One Step at a Time

ID: 8683

Time required
30 minutes

Activity Overview

In this activity, students solve one-step equations involving addition and multiplication by substituting possible values of the variable. The equations they solve and their solutions become data as the students are guided to formulate and test a hypothesis about solving one-step equations. The students use their result to solve several one-step equations algebraically. The activity closes with a discussion of inverse operations and a general rule for 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, perform basic operations with integers, and be familiar with the terms variable, expression, 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.)*
- *This activity is designed to be **student-centered** with the teacher acting as a facilitator while students work cooperatively and brief periods of teacher-led, whole class discussion. The student worksheet is intended to guide students through the main ideas of the activity and provide a place to record their observations.*
- ***To download the student worksheet, go to education.ti.com/exchange and enter "8683" in the keyword search box.***

Associated Materials

- *One_Step_at_a_Time_Student.doc*

Suggested Related Activities

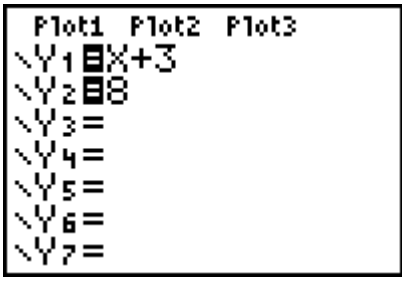
To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

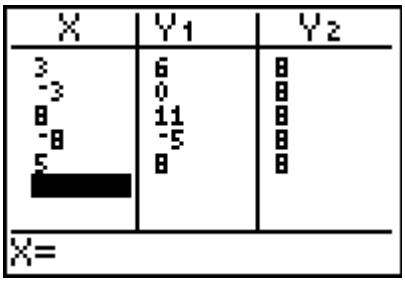
- *Solving Multi-Step Equations – LearningCheck™ quiz (LearningCheck) — 10464*
- *Linear Equations: Using Algebra (TI-84 Plus) — 4416*

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 – Addition Equations

Students begin by testing values for *x* in the equation *x* + 3 = 8, looking for the value of *x* that makes the equation true. They will set up the **Table** feature to perform the substitution automatically. Students are prompted to enter other addition equations into the Y= screen and repeat the process of entering values in the **Table** to find a solution.





Note: When students change the expressions in the Y= screen, the *x*-values they entered previously in the **Table** will remain. To delete the *x*-values, when on the **Table** screen, use the arrow keys to highlight the value and then press DEL.

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.

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

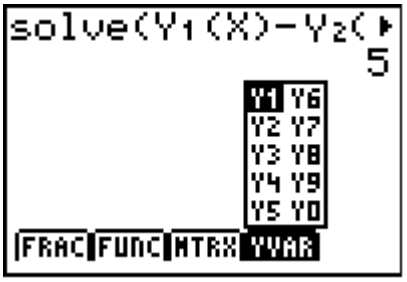
Discuss and demonstrate the **Subtraction Property of Equality** and its application to solving one-step addition equations in a whole-class setting before having students individually complete the equations for Question 4.

If using Mathprint OS:

Students can confirm their answers using the **solve** command from the Catalog 2nd [CATALOG]. On the Home screen they can enter the following:

solve(expr, variable, guess, {low bd, high bd}) ,

where the expression is entered as if already set equal to 0 and the low and high bounds are optional. For the first problem, enter **Y1(X) – Y2(X)**. To enter **Y1** and **Y2** quickly, students can press ALPHA [F4] and select **Y1**.

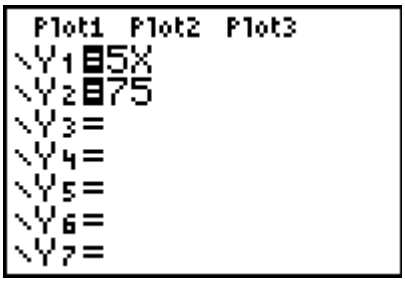


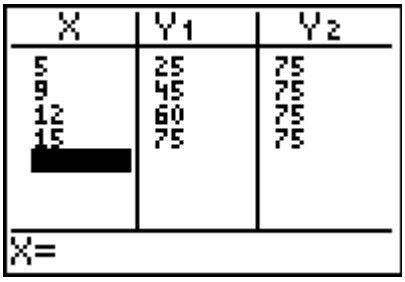
Problem 2 – Multiplication Equations

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 **Table** feature 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 equations for Question 8.





Problem 3 – Inverse Operations

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

1. **a.** $x = 50$

b. $x = 22$

c. $x = 69$

d. $x = -2$

2. Answers will vary. Check that students' equations are solved correctly.

3. **a.** Subtract 3 from 8 to get 5

b. Yes. The solution to $x + 30 = 80$ is $x = 50$, and you can subtract 30 from 80 to get 50.

4. **a.**
$$2 + q = 11$$
$$2 - 2 + q = 11 - 2$$
$$q = 9$$

b.
$$t + 11 = 10$$
$$t + 11 - 11 = 10 - 11$$
$$t = -1$$

c.
$$n + 32 = 5$$
$$n + 32 - 32 = 5 - 32$$
$$n = -27$$

d.
$$p + 17 = 0$$
$$p + 17 - 17 = -17$$
$$p = -17$$

Problem 2

5. **a.** $x = 15$

b. $x = -4$

c. $x = 13$

d. $x = -9.6$

6. Answers will vary. Check that students' equations are solved correctly.

7. **a.** Divide 75 by 5 to get 15

b. Yes. The solution to $-7x = 28$ is $x = -4$, and you can divide 28 by -7 to get -4.

8. **a.** $8q = 64$

$\frac{8q}{8} = \frac{64}{8}$

$q = 8$

b. $6t = -120$

$\frac{6t}{6} = \frac{-120}{6}$

$t = -20$

c. $2n = 2$

$\frac{2n}{2} = \frac{2}{2}$

$n = 1$

d. $-3p = 48$

$\frac{-3p}{-3} = \frac{48}{-3}$

$p = -16$

Problem 3

9. **a.** subtraction

b. addition

c. division

d. multiplication

10. To solve a one-step equation, apply the inverse operation to both sides of the equation.