Richmond Public Schools

Curriculum Framework

Grade 8

Strand: Patterns, Functions, and Algebra	
8.14 **The student will** **a) evaluate an algebraic expression for given replacement values of the variables; and** **b) simplify algebraic expressions in one variable.**	
Suggested Pacing	
First Nine Weeks – 5 Instructional Days (including common assessment)	
Related Standards	
Spiral Down **7.1** The student will d) determine square roots of perfect squares; and e) identify and describe absolute value of rational numbers. **7.11** The student will evaluate algebraic expressions for given replacement values of the variables. **6.6** The student will c) simplify numerical expressions involving integers	**Spiral Up** **A.1** The student will a) represent verbal quantitative situations algebraically; and b) evaluate algebraic expressions for given replacement values of the variables.
Essential Questions	**Common Misconceptions**
What is the role of the order of operations when evaluating expressions? *The order of operations ensures only one correct answer for an expression.*	• Students would benefit from simplifying expressions involving a variety of grouping symbols using the order of operations. • Students need additional practice identifying the properties of operations used to simplify expressions. • Students need additional practice substituting values into an expression with fractions and cubes.
Understanding the Standard	**Essential Knowledge and Skills**

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• An expression is a representation of a quantity. It may contain numbers, variables, and/or operation symbols. It does not have an "equal sign (=)" (e.g., $\frac{3}{4}$, 5x, 140 - 38.2, -18 · 21, (5 + 2x) · 4). An expression cannot be solved. • A numerical expression contains only numbers, the operations symbols, and grouping symbols. • Expressions are simplified using the order of operations. • Simplifying an algebraic expression means to write the expression as a more compact and equivalent expression. This usually involves combining like terms. • Like terms are terms that have the same variables and exponents. The coefficients do not need to match (e.g., 12x and -5x; 45 and $-5\frac{2}{3}$; 9y, -51y and $\frac{4}{9}y$.) • Like terms may be added or subtracted using the distributive and other properties. For example, – $2(x - \frac{1}{2}) + 5x = 2x - 1 + 5x = 2x + 5x - 1 = 7x - 1$ - $w + w - 2w = (1 + 1)\,w - 2w = 2w - 2w = (2 - 2)\,w = 0$ $w = 0$ • The order of operations is as follows: - First, complete all operations within grouping symbols*. If there are grouping symbols within other grouping symbols, do the innermost operation first. - Second, evaluate all exponential expressions. - Third, multiply and/or divide in order from left to right. - Fourth, add and/or subtract in order from left to right.	**The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to** • Use the order of operations and apply the properties of real numbers to evaluate algebraic expressions for the given replacement values of the variables. Exponents are limited to whole numbers and bases are limited to integers. Square roots are limited to perfect squares. Limit the number of replacements to no more than three per expression. (a) • Represent algebraic expressions using concrete materials and pictorial representations. Concrete materials may include colored chips or algebra tiles. (a) • Simplify algebraic expressions in one variable. Expressions may need to be expanded (using the distributive property) or require combining like terms to simplify. Expressions will include only linear and numeric terms. Coefficients and numeric terms may be rational. (b)

* Parentheses ( ), brackets [ ], braces {}, absolute value || (i.e., $\|3(-5+2)\| - 7$), and the division bar (i.e., $\frac{3+4}{5+6}$) should be treated as grouping symbols. ● Properties of real numbers can be used to express simplification. Students should use the following properties, where appropriate, to further develop flexibility and fluency in problem solving (limitations may exist for the values of a, b, or c in this standard): – Commutative property of addition: $a + b = b + a$. – Commutative property of multiplication: $a \cdot b = b \cdot a$. – Associative property of addition: $(a + b) + c = a + (b + c)$. – Associative property of multiplication: $(a \cdot b) \cdot c = a \cdot (b \cdot c)$. - Subtraction and division are neither commutative nor associative. - Distributive property (over addition/subtraction): $a \cdot (b + c) = a \cdot b + a \cdot c$ *and* $a \cdot (b - c) = a \cdot b - a \cdot c$. - The additive identity is zero (0) because any number added to zero is the number. The multiplicative identity is one (1) because any number multiplied by one is the number. There are no identity elements for subtraction and division. – Identity property of addition (additive identity property): $a + 0 = a$ *and* $0 + a = a$. – Identity property of multiplication (multiplicative identity property): $a \cdot 1 = a$ *and* $1 \cdot a = a$.	

- Inverses are numbers that combine with other numbers and result in identity elements
  [e.g., $5 + (-5) = 0$; $\frac{1}{5} \cdot 5 = 1$].
- Inverse property of addition (additive inverse property): $a + (-a) = 0$ *and* $(-a) + a = 0$.
- Inverse property of multiplication (multiplicative inverse property): $a \cdot \frac{1}{a} = 1$ *and* $\frac{1}{a} \cdot a = 1$.
- Zero has no multiplicative inverse.
- Multiplicative property of zero: $a \cdot 0 = 0$ *and* $0 \cdot a = 0$.
- Division by zero is not a possible mathematical operation. It is undefined.
- Substitution property: If $a = b$, then b can be substituted for a in any expression, equation, or inequality.

- A power of a number represents repeated multiplication of the number. For example, $(-5)^4$ means $(-5) \cdot (-5) \cdot (-5) \cdot (-5)$. The base is the number that is multiplied, and the exponent represents the number of times the base is used as a factor. In this example, (–5) is the base, and 4 is the exponent. The product is 625. Notice that the base appears inside the grouping symbols. The meaning changes with the removal of the grouping symbols. For example, -5^4 means $5 \cdot 5 \cdot 5 \cdot 5$ negated which results in a product of -625. The expression $-(5)^4$ means to take the opposite of
  $5 \cdot 5 \cdot 5 \cdot 5$ which is -625. Students should be exposed to all three representations.

- An algebraic expression is an expression that contains variables and numbers.

• Algebraic expressions are evaluated by substituting numbers for variables and applying the order of operations to simplify the resulting numeric expression.	
Vocabulary	**Instructional Activities Organized by Learning Objective**
Expression Variables Operation Coefficients Numerical Expression Grouping Symbols Parentheses Brackets Braces Absolute Value Exponential Expressions Multiplication Division Addition Subtraction Order of Operations Algebraic Expression Combining Like Terms Commutative Property of Addition Commutative Property of Multiplication Associative Property of Addition Associative Property of Multiplication Distributive Property (over addition/subtraction) Identity Property of Addition (additive identity property) Identity Property of Multiplication (multiplicative identity property) Inverse Property of Addition (additive inverse property)	**Virginia Department of Education** Evaluating Expressions – Lesson Plan **Textbook** *Virginia Pre-Algebra, ©2012, Glencoe/McGraw-Hill* • Words and Expressions, page(s) 5 – 9 • Variables and Expressions, page(s) 11 – 16 • Powers and Exponents, page(s) 481 – 485 **Notes** • Evaluating Algebraic Expressions **Resources** • **Print** *Virginia Coach,* NEW SOL Edition, Grade 8, Mathematics Lesson 18 – page 138 (Evaluate Algebraic Expressions) • **Technology-based** o *VirtualNerd.com* – How do you Evaluate Algebraic Expressions, What's the Order of Operations, and Simplify an Expression using Order of Operations – Instructional Video o *ExploreLearning (Gizmos)* – Equivalent Algebraic Expressions I, Equivalent Algebraic Expressions II, and Order of Operations – Interactive Skill Review **Sign-in required*

Inverse Property of Multiplication (multiplicative inverse property)
Multiplicative Property of zero
Substitution Property
Power
Base
Exponent
Product
Simplify

Assessment

RPS PowerSchool Unit Test – RPS 8.14 Common Assessment
Test ID#:

Formative Assessments
White Board Checks
Kahoot.it
Plickers
Exit Tickets
Graphic Organizers
Venn Diagrams

Station Activities

- Task Cards - Have students complete problems in small groups Think-Pair-Share.
- Use crafting to simplify expressions in the correct order.
- Number Cube Activity (example)
- Use candy/objects to replace variables in expressions
- Partner Match
- BINGO
- Riddles
- Card Game
- A Hidden Message

Cross-Curricular Connections

English
Have students explain in complete sentences why a certain expression was not done correctly. Have them explain the steps the correct way.

Differentiations

- Have students make graphic organizer to help with the steps for replacing values.
- Have students write a verbal expression and use sticky notes to replace the variable and then evaluate the expression.
- Using above strategy, add more variables and replace.
- Use a real world practical problem, have students write the verbal expression, then replace the variable with given values, and graph the data.