

Richmond Public Schools
Curriculum Framework
Grade 6 Honors (6/7)

Strand: Measurement and Geometry	
<p>6.6 The student will</p> <p>a) add, subtract, multiply, and divide integers;*</p> <p>b) solve practical problems involving operations with integers; and</p> <p>c) simplify numerical expressions involving integers.*</p> <p>*On the state assessment, items measuring this objective are assessed without the use of a calculator.</p> <p>7.11 The student will evaluate algebraic expressions for given replacement values of the variables.</p>	
Suggested Pacing	
Related Standards	
Spiral Down: 5th Grade: <ul style="list-style-type: none"> • SOL 5.7 	Spiral Up: 8th Grade: <ul style="list-style-type: none"> • SOL 8.14
Essential Questions	Common Misconceptions
<ul style="list-style-type: none"> • Where do we see integers in the real world? • How do number properties assist in computation? • How can we predict that the sum of two integers is positive, negative or zero? • What is the difference between the opposite and the absolute value of a number? • What is the process for adding integers (same sign or different signs)? • How can concrete and pictorial models represent operations with integers? • How do you rewrite a subtraction sentence as an equivalent addition sentence? • How do we determine if the product or quotient of two integers is positive or negative, based on the signs of the numbers? • What does it mean to evaluate algebraic expressions? 	<ul style="list-style-type: none"> • Integer Addition: students get confused about when to add/subtract the addends; sign of the answer; Understand additive inverse and that opposite quantities combine to make zero • Integer Subtraction: students get confused about how to rewrite the subtraction expression as an addition expression; Understand subtraction of integers as adding the additive inverse • Integer Multiplication/Division: sign of the product/quotient • Evaluating Expressions: what order to simplify an expression (PEMDAS)
Understanding the Standard	Essential Knowledge and Skills

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SOL 6.6:

- The set of integers is the set of whole numbers and their opposites (e.g., ...-3, -2, -1, 0, 1, 2, 3...). Zero has no opposite and is neither positive nor negative.
- Integers are used in practical situations, such as temperature changes (above/below zero), balance in a checking account (deposits/withdrawals), golf, time lines, football yardage, and changes in altitude (above/below sea level).
- Concrete experiences in formulating rules for adding, subtracting, multiplying, and dividing integers should be explored by examining patterns using calculators, using a number line, and using manipulatives, such as two-color counters, drawings, or by using algebra tiles.
- Sums, differences, products and quotients of integers are either positive, negative, undefined or zero. This may be demonstrated through the use of patterns and models.
- The order of operations is a convention that defines the computation order to follow in simplifying an expression. Having an established convention ensures that there is only one correct result when simplifying an expression.
- 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 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.
- ¹Parentheses (), absolute value | | (e.g., $|3(-5 + 2)|$), and the division bar (e.g., $\frac{3+4}{5+6}$) 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):

SOL 6.6:

- Model addition, subtraction, multiplication and division of integers using pictorial representations or concrete manipulatives.
 - (a) Add, subtract, multiply, and divide two integers.
 - (b) Solve practical problems involving addition, subtraction, multiplication, and division with integers.
 - (c) Use the order of operations and apply the properties of real numbers to simplify numerical expressions involving more than two integers. Expressions should not include braces { } or brackets [], but may contain absolute value bars | |. Simplification will be limited to three operations, which may include simplifying a whole number raised to an exponent of 1, 2 or 3.

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.

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- 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: $(ab)c = a(bc)$.
- Subtraction and division are neither commutative nor associative.
- Distributive property (over addition/subtraction): $a(b + c) = ab + ac$ and $a(b - c) = ab - ac$.
- 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 $1 \cdot a = a$.
- 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.
- Inverse property of addition (additive inverse property):
 $a + (-a) = 0$ and $(-a) + a = 0$.
- Multiplicative property of zero: $a \cdot 0 = 0$ and $0 \cdot a = 0$
- Substitution property: If $a = b$ then b can be substituted for a in any expression, equation or inequality.
- The power of a number represents repeated multiplication of the number (e.g., $8^3 = 8 \cdot 8 \cdot 8$). The base is the number that is multiplied, and the exponent represents the number of times the base is used as a factor. In the example, 8 is the base, and 3 is the exponent.
- Any number, except zero, raised to the zero power is 1. Zero to the zero power (0^0) is undefined.

SOL 7.11:

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- 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 symbols¹. 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

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<p>number multiplied by one is the number. There are no identity elements for subtraction and division.</p> <ul style="list-style-type: none"> - 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., $5 + (-5) = 0$; $\cdot 5 = 1$). - 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. 										
Vocabulary	Instructional Activities Organized by Learning Objective									
SOL 6.6	Textbook									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Integers</td> <td style="width: 33%;">Order of Operations (GEMDAS)</td> <td style="width: 33%;">Expression</td> </tr> <tr> <td>Commutative Property</td> <td>Associative Property</td> <td>Distributive Property</td> </tr> <tr> <td>Identity Property</td> <td>Inverse Property</td> <td>Substitution Property</td> </tr> </table>	Integers	Order of Operations (GEMDAS)	Expression	Commutative Property	Associative Property	Distributive Property	Identity Property	Inverse Property	Substitution Property	Notes
Integers	Order of Operations (GEMDAS)	Expression								
Commutative Property	Associative Property	Distributive Property								
Identity Property	Inverse Property	Substitution Property								
SOL 7.11	Resources <ul style="list-style-type: none"> ● Print ● Technology-based 									

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Expression	Order of Operations (GEMDAS)	Evaluate	Station Activities
Commutative Property	Associative Property	Distributive Property	
Identity Property	Inverse Property	Substitution Property	
Assessment			
Cross-Curricular Connections			Tiered Differentiations