One Step at a Time

ID: 8678

Time required
45 minutes

Activity Overview

*In this activity, students first solve one-step addition equations and then use **nSolve**. The equations and their solutions become data as the students formulate and test a hypothesis about solving one-step equations. The same investigation technique is applied to one-step equations involving multiplication. The activity closes with a discussion of inverse operations and generalizing solving one-step equations.*

Topic: Linear Equations

- *Solve "one-step" linear equations of the form x + a = b and ax = b where a and b are real numbers.*
- *Verify the solution to a linear equation by substitution.*

Teacher Preparation

- *This activity is designed for use in an Algebra 1 or Pre-Algebra classroom. It uses a numerical and empirical approach to help students discover one of the basic techniques of algebra on their own. These concepts can also be presented via manipulatives such as the balanced scale or algebra tiles, or as consequences of the Properties of Equality. This activity is not intended to replace those approaches, but to supplement them*
- *Prior to beginning the activity, students should know how to evaluate algebraic expressions, including using integer operations, and be familiar with the terms variable and equation.*
- *One step equations involving subtraction and division are not covered in this lesson. This allows the teachers to choose how to present these types of equations (either as further examples of addition and multiplication equations or as operations in their own right, or both.)*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "8678" in the quick search box.***

Associated Materials

- *OneStep_Student.doc*
- *OneStep.tns*
- *OneStep_Soln.tns*

Suggested Related Activities

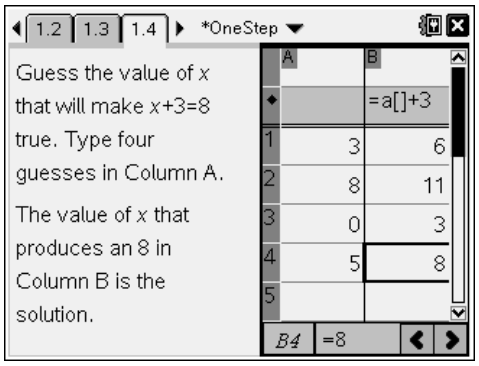
To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Solving Equations with a Calculator? No Way! (TI-Nspire CAS technology) — 8758*
- *Solve Me – Multi-Step Equations (TI-Nspire CAS technology) — 9163*
- *Doin' the TI Two-Step – Solving Equations (TI-Nspire CAS technology) — 9153*

An equation is like a statement in mathematical language. The solution to an equation is the value that makes the statement true. The statement is true when one side of the equation equals the other.

Problem 1 – Solving with substitution

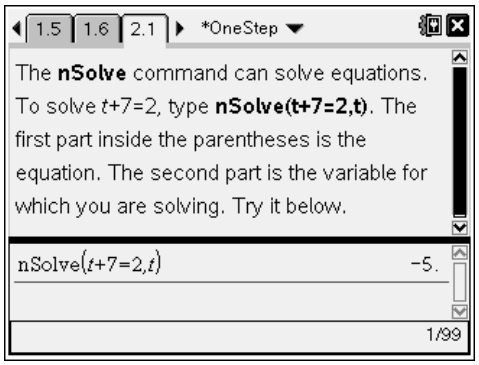
Students begin by testing values for *x* in the equation *x* + 3 = 8, looking for the value of *x* that makes the equation true. The spreadsheet is set up to perform the substitution automatically. Students are prompted to enter other addition equations into the spreadsheet and repeat the process of substituting values to find a solution.



(***Note:*** When students enter expressions in the formula bar, they should use [ ] (square brackets) for a column reference. This is to distinguish it from a variable reference.)

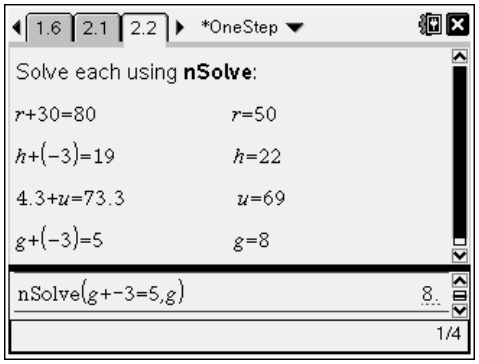
Problem 2 – Solving with nSolve

Students use the **nSolve** command to solve one-step addition equations. Explain that the **nSolve** command instructs the calculator to test many values for the variable until it finds the value that makes the equation true, just as students did on the previous screen.



(***Note:*** The **nSolve** command will only return one solution. All equations considered in this activity may be correctly solved by using this command. However, for equations encountered later in students' mathematical studies that have multiple solutions, care must be taken to ensure *all* solutions are found.)

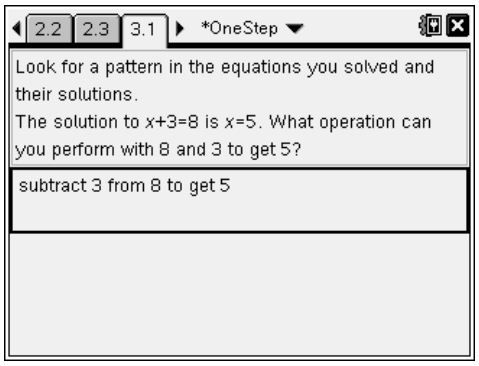
Students are prompted to use the **nSolve** command to solve a series of one-step addition equations—including some of their own creation—and record their answers in the *Notes* pane. By observing the solutions to many equations of the same form, students gather data to form a hypothesis about the solving an equation of this form.



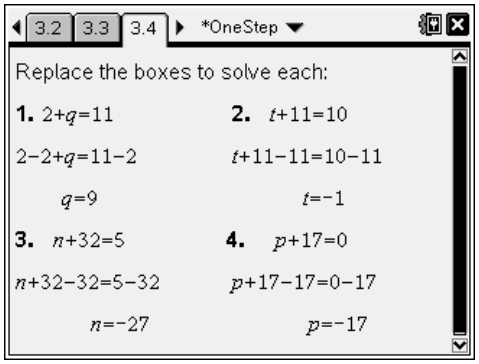
After students write and solve their own equations is a good point to introduce solving one-step addition equations with algebra tiles. The action of taking ones tiles away from both sides reinforces the pattern that students have observed.

Problem 3 – Looking for a pattern

Advancing to page 3.1, students are guided through a series of questions to ultimately form a hypothesis about solving one-step addition equations. Students will check their hypotheses against the equations they solved on previous screens.



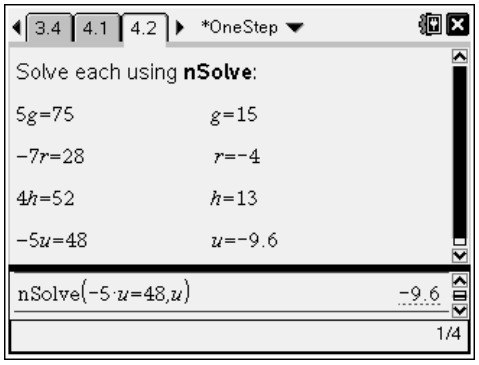
Discuss and demonstrate the Subtraction Property of Equality and its application to solving one-step addition equations in a whole-class setting before having students individually complete the calculations on page 3.4.



Problem 4 – Other operations

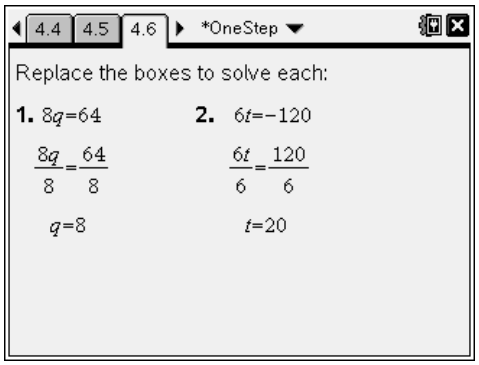
Students now turn their attention to one-step equations involving operations other than addition. This example focuses on equations of the form $ax = b$.

As before, students use the **nSolve** command to solve several one-step multiplication equations, formulate a hypothesis about the solution to a multiplication equation, and test the hypothesis by looking back at the equations they solved.



Discuss and demonstrate the Division Property of Equality and its application to solving one-step multiplication equations in a whole-class setting before having students individually complete the calculations on pages 4.6 and 4.7.

Wrap up the activity with a discussion of **inverse operations** as operations that "undo" each other. With the class, formulate a general rule for solving any one-step equation.



Solutions – Student worksheet

Problem 1

- $x = 5$
- $v = -18$
- $f = 4$, $y = -7$, $c = -37$, $d = 2$, $s = 3.75$

Problem 2

- $t = -5$
- $r = 50$, $h = 22$, $u = 69$, $g = 8$
- Answers will vary. Check that students' equations are solved correctly.

Problem 3

- subtract 3 from 8 to get 5
- Yes. The solution to $f + 2 = 6$ is 4. You can subtract 2 from 6 to get 4.
- $q = 9$, $t = -1$, $n = -27$, $p = -17$

Problem 4

- Answers may vary: Sample: Yes, division will undo multiplication.
- $g = 15$, $r = -4$, $h = 13$, $u = -9.6$
- divide 75 by 5 to get 15
- Yes. The solution to $-7r = 28$ is –4. You can divide 28 by –7 to get –4.
- $q = 8$, $t = 20$, $n = 1$, $p = -16$
- division
- multiplication
- To solve a one-step equation, apply the inverse operation to both sides.