Richmond Public Schools

Curriculum Framework

Grade 7 Honors (7/8)

Strand: Measurement and Geometry	
8.14	**The student will** **a) evaluate an algebraic expression for given replacement values of the variables; and simplify algebraic expressions in one variable.**
7.11	**The student will evaluate algebraic expressions for given replacement values of the variables.**

Suggested Pacing

Related Standards	
Spiral Down: 5th Grade: • SOL 5.7	Spiral Up: Algebra: • SOL A.1b

Essential Questions	Common Misconceptions
• What strategies are used to evaluate expressions? • Why is it important to evaluate expressions in the correct order, using GEMDAS? • How can error analysis assist in understanding the order of operations?	• Addition/Subtraction: students have difficulty with which one is performed first, specifically when they are next to each other • Multiplication/Division: students have difficulty with which one is performed first, specifically when they are next to each other

Understanding the Standard	Essential Knowledge and Skills
SOL 8.14: • 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.	SOL 8.14: • 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)

- 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.

* 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.

- 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)

SOL 7.11:

- Represent algebraic expressions using concrete materials and pictorial representations. Concrete materials may include colored chips or algebra tiles.
- Use the order of operations and apply the properties of real numbers to evaluate expressions for given replacement values of the variables. Exponents are limited to 1, 2, 3, or 4 and bases are limited to positive integers. Expressions should not include braces { } but may include brackets [ ] and absolute value | |. Square roots are limited to perfect squares. Limit the number of replacements to no more than three per expression.

- 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; · 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 $(-5)\cdot(-5)\cdot(-5)\bullet(-5)$. 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 $5\bullet 5\bullet 5\bullet 5$ negated which

results in a product of -625. The expression $-(5)^4$ means to take the opposite of 5 • 5 • 5 • 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. SOL 7.11: ● To evaluate an algebraic expression, substitute a given replacement value for a variable and apply the order of operations. For example, if a = 3 and b = -2 then $5a + b$ can be evaluated as: 5(3) + (-2) and simplified using the order of operations to equal 15 + (-2) which equals 13. ● Expressions are simplified by using the order of operations. ● The order of operations is a convention that defines the computation order to follow in simplifying an expression. It ensures that there is only one correct value. The order of operations is as follows: - First, complete all operations within grouping symbols[1]. If there are grouping symbols within other grouping symbols, do the innermost operations 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. [1] Parentheses ( ), brackets [ ], and the division bar should be treated as grouping symbols. ● Expressions are simplified using the order of operations and applying the properties of real numbers. 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.
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- Inverse property of addition (additive inverse property): $a + (-a) = 0$ *and* $(-a) + a = 0$.
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Vocabulary

Instructional Activities Organized by Learning Objective

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SOL 8.14:

Expression	Variables	Algebraic Expression
Numerical Expression	Commutative Property	Associative Property
Identify Property	Inverse Property	Distributive Property
Multiplicative Property of Zero	Substitution Property	

SOL 7.11:

Order of Operations (GEMDAS)	Evaluate	Expression
Simplified	Commutative Property	Associative Property
Distributive Property	Identity Property	Inverse Property
Multiplicative Property of Zero	Substitution Property	

Assessment

Cross-Curricular Connections

Textbook

Notes

Resources

- Print
- Technology-based

Station Activities

Tiered Differentiations