



Topic C

Solving Equations and Inequalities

A-CED.A.3, A-CED.A.4, A-REI.A.1, A-REI.B.3, A-REI.C.5, A-REI.C.6, A-REI.D.10, A-REI.D.12

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| Focus Standards: | A-CED.A.3 | Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i> ★ |
| | A-CED.A.4 | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law $V = IR$ to highlight resistance R.</i> ★ |
| | A-REI.A.1 | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. |
| | A-REI.B.3 | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. |
| | A-REI.C.5 | Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. |
| | A-REI.C.6 | Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. |
| | A-REI.D.10 | Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). |
| | A-REI.D.12 | Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. |

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| Instructional Days: | 15 |
| Lesson 10: | True and False Equations (P) ¹ |
| Lesson 11: | Solution Sets for Equations and Inequalities (P) |
| Lesson 12: | Solving Equations (P) |
| Lesson 13: | Some Potential Dangers When Solving Equations (P) |
| Lesson 14: | Solving Inequalities (P) |
| Lesson 15: | Solution Sets of Two or More Equations (or Inequalities) Joined by “And” or “Or” (E) |
| Lesson 16: | Solving and Graphing Inequalities Joined by “And” or “Or” (P) |
| Lesson 17: | Equations Involving Factored Expressions (S) |
| Lesson 18: | Equations Involving a Variable Expression in the Denominator (P) |
| Lesson 19: | Rearranging Formulas (P) |
| Lessons 20: | Solution Sets to Equations with Two Variables (P) |
| Lessons 21: | Solution Sets to Inequalities with Two Variables (P) |
| Lessons 22–23: | Solution Sets to Simultaneous Equations (P, E) |
| Lesson 24: | Applications of Systems of Equations and Inequalities (E) |

Teaching the process of how to solve an equation is fraught with well-meaning models and procedures suggested by textbook curricula (balance scales, algebra tiles, equivalent equations, etc.) that are often incompatible with what it actually means “to solve.” An equation with variables can be viewed as a question asking for which values of the variables (the solution set) will result in true number sentences when those values are substituted into the equation. Equations are manifestly about *numbers* and understanding true *and false* number sentences. In Algebra I, the application of this idea expands to include solutions to compound statements such as equations or inequalities joined by “and” or “or,” including simultaneous systems of equations or inequalities.

The Common Core Learning Standards rightfully downplay the notion of equivalent equations and instead place a heavy emphasis on students studying the solution sets to equations. In Lessons 12–14 of this topic, students formalize descriptions of what they learned before (true/false equations, solution sets, identities, properties of equality, etc.) and learn how to explain the steps of solving equations to construct viable arguments to justify their solution methods. They then learn methods for solving inequalities, again by focusing on ways to preserve the (now infinite) solution sets. With these methods now on firm footing, students investigate in Lessons 15–18 solution sets of equations joined by “and” or “or” and investigate ways to change an equation such as squaring both sides, which changes the solution set in a controlled (and often useful) way. In Lesson 19, students learn to use these same skills as they rearrange formulas to define one quantity in terms of another. Finally, in Lessons 20–24, students apply all of these new skills and understandings as they work through solving equations and inequalities with two variables including systems of such equations and inequalities.

¹Lesson Structure Key: **P**-Problem Set Lesson, **M**-Modeling Cycle Lesson, **E**-Exploration Lesson, **S**-Socratic Lesson