Lesson 7.3 – Solving a Linear System Using Substitution

Specific Outcome: 9.1 – Model a situation, using a system of linear equations. 9.2 – Relate a system of linear equations to the context of a problem. 9.5 – Determine and verify the solution of a system of linear equations algebraically. 9.7 – Explain a strategy to solve a system of linear equations. 9.8 – Solve a problem that involves a system of linear equations.

To solve a linear system by **substitution**, we isolate one of the variables in one of the equations. The value of this variable is substituted into the other equation. Now we have one equation in one variable.

(Hint: Solve for the simpler variable.)

Solve: $y = 3x$
$x - 2y = 10$

We can see that the first equation is already expressed with the y variable isolated ($'y ='$). Now we can take its new value ($3x$) and substitute it into the second equation:

Practice: Use substitution to solve each of the following linear systems.

a) $x = 7 + y$
$2x + 5y = 21$

b) $x + 2y = 13$
$2x + 3y = -9$

c) $4x + 3y = 7$
$3x + y = -1$

d) $x - y = 2$
$4x - 3y = 11$

e) $5(2x - 3) + y = 5$
$6x - 2(y - 4) = 20$

f) $4x + 3y = 0$
$8x - 9y = 5$

Problem Solving: Show all the work. Verify.
1. Frank has $3.85 in dimes and quarters. There are 25 coins in all. How many of each type of coin does Frank have? Use substitution to solve.

2. Louise purchased a Metis flag whose length was 90 cm longer than its width. The perimeter of the flag was 540 cm. What are the dimensions of the flag? Use substitution to solve.

3. Alexia invested $1800. Part of it was invested at an annual interest rate of 3.5%, and the rest at an annual interest rate of 4.5%. After one year the total interest was $73. Use substitution to determine how much she invested at each rate.

4. If $x + 2y = 10$ and $x - 2y = 2$, then $x + y$ is equal to
    A. 8
    B. 12
    C. 13
    D. -2

Solve each system of equations below by the substitution method. Find the solution in the table below and write these letters in the two boxes under the table that contains the number of the exercise. Solutions to #1 to 6 are in the first row and #7 to 12 are in the second row.

Why did the ghost decide to haunt city hall?

ST	TO	SA	IT	NT	TH	BE	ED	HA	WA
(4,2)	(6,-1)	(1,2)	(4,8)	(1,-3)	(6,-3)	(5,3)	(9,2)	(7,3)	(5,2)
ER	TE	IG	RE	ST	EN	EX	TH	MA	HT
$(\frac{1}{2},-3)$	$(8,-\frac{1}{2})$	$(-\frac{1}{3},\frac{4}{3})$	(8,0)	(-3,4)	$(\frac{1}{2},7)$	$(\frac{5}{2},\frac{4}{3})$	(-1,4)	$(\frac{5}{2},-\frac{1}{2})$	(-4,-3)

1	2	3	4	5	6	7	8	9	10	11	12

1. $y = 2x$
   $x + y = 12$

2. $x = 3y - 1$
   $x + 2y = 9$

3. $y = 2x - 5$
   $4x - y = 7$

4. $2x - 3y = 12$
   $x = 4y + 1$

5. $y = -x + 5$
   $x - 4y = 10$

6. $x - y = 2$
   $4x - 3y = 11$

7. $-2x + 3y = 14$
   $x + 2y = 7$

8. $6x - y = -4$
   $2x + 2y = 15$

9. $x + y = 1$
   $2x - y = -2$

10. $5x - 3y = -11$
    $x - 2y = 2$

11. $x - y = 3$
    $6x + 4y = 13$

12. $2x - y = 16$
    $-x + 2y = -8$