Grade 5 Math Unit 5 -Operations and Algebraic Thinking

UNIT OVERVIEW

Grade 5 instruction time centers around 3 Critical Areas of Focus. This unit is connected to **Focus Area #2, Extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations**
The work in this unit goes beyond the Critical Areas of Focus to address the concepts of Modeling numerical relationships with the coordinate plane (See Connections for explanation)

The work in this unit addresses these clusters:
- Write and interpret numerical expressions
- Analyze patterns and relationships
- Graph points on the coordinate plane to solve real-world and mathematical problems

STANDARDS

CC_Common Core State Standards - Mathematics (2010) - Grade 5
Domain 5.OA Operations and Algebraic Thinking
Cluster Statement: *Write and interpret numerical expressions.*
Standard 5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.
Standard 5.OA.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.

Cluster Statement: *Analyze patterns and relationships* .
Standard 5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

Domain 5.G Geometry
Cluster Statement: *Graph points on the coordinate plane to solve real-world and mathematical problems.*
Standard 5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).
Standard 5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

CONTENT ELABORATIONS

5.OA.1	**5.OA.1** builds on the expectations of third grade where students are expected to start learning the conventional order. Students need experiences with multiple expressions that use grouping symbols throughout the year to develop understanding of when and how to use parentheses, brackets and braces. First students use these symbols with whole numbers. Then the symbols can be used as students add, subtract, multiply and divide decimals and fractions. To further develop sudents' understanding of grouping symbols and facility with operations, students place grouping symbols in equations to make the equations true or they compare expressions that are grouped differently. **MP.1, MP.5, MP.8** should be emphasized.

5.OA.2	**5.OA.2** refers to expressions. Expressions are a series of numbers and symbols (+, -, x,) Example: 4 (5 + 3) is an expression. When we compute 4 (5+3) we are evaluating the expression. The expression equals 32. 4 (5 + 3) = 32 is an equation. This standard calls for students to verbally describe the relationship between expressions without actually calculating them. This standard calls for students to apply their reasoning of the four operations as well as place value while describing the relationship between numbers. The standard does not include the use of variable, only numbers and signs of operations. Examples: - Write an expression for the steps "double five and then add 26." Student response: (2 x 5) + 26 - Describe how the expression 5(10 x 10) relates to 10 x 10. Student response: The expression 5(10 x 10) is 5 times larger than the expression 10 x 10 since I know that 5(10 x 10) means that I have 5 groups of (10 x 10). Students use their understanding of operations and grouping symbols to write expressions and interpret the meaning of a numerical expression. Examples: - Students write an expression for calculations given in words such as "divide 144 by 12, and then subtact 7/8." They write (144 12) - 7/8. - Students recognize that 0.5 x (300 1/2 15) is 1/2 of (3015) without calculating the quotient. **MP.1, MP.2, MP.7, MP.8** should be emphasized.
5.OA.3	**5.OA.3** extends work from Grade 4, where students generate numerical patterns when they are given one rule. In Grade 5, students are given two rules and generate two numerical patterns. The graphs that are created should be line graphs to represent the pattern. This is a linear function which is why we get the straight lines. **MP.2, MP.7** should be emphasized.
5.G.1	Examples: - Connect these points in order on the coordinate grid below: (2,2) (2,4) (2,6) (2,8) (4,5) (6,8) (6,6) (6,4) and (6,2). What letter is formed on the grid? - Connect the points in order. (2,6) (4,6) (6,3) (2,3). Make sure to connect (2,3) back to (2,6). What geometric figure is formed? What attributes did you use to identify it? What line segments in this figure are parallel? What line segments in this figure are perpendicular? **MP.1, MP.4, MP.5, MP.6, MP.7** should be emphasized.
5.G.2	**5.G.2** references real-world and mathematical problems, including the traveling from one point to another and identifying the coordinates of missing points in geometric figures such as squares, rectangles and parallelograms. **MP.1, MP.2, MP.4, MP.5, MP.6, MP.7** should be emphasized.

UNIT VOCABULARY

numerical expression	term	ordered pair
evaluate	coordinate plane	x-coordinate
order of operations	origin	y-coordinate
sequence		

BIG IDEAS

ENDURING UNDERSTANDINGS	**ESSENTIALS QUESTIONS** Choose a few questions based on the needs of your students

•On the coordinate plane, a point represents the two facets of information associated with an ordered pair.
•Graphical representations can be used to make predictions and interpretations about real world situations.
•Given two rules, students can generate two numerical patterns. Students create line graphs from the pattern. This explains a linear function and why straight lines are generated from the pattern.

* How are patterns used to solve patterns?

CONNECTIONS

In **Critical Focus Area #2**, students develop understanding of why division procedures work based on the meaning of base-ten numerals and properties of operations. They finalize fluency with multi-digit addition, subtraction, multiplication and division. They apply their understandings of models for decimals, decimal notation, and properties of operations to add and subtract decimals to hundredths. They develop fluency in these computations, and make reasonable estimates of their results. Students use the relationship between decimals and fractions, as well as the relationship between finite decimals and whole numbers (i.e., a finite decimal multiplied by an appropriate power of 10 is a whole number) to understand and explain why the procedures for multiplying and dividing finite decimals make sense. They compute products and quotients of decimals to hundredths efficiently and accurately.

The work in this unit connects to **6.OA.1** and **4.OA.3**

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

WRITE AND INTERPRET NUMERICAL EXPRESSIONS

	CONTENT	SKILLS
5.OA.1	Use parentheses, brackets or braces in numerical expressions	Use parentheses, brackets or braces in numerical expressions 1. Use the symbols with whole numbers 2. Use the symbols with decimals and fractions
5.OA.1	Evaluate expressions with these symbols	Evaluate expressions with these symbols 1. Place grouping symbols in equations to make the equations true 2. Compare expressions that are grouped differently

5.OA.2	Write simple expressions that record calculations with numbers and interpret numerical expressions without evaluating them	Write simple expressions that record calculations with numbers and interpret numerical expressions without evaluating them 1. Write numerical expressions for given numbers with operation words 2. Write operation words to describe a given numerical expression 3. Interpret numerical expressions without evaluating them

ANALYZE PATTERNS AND RELATIONSHIPS

	CONTENT	SKILLS
5.OA.3	Generate patterns using two given rules	Generate patterns using two given rules 1. Generate two numerical patterns using two given rules 2. Form ordered pairs consisting of corresponding terms for the two patterns 3. Analyze and explain the relationships between the corresponding terms in the two numerical patterns

GRAPH POINTS ON THE COORDINATE PLANE TO SOLVE REAL-WORLD AND MATHEMATICAL PROBLEMS

	CONTENT	SKILLS
5.G.1 **5.G.2**	Graph points on a coordinate plane	Graph points on a coordinate plane 1. Define the coordinate system 2. Identify the x- and y- axis 3. Locate the origin on the coordinate system 4. Recognize and describe the connection between the ordered pair and the x- and y- axis (from the origin) 5. Graph points in the first quadrant 6. Examine plotted points on a grid and name the ordered pairs 7. Create a coordinate grid 8. Represent real-world and mathematical problems by graphing points in the first quadrant 9. Interpret coordinate value of points in real-world context and mathematical problems

UNIT RESOURCES

Common Core Model Curriculum
Smartboard Resources
Hands on Standards - Grade 5/6, Algebra lessons 4, 5, 6
McGraw-Hill, **My Math** Chapter 7
Georgia Math frameworks, Grade 5 Units 1 & 5
Math Playground/Common Core http://www.mathplayground.com/common_core_state_standards_for_mathematics_grade_5.html
Educational games connected to CCS
IXL http://www.ixl.com/math/standards/common-core/grade-5