



## **Hands-On Equations® Correlation to the Common Core State Standards**

**The Mathematical Practices listed below are addressed by Hands-On Equations in the specified lessons of Level I, the Hands-On Equations Verbal Problems Introductory Workbook and the Level I problems of the Hands-On Equations Verbal Problems Book.**

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

### **Hands-On Equations Objectives**

**Lesson 1** [Each objective followed by numbered standard(s)]

Students will use a symbol to represent an unknown. [MP: 2, 5]

Students will demonstrate an understanding of the concepts of *equivalence*, *variable*, *constant*, *equation*, *equal to* ( $=$ ), and *not equal to* ( $\neq$ ). [MP: 1]

Students will use substitution and mental math to find and check solutions to physical or pictorial representations of algebraic equations in one variable. [MP: 1, 2, 3, 7]

**Lesson 2** [Each objective followed by numbered standard(s)]

Students will demonstrate an understanding of the abstract representation of an algebraic equation in one variable. [MP: 1, 2]

Students will model an abstract algebraic equation using concrete materials. [MP: 2, 5]

Students will use repeated addition to represent multiplication by a whole number in an algebraic expression. [MP: 1, 7]

Students will demonstrate an understanding of the concepts of equivalence, variable, constant, coefficient, equation, equal to ( $=$ ), and not equal to ( $\neq$ ). [MP: 1]

Students will use concrete models, guess-and-check, and number sense to solve one- and multi-step algebraic equations in one variable. [MP: 1, 2, 3, 7, 8]

Students will use substitution and mental math to check solutions to algebraic equations in one variable. [MP: 1, 2, 3]

**Lesson 3** [Each objective followed by numbered standard(s)]

Students will understand that there is more than one way to represent a problem, e.g., the constant 14 may be represented by 10 and 4 or 8 and 6. [MP: 7, 8]

Students will use concrete models to represent algebraic equations in one variable with unknowns on both sides of the equation. [MP: 5]

Students will use kinesthetic motions (physical actions) to solve algebraic equations in one variable with unknowns on both sides of the equation. [MP: 1, 5]

Students will demonstrate an understanding of the concepts of equivalence, variable, constant, coefficient, equation, equal to ( $=$ ), and not equal to ( $\neq$ ). [MP: 1]

Students will use repeated addition to represent multiplication by a whole number in an algebraic expression. [MP: 1, 7]

Students will use the Subtraction Property of Equality with variables to form equivalent statements when solving algebraic equations in one variable with unknowns on both sides of the equation. [MP: 1, 2, 7, 8]

Students will check the solution to an algebraic equation in one variable by using substitution and mental math in the physical representation of the original equation. [MP: 1, 2, 3]

Students will demonstrate their ability to orally communicate the full representation and solution process using clear mathematical reasoning. [MP: 1, 3, 6]

**Lesson 4** [Each objective followed by numbered standard(s)]

Students will use concrete models to represent algebraic equations in one variable with unknowns on both sides of the equation. [MP: 5]

Students will use kinesthetic motions (physical actions) to solve algebraic equations in one variable with unknowns on both sides of the equation. [MP: 1, 5]

Students will demonstrate an understanding of the concepts of equivalence, variable, constant, coefficient, equation, equal to ( $=$ ), and not equal to ( $\neq$ ). [MP: 1]

Students will learn that they can use their own reasoning and sequence of steps to solve a problem, rather than using a memorized procedure. [MP: 1, 2, 3, 7]

Students will understand that there is more than one way to solve a problem, e.g., students can start with the unknown or the constants. [MP: 1, 2, 7]

Students will use the Subtraction Property of Equality with the unknown and with the constants to form equivalent statements when solving algebraic equations in one variable. [MP: 1, 2, 7, 8]

Students will check the solution to an algebraic equation in one variable by using substitution and mental math in the physical representation of the original equation. [MP: 1, 2, 3]

Students will demonstrate their ability to orally communicate the full representation and solution process using clear mathematical reasoning. [MP: 1, 3, 6]

**Lesson 5** [Each objective followed by numbered standard(s)]

Students will use concrete models and kinesthetic motions (physical actions) to represent and solve algebraic equations in one variable with unknowns on both sides of the equation. [MP: 1, 5]

Students will observe patterns and learn to combine like terms. [MP: 7]

Students will add and subtract monomials and combine like terms to form equivalent expressions when solving algebraic equations in one variable. [MP: 1, 2, 7, 8]

Students will use Properties of Equality, such as the Subtraction Property of Equality, to form equivalent statements when solving algebraic equations in one variable with unknowns on both sides of the equation. [MP: 1, 2, 7]

Students will demonstrate an understanding of the concepts of equivalence, variable, constant, coefficient, equation, equal to ( $=$ ), and not equal to ( $\neq$ ). [MP: 1]

Students will learn that they can use their own reasoning and sequence of steps to solve a problem, rather than using a memorized procedure. [MP: 1, 2, 3, 7]

Students will understand that there is more than one way to solve a problem, e.g., students can start with the unknown or the constants. [MP: 1, 2, 7]

Students will check the solution to an algebraic equation in one variable by using substitution and mental math in the physical representation of the original equation. [MP: 1, 2, 3]

Students will demonstrate their ability to orally communicate the full representation and solution process using clear mathematical reasoning. [MP: 1, 3, 6]

**Lesson 6** [Each objective followed by numbered standard(s)]

Students will use concrete models to represent the multiplication of a binomial by a positive integer constant, such as  $2(x + 1)$ . [MP: 1, 2, 5]

Students will use concrete models and kinesthetic motions (physical actions) to represent and solve algebraic equations in one variable with unknowns on both sides of the equation. [MP: 1, 5]

Students observe patterns and discover the Distributive Property of Multiplication over Addition. [MP: 7, 8]

Students will use algebraic properties, such as the Subtraction Property of Equality and the Distributive Property of Multiplication over Addition, to form equivalent statements and expressions when solving algebraic equations in one variable. [MP: 1, 2, 7, 8]

Students will demonstrate an understanding of the concepts of equivalence, variable, constant, coefficient, equation, equal to ( $=$ ), and not equal to ( $\neq$ ). [MP: 1]

Students will learn that they can use their own reasoning and sequence of steps to solve a problem, rather than using a memorized procedure. [MP: 1, 2, 3, 7]

Students will understand that there is more than one way to solve a problem, e.g., students can start with the unknown or the constants. [MP: 1, 2, 7]

Students will check the solution to an algebraic equation in one variable by using substitution and mental math in the physical representation of the original equation. [MP: 1, 2, 3]

Students will demonstrate their ability to orally communicate the full representation and solution process using clear mathematical reasoning. [MP: 1, 3, 6]

**Lesson 7** [Each objective followed by numbered standard(s)]

Students will use pictorial models to represent abstract algebraic equations, including equations that contain multiplication of a binomial by a positive integer constant, such as  $2(x + 1)$ . [MP: 1, 2, 5]

Students will use pictorial representations to solve algebraic equations in one variable with unknowns on both sides of the equation. [MP: 1, 2, 5]

Students will use algebraic properties, such as the Subtraction Property of Equality and the Distributive Property of Multiplication over Addition, to form equivalent statements and expressions when solving algebraic equations in one variable. [MP: 1, 2, 7, 8]

Students will demonstrate an understanding of the concepts of equivalence, variable, constant, coefficient, equation, equal to ( $=$ ), and not equal to ( $\neq$ ). [MP: 1]

Students will analyze problems to determine if a concrete or pictorial method is more appropriate, e.g., a large constant value suggests a pictorial representation. [MP: 1, 5]

Students will learn that they can use their own reasoning and sequence of steps to solve a problem, rather than using a memorized procedure. [MP: 1, 2, 3, 7]

Students will understand that there is more than one way to solve a problem, e.g. students can start with the unknown or the constants. [MP: 1, 2, 7]

Students will check the solution to an algebraic equation in one variable by using substitution and mental math in the pictorial representation of the original equation. [MP: 1, 2, 3]

Students will demonstrate their ability to orally communicate the full representation and solution process using clear mathematical reasoning. [MP: 1, 3, 6]

**Hands-On Equations Introductory Verbal Problems Book (VP-IW); Hands-On Equations Verbal Problems Book (VPB-Level 1)** [Each objective followed by numbered standard(s)]

Students will analyze verbal problems to identify the known or given elements and the unknown elements that need to be determined. [MP: 1, 2]

Students will write down the representation of the unknown elements of the verbal problem. [MP: 2]

Students will analyze verbal problems and determine what strategy is best for representing the problem using concrete models or pictorial symbols. [MP: 1, 5]

Students will understand that there is more than one way to represent and solve a problem. [MP: 1, 2, 7]

Students will demonstrate an understanding of the concepts of equivalence, variable, constant, coefficient, equation, equal to ( $=$ ), and not equal to ( $\neq$ ). [MP: 1]

Students will use mathematical models (e.g., concrete, pictorial) to represent and solve application problems involving quantitative relationships with whole numbers. [MP: 1, 2, 5, 7]

Students will use mathematical models (e.g., concrete, pictorial) to represent and solve application problems involving quantitative relationships with fractional relations, e.g., Jim is  $\frac{2}{3}$  Kathy's age. (VPB only) [MP: 1, 2, 5, 7]

Students will observe patterns among numbers and learn how to represent consecutive integers, consecutive even and consecutive odd integers. (VPB only) [MP: 1, 2, 7, 8]

Students will use multiple strategies (e.g., a 5-step problem solving process, breaking a problem into parts, and determining whether a problem has too much information or not enough information) to solve real-world application problems. [MP: 1, 2, 3, 4]

Students will represent physically or pictorially given relations, such as Jim's age 10 years from now given his current age, the amount of rain that falls in three months given the amount it falls in one month, the distance travelled by a train in two hours given the distance it travels in one hour. [MP: 1, 2, 4, 5]

Students will represent and solve application problems including problems involving number, distance, money and age. [MP: 1, 2, 4, 5, 7, 8]

Students will represent and solve application problems involving two moving vehicles going in the same direction or in opposite directions, to determine the speed of the vehicles in order for one vehicle to overtake another, or for two vehicles to be a certain distance apart. (VPB only) [MP: 1, 2, 4, 5, 7, 8]

Students will represent and solve application problems involving the perimeter of a rectangle, e.g., given the perimeter and the relationship between the width and the length, find the dimensions. (VP-IW only) [MP: 1, 2, 4, 5, 7, 8]

Students will represent and solve application problems involving averages, e.g., given three test grades, find the fourth test grade to attain a specified average. (VP-IW only) [MP: 1, 2, 4, 5, 7, 8]

Students will represent and solve application problems involving patterns of numbers, e.g., consecutive numbers, consecutive even numbers, and consecutive odd numbers. (VPB only) [MP: 1, 2, 5, 7, 8]

Students will use algebraic means to solve pictorial or concrete equations derived from the verbal problem to determine value of the unknown. [MP: 1, 2, 5, 7, 8]

Students will refer to the representation to determine answers to the unknown elements of the verbal problem after solving the pictorial or concrete equation. [MP: 1, 2]

Students will provide the answer to verbal problems in full sentence format. [MP: 6]

Students will use substitution and mental math to check solutions to application problems involving algebraic equations in one variable. [MP: 1, 2, 3]

Students will check solutions to verbal problems in the original verbal statement. [MP: 2]

Students will demonstrate their ability to orally communicate the full representation and solution process using clear mathematical reasoning. [MP: 1, 3, 6]

Students will learn to use logical reasoning to evaluate the solution of a fellow student, even if the solution is different than their own. [MP: 3]