

Richmond Public Schools
Curriculum Framework
Grade 7 Honors (7/8)

| Strand: Measurement and Geometry | |
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| 8.17 | The student will solve multistep linear equations in one variable with the variable on one or both sides of the equation, including practical problems that require the solution of a multistep linear equation in one variable. |
| 7.12 | The student will solve two-step linear equations in one variable, including practical problems that require the solution of a two-step linear equation in one variable. |
| Suggested Pacing | |
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| Related Standards | |
| Spiral Down: 5 th Grade: <ul style="list-style-type: none"> ● SOL 5.19a-d 6 th Grade: <ul style="list-style-type: none"> ● SOL 6.13 | Spiral Up: Algebra: <ul style="list-style-type: none"> ● SOL A.4a |
| Essential Questions | Common Misconceptions |
| <ul style="list-style-type: none"> ● What is the process for solving multi-step equations? ● How can writing equations help solve mathematical and real-life problems? ● How can we represent and solve situations involving variable quantities? | <ul style="list-style-type: none"> ● Equations: students forget the process; students misinterpret the practical/word problems when writing the equation ● Properties: students forget how to apply the distributive property, which will affect them solving an equation. |
| Understanding the Standard | Essential Knowledge and Skills |
| <ul style="list-style-type: none"> ● SOL 8.17: ● A multistep equation may include, but not be limited to equations such as the following: $2x + 1 = \frac{x}{4}$; $-3(2x + 7) = \frac{1}{2}x$; $2x + 7 - 5x = 27$; $-5x - (x + 3) = -12$. | <ul style="list-style-type: none"> ● SOL 8.17: ● |

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| <ul style="list-style-type: none"> ● An expression is a representation of quantity. It may contain numbers, variables, and/or operation symbols. It does not have an “equal sign (=)” (e.g., $\frac{3}{4}$, $5x$, $140 - 38.2$, $18 \cdot 21$, $5 + x$.) ● An expression that contains a variable is a variable expression. A variable expression is like a phrase: as a phrase does not have a verb, so an expression does not have an “equal sign (=)”. An expression cannot be solved. ● A verbal expression can be represented by a variable expression. Numbers are used when they are known; variables are used when the numbers are unknown. For example, the verbal expression “a number multiplied by five” could be represented by the variable expression “$n \cdot 5$” or “$5n$”. ● An algebraic expression is a variable expression that contains at least one variable (e.g., $2x - 3$). ● A verbal sentence is a complete word statement (e.g., “The sum of two consecutive integers is thirty-five.” could be represented by “$n + (n + 1) = 35$”). ● An algebraic equation is a mathematical statement that says that two expressions are equal (e.g., $2x + 3 = -4x + 1$). ● In an equation, the “equal sign (=)” indicates that the value of the expression on the left is equivalent to the value of the expression on the right. ● 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 $\frac{4}{5}y$.) ● Like terms may be added or subtracted using the distributive and other properties. For example, <ul style="list-style-type: none"> - $4.6y - 5y = (-4.6 - 5)y = -9.6y$ - $w + w - 2w = (1 + 1)w - 2w = 2w - 2w = (2 - 2)w = 0 \cdot w = 0$ ● Real-world problems can be interpreted, represented, and solved using linear equations in one variable. | <ul style="list-style-type: none"> ● Represent and solve multistep linear equations in one variable with the variable on one or both sides of the equation (up to four steps) using a variety of concrete materials and pictorial representations. ● Apply properties of real numbers and properties of equality to solve multistep linear equations in one variable (up to four steps). Coefficients and numeric terms will be rational. Equations may contain expressions that need to be expanded (using the distributive property) or require collecting like terms to solve. ● Write verbal expressions and sentences as algebraic expressions and equations. ● Write algebraic expressions and equations as verbal expressions and sentences. ● Solve practical problems that require the solution of a multistep linear equation. ● Confirm algebraic solutions to linear equations in one variable. ● SOL 7.12: <ul style="list-style-type: none"> ● Represent and solve two-step linear equations in one variable using a variety of concrete materials and pictorial representations. ● Apply properties of real numbers and properties of equality to solve two-step linear equations in one variable. Coefficients and numeric terms will be rational. ● Confirm algebraic solutions to linear equations in one variable. ● Write verbal expressions and sentences as algebraic expressions and equations. ● Write algebraic expressions and equations as verbal expressions and sentences. ● Solve practical problems that require the solution of a two-step linear equation. |
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- Properties of real numbers and properties of equality can be used to solve equations, justify solutions and 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., $5 + (-5) = 0$; $5 \cdot \frac{1}{5} = 1$).
 - 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.

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- 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.
- Addition property of equality: If $a = b$, then $a + c = b + c$.
- Subtraction property of equality: If $a = b$, then $a - c = b - c$.
- Multiplication property of equality: If $a = b$, then $a \cdot c = b \cdot c$.
- Division property of equality: If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.

- SOL 7.12:
- An equation is a mathematical sentence that states that two expressions are equal.
- The solution to an equation is the value(s) that make it a true statement. Many equations have one solution and can be represented as a point on a number line.
- A variety of concrete materials such as colored chips, algebra tiles, or weights on a balance scale may be used to model solving equations in one variable.
- The inverse operation for addition is subtraction, and the inverse operation for multiplication is division.
- A two-step equation may include, but not be limited to equations such as the following:
 $2x + \frac{1}{2} = -5$; $-25 = 7.2x + 1$; $\frac{x-7}{-3} = 4$; $\frac{3}{4}x - 2 = 10$.
- An expression is a representation of quantity. It may contain numbers, variables, and/or operation symbols. It does not have an "equal sign (=)" (e.g., $\frac{3}{4}$, $5x$, $140 - 38.2$, $18 \cdot 21$, $5 + x$).
- An expression that contains a variable is a variable expression. A variable expression is like a phrase: as a phrase does not have a verb, so an

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expression does not have an “equal sign (=).”
An expression cannot be solved.

- A verbal expression can be represented by a variable expression. Numbers are used when they are known; variables are used when the numbers are unknown. For example, the verbal expression “a number multiplied by 5” could be represented by “ $n \cdot 5$ ” or “ $5n$ ”.
- An algebraic expression is a variable expression that contains at least one variable (e.g., $2x - 3$).
- A verbal sentence is a complete word statement (e.g., “The sum of twice a number and two is fifteen.” could be represented by “ $2n + 2 = 15$ ”).
- An algebraic equation is a mathematical statement that says that two expressions are equal (e.g., $2x - 8 = 7$).
- Properties of real numbers and properties of equality can be applied when solving equations, and justifying solutions. 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: $a \cdot b = b \cdot a$.
 - Subtraction and division are not commutative.
 - 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):
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 $a + (-a) = 0$ 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.
- Addition property of equality: If $a = b$, then $a + c = b + c$.
- Subtraction property of equality: If $a = b$, then $a - c = b - c$.
- Multiplication property of equality: If $a = b$, then $a \cdot c = b \cdot c$.
- Division property of equality: If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.

Vocabulary

Instructional Activities Organized by Learning Objective

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| Multi-step Linear Equations | Expression | Algebraic Expression |
| Like Terms | Commutative Property | Associative Property |
| Distributive Property | Identity Property | Inverse Property |

Textbook

Notes

Resources

- Print
- Technology-based

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| Multiplicative Property of Zero | Addition Property of Equality | Subtraction Property of Equality | Station Activities |
| Multiplication Property of Equality | Division Property of Equality | | |
| Assessment | | | |
| Cross-Curricular Connections | | | |
| Tiered Differentiations | | | |