Solving Systems by Substitution (6-2) – 2 days

Grade Level and Content

8th Grade Algebra

Big Idea

In this lesson, students explore the idea behind substitution by considering an example they are very familiar with, i.e., substituting ingredients into a recipe when they are out of a key ingredient. Students review that the solution of a system of linear equations is an ordered pair that makes both equations true. They then learn how to solve and practice solving systems of equations using substitution.

Objectives

Students will be able to …

1. Correctly solve systems of linear equations in two variables by substitution 8 out of 10 times.

PA State Standards

Anchor Descriptor - A1.1.2.2: Write, solve and/or graph systems of linear equations using various methods.

A1.1.2.2.1: Write and/or solve a system of linear equations (including problem situations) using graphing, substitution and/or elimination (limit systems to 2 linear equations).

A1.1.2.2.2: Interpret solutions to problems in the context of the problem situation (systems of 2 linear equations only).

Rationale for Students

The graphics, color, and realistic analogy will promote interest and motivation. Students need to know this technique for future classes and for future standardized tests. It is required by the standards.

Materials

- 1 promethean board with computer

Adaptations for Special Needs

No adaptations were recommended by the special education teacher. I approach this lesson first by presenting new properties and questioning in a way that guides students to put the pieces together on their own. I then summarize or have students summarize the steps required to solve the problem.

Technology

The promethean board will be used to present the lesson and enables the teacher and the students to work out solutions together. Students have access to online tutorials for each section so they can review concepts and have guided practice at home. All assignments will be posted on the class website so students who miss class won't fall behind.

Anticipatory Set – day 1   5 minutes, 5 minutes

Solve each equation for x.
1. $y = x + 3$ x = y - 3
2. $y = 3x - 4$ x = (y − 4)/3
Simplify each expression.
3. $2(x - 5)$ 2x - 10
4. $12 - 3(x + 1)$ 9 – 3x
Evaluate each expression for the given value of x.
5. $2/3x + 8$ for $x = 6$ 12

6. $3(x - 7)$ for x = 10   9

Go over the homework and or assessment.

For just a moment, I want you to think about making buttermilk pancakes from scratch. Here is our recipe: Flour plus eggs plus buttermilk plus baking soda. Imagine that you start making this only to find that you don't have buttermilk. There is a blizzard outside and you can't get to the store to buy some. Buttermilk is a critical ingredient for buttermilk pancakes. What can you do?
(substitute)

You can use milk and lemon juice in place of buttermilk.

Here's a way to remember this: Circle and Switch.

$2x + y = 5$
$y = x - 4$

We reviewed solving equations in one variable in our warm up today.

The goal is to reduce this system to one equation that has only one variable. If we can combine these two equations into one with only one variable, we can solve for that variable.

How do you think we might do that? What did we do with the buttermilk pancake recipe?

What you want to do is substitute the x – 4 in the second equation for the y in the first equation. Circle and Switch.

This results in the equation $5 = 2x + (x - 4)$. We can perform inverse operations to find that $9 = 3x$ and then $x = 3$.

Are we finished?

We still need the y-value that goes with it to have the ordered pair that is the solution of the system.

Let's review what we know. We now have the value of x that, when paired with the unknown y, makes both equations true. And we have the two original equations.

What can we do with a variable whose value we know and an equation in two variables?
(create another equation in one variable by substituting what we know (x = 3) and then solve for what we don't know)

You can circle and switch here, too.

We need to check our solution to make sure it works.

Students are assigned problems to work on individually:

Choose students to write the problem on the board and to explain what they did.

For example 3, point out that either substitution yields the same result.

Remind students to Circle and Switch.

Closing/Homework – day 1   5 minute, 45 minutes

How does the solution found by substitution compare to that found by graphing?

🏠 Homework
6-2 Practice B

Anticipatory Set – day 2   5 minutes, 5 minutes

Students will write a response to the question, "Why does making a one-variable equation—by substituting part of one equation into the other—give us the solution to the system?"

Procedure – day 2   35 minutes, 40 minutes

Homework   10 minutes, 15 minutes

Go over the homework from yesterday.

Presentation   10 minutes, 25 minutes

Students will solve a problem two ways: they will solve once by substituting for y and then substituting for x. The idea here is to point out that the answer will be the same.

Guided Practice   15 minutes, 40 minutes

Vegetable Riddle Worksheet

Students do problems 1 – 3 and three share answers at the board.

Closing/Homework – day 2   15 minute, 45 minutes

📄 EXIT TICKET
Solve by substitution.

$$\begin{cases} x = 2y - 4 \\ x + 8y = 16 \end{cases}$$

🏠 Homework
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