and identify the number as a multiple of the factors.
Find All the Factor Pairs Abstract	Students are asked to find the factor pairs for each of the given numbers.
Multiples of Six Abstract	Students determine if a given number is a multiple of six, both with and without context.
Prime or Composite Abstract	Students are asked to determine whether each of four given numbers is prime or composite and justify their choices.

Instructional Resources

MAFS.4.OA.3.5 Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. *For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.*

Pattern Fun *Lesson Plan* Concrete-Representational	In this lesson, students will use manipulatives to build, extend and describe increasing patterns from a rule.
Rules, Number Patterns and Tables *Lesson Plan* Concrete-Representational-Abstract	In this introductory lesson students will follow a rule to generate a number pattern in a table and then identify apparent features of the pattern.
Doubles Plus One *Problem-Solving Task* Abstract	The purpose of this task is to help students gain a better understanding of patterns. This task is meant to be used in an instructional setting.

Formative Assessments

Dot Patterns Representational-Abstract	Students examine triangular numbers through a given dot pattern.
Baseball Cards Abstract	Students generate a number pattern based on a given rule and explain the pattern found.
Multiply by Four Abstract	Students are asked to generate a sequence of numbers based on a given rule and identify features of the pattern that are not explicit.