Math Virtual Learning

Algebra 1 S1

Solving a system of linear equations by elimination

April 23, 2020

Algebra I S1
Lesson: April 23, 2020

Objective/Learning Target:

Students will find the solution to a system of linear equations by using the elimination method.

BELL RINGER-ELIMINATION (REFRESHER-QUESTION # 1)

Elimination Method Using Addition and Subtraction:

In systems of equations where the coefficient (the number in front of the variable) of the x or y terms are additive inverses, solve the system by adding the equations. Because one of the variables is eliminated, this method is called elimination.

Use elimination to solve the system of equations:
$x - 3y = 7$ and $3x + 3y = 9$.

BELL RINGER-ELIMINATION (REFRESHER-QUESTION #1 answer)

Question 1: $x - 3y = 7$ and $3x + 3y = 9$.

1) Add the two equations.---------->

$$x - 3y = 7$$
$$+\ 3x + 3y = 9$$
$$4x \qquad = 16$$
$$\frac{4x}{4} = \frac{16}{4}$$
$$x = 4$$

BELL RINGER-ELIMINATION (REFRESHER-QUESTION #1 answer)

Question 1: $x - 3y = 7$ and $3x + 3y = 9$.

2) Substitute 4 for x in either original equation.

Then solve for y.

$$x - 3y = 7$$
$$4 - 3y = 7$$
$$-3y = 3$$

$$\frac{-3y}{-3} = \frac{3}{-3}$$
$$y = -1$$

The solution of this system is (4, -1).

BELL RINGER-ELIMINATION (REFRESHER-QUESTION # 2)

Elimination Method Using Multiplication:

Some systems of equations cannot be solved simply by adding or subtracting the equations. One or both equations must first be multiplied by a number before the system can be solved by elimination.

Use elimination to solve the system of equations:
$x + 10y = 3$ and $4x + 5y = 5$.

BELL RINGER-ELIMINATION (REFRESHER-QUESTION #2)

Question 2: $x + 10y = 3$ and $4x + 5y = 5$.

1) $x + 10y = 3$

$4x + 5y = 5$

(Multiply $x + 10y = 3$) by -4 -------> $-4x - 40y = -12$

Then add the two equations -----> $4x + 5y = 5$

$-35y = -7$

$\frac{-35y}{-35} = \frac{-7}{-35}$

$y = 1/5$

BELL RINGER-ELIMINATION (REFRESHER-QUESTION #2)

2) Substitute 1 /5 for y into either -------> original equation. Then solve for y

$$x + 10y = 3$$

$$x + 10(1/5) = 3$$

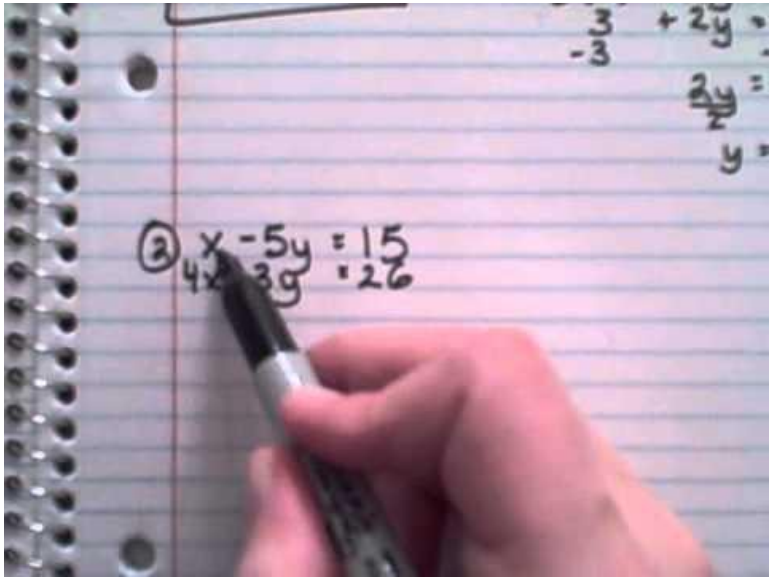
$$x + 2 = 3$$

$$x + 2 - 2 = 3 - 2$$

$$x = 1$$

The solution of this system is (1, 1/5)

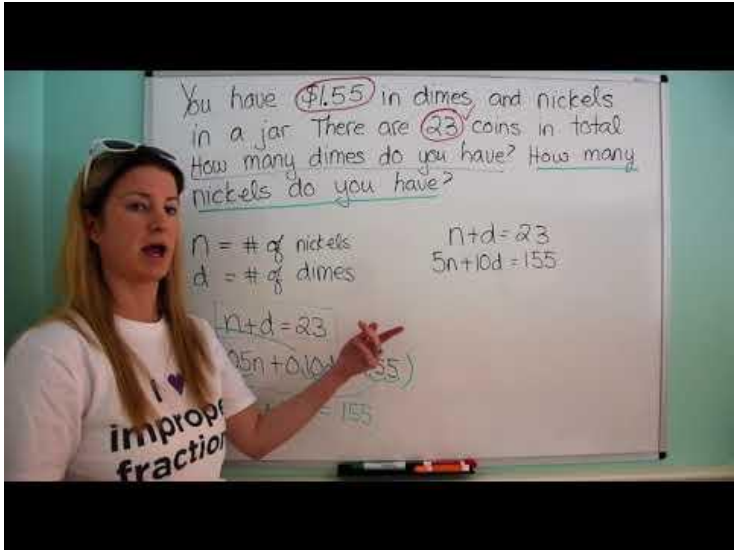
If needed, click the video for a review of solving systems of equations using elimination.



ELIMINATION WORD PROBLEMS

VIDEO 1:

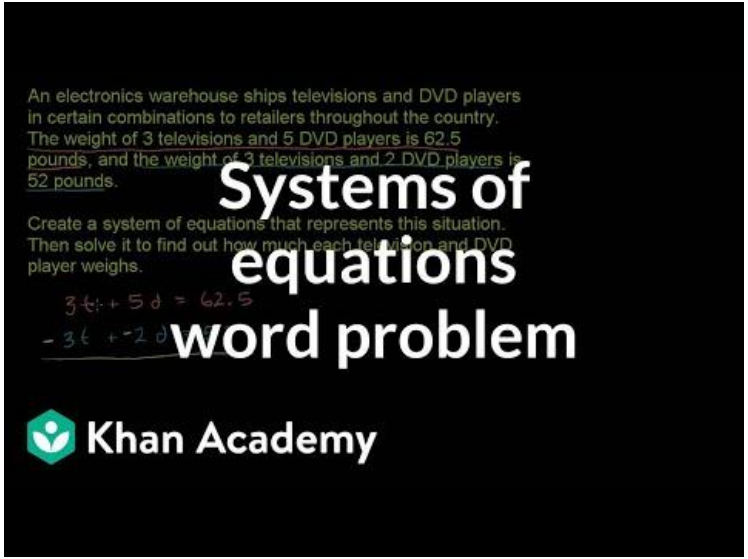
Systems of Equations Word problems-Money-Coins-Nickels-Dimes



ELIMINATION WORD PROBLEMS

VIDEO 2:

Systems of equations word problems



ELIMINATION WORD PROBLEM #1 PRACTICE

A landscaping company placed two orders with a nursery. The first order was for 13 bushes and 4 trees, and totalled $487. The second order was for 6 bushes and 2 trees, and totalled $232. The bills do not list the per-item price.

What were the costs of one bush and of one tree?

ELIMINATION WORD PROBLEM #1 PRACTICE -SOLUTION

I could try to add the bushes and trees, to get 19 bushes and 6 trees, but this wouldn't get me anywhere, because I don't have subtotals for the bushes and trees. So I'll pick variables:

number of bushes: B,

number of trees: t

With these variables, I can set up a system of equations; each equation will represent one of the transactions they've given me:

1st order: $13\mathrm{B} + 4t = 487$

2nd order: $6\mathrm{B} + 2t = 232$

ELIMINATION WORD PROBLEM #1 PRACTICE -SOLUTION CONTINUED

Multiplying the second row by -2, I get:

$$13B + 4t = 487$$

$$-12B - 4t = -464$$

Adding down the t-terms cancel out, leaving me with $B = 23$. Back-solving, I get that $t = 47$. Of course, the exercise didn't ask for the values of the two variables. Translating back into English, my solution is:

bushes: $23 each

trees: $47 each

ELIMINATION WORD PROBLEM #2 PRACTICE

You and a friend go to Tacos Galore for lunch. You order three soft tacos and three burritos and your total bill is $11.25. Your friend's bill is $10.00 for four soft tacos and two burritos.

How much do soft tacos cost? How much do burritos cost?

ELIMINATION WORD PROBLEM #2 PRACTICE-SOLUTION

1. Let's start by identifying the important information:

- 3 soft tacos + 3 burritos cost $11.25
- 4 soft tacos + 2 burritos cost $10.00

2. Define your variables.

- Ask yourself, "What am I trying to solve for? What don't I know?

In this problem, I don't know the price of the soft tacos or the price of the burritos.

Let x = the price of 1 soft taco

Let y = the price of 1 burrito

ELIMINATION WORD PROBLEM #2 PRACTICE-SOLUTION

3. Write two equations.

One equation will be related your lunch and one equation will be related to your friend's lunch.

$3x + 3y = 11.25$ (Equation representing your lunch)

$4x + 2y = 10$ (Equation representing your friend's lunch)

4. Solve!

We can choose any method that we like to solve the system of equations. I am going to choose the elimination method for this particular practice problem.

ELIMINATION WORD PROBLEM #2 PRACTICE-SOLUTION

Step 1: Rewrite each equation in order to have opposite terms!

$2\,[3x + 3y = 11.25] \quad = \quad 6x + 6y = 22.50$

$-3\,[4x + 2y = 10] \quad = \quad -12x - 6y = -30$

$$\begin{array}{r} 6x + 6y = 22.50 \\ -12x - 6y = -30 \\ \hline \end{array}$$

$$\frac{-6x}{-6} = \frac{-7.50}{-6}$$

$x = 1.25$

ELIMINATION WORD PROBLEM #2 PRACTICE-SOLUTION

Step 2: Now substitute the value for x (1.25) back into one of the equations and solve for y.

$4x + 2y = 10$	
$4(1.25) + 2y = 10$	Substitute.
$5 + 2y = 10$	Simplify.
$5 - 5 + 2y = 10 - 5$	Subtract 5 from both sides.
$\frac{2y}{2} = \frac{5}{2}$	Divide by 2.

$y = 2.5$

(1.25, 2.5) is the solution to this system of equations.

ELIMINATION WORD PROBLEM #2 PRACTICE-SOLUTION

Step 3: Check:

$3x + 3y = 11.25$

$3(1.25) + 3(2.5) = 11.25$

$3.75 + 7.5 = 11.25$ ☺

$4x + 2y = 10$

$4(1.25) + 2(2.5) = 10$

$5 + 5 = 10$ ☺

ELIMINATION WORD PROBLEM #2
PRACTICE-SOLUTION

Think about what the solution means in context of the problem.

x = the price of 1 soft taco and x = 1.25.

That means that 1 soft tacos costs $1.25.

y = the price of 1 burrito and y = 2.5.

That means that 1 burrito costs $2.50.