FMP10
Date: _____

Name: _____

Unit 9: Solving Systems of Linear Equations Algebraically

9.1 Solving Systems of Linear Equations by Substitution

Substitution Method:

Ex. Solve $4x + 5y = 26$, $3x = y - 9$

(x, y)

(-1, 6)

Steps

- Isolate a single variable in one of the two equations (If possible choose a variable with a coefficient of 1)
- Substitute the expression into the other equation and solve one of the variables
- Substitute the first variable solution into either original equation and solve for the remaining variable
- Verify your solution by substituting into both original equations

① $(3x+9) = y$

② $4x + 5(3x+9) = 26$

$4x + 15x + 45 = 26$

$19x + 45 = 26$

$-45 \quad -45$

$19x = -19$

$x = -1$

③ $3(-1) = y - 9$

$-3 + 9 = y$

$6 = y$

(-1, 6)

Check

$4(-1) + 5(6) = 26$

$-4 + 30 = 26$

$26 = 26$ ✓

$3(-1) = 6 - 9$

$-3 = -3$ ✓

Ex. Solve $2x + y = 13$, $x - 0.4y = -16$

① $y = (-2x + 13)$

② $10x - 4y = -160$

$10x - 4(-2x+13) = -160$

$10x + 8x - 52 = -160$

$18x - 52 = -160$

$+52 \quad +52$

$18x = -108$

$x = -6$

③ $2(-6) + y = 13$

$-12 + y = 13$

$y = 25$

(-6, 25)

④ ch

$2(-6) + 25 = 13$

$-12 + 25 = 13$

$13 = 13$ ✓

$(-6) - 0.4(25) = -16$

$-6 - 10 = -16$

$-16 = -16$ ✓

Ex. Solve $\frac{2}{3}x + \frac{3y}{5} = -2$, $\frac{x}{6} - \frac{6y}{2} = \frac{6}{-7}$

LCM: 15

① $10x + 9y = -30$

$x - 3y = -42$

$x = (3y - 42)$

② $10(3y - 42) + 9y = -30$

$30y - 420 + 9y = -30$

$39y - 420 = -30$

$39y = 390$

$y = 10$

③ $x - 3(10) = -42$

$x - 30 = -42$

$x = -12$

(-12, 10)

④ ch $\frac{2}{3}(-12) + \frac{3}{5}(10) = -2$

$-8 + 6 = -2$

$-2 = -2$ ✓

ch $\frac{-12}{6} - \frac{10}{2} = -7$

$-2 - 5 = -7$

$-7 = -7$ ✓

Ex. At a dance recital, there were 220 people. Tickets cost $9 for an adult and $6 for a child. The dance collected $1614 in ticket sales. How many adults and how many children attended the recital?

Let a = # of adults
Let c = # of childrens

① $220 = a + c$
$-c \quad -c$

$(220 - c) : a$

$6c + 9a = 1614$

② $6c + 9(220 - c) = 1614$

$6c + 1980 - 9c = 1614$

$\frac{-3c}{-3} = \frac{-366}{-3}$

$c = 122$

③ $220 = a + 122$

$98 = a$

④ ch
$220 = 98 + 122$
$220 = 220$ ✓

ch.
$6(122) + 9(98) = 1614$

$732 + 882 = 1614$

$1614 = 1614$ ✓

98 adults
122 children

Practice: pg. 474/ # 1, 2, 4 – 7, 9 – 14, 19, 20a, 24

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4.2 Solving Systems of Linear Equations by Elimination

Elimination Method:

$12x + 10y = 48$
$-(12x + 9y = 36)$
$1y = 12$

Steps:

Ex. Solve $6x = 24 - 5y$
$3y + 4x = 12$

(1) $6x + 5y = 24$ $\xrightarrow{\times 2}$ $12x + 10y = 48$
$4x + 3y = 12$ $\xrightarrow{\times -3}$ $-12x - 9y = -36$
$0x \quad y = 12$ (2)

(3) $6x = 24 - 5(12)$
$6x = 24 - 60$
$6x = -36$
$x = -6$

(4) Ch
$6(-6) = 24 - 5(12)$
$-36 = 24 - 60$
$-36 = -36$ ✓

Ch $3(12) + 4(-6) = 12$
$36 + -24 = 12$
$12 = 12$ ✓

$(-6, 12)$

- Rearrange the equations so that like variables appear in the same position in both equations. The most common form is $ax + by = c$.
- Determine which variable to eliminate. If necessary, multiply one or both equations by a constant to eliminate the variable by addition or subtraction.
- Solve for the remaining variable.
- Solve for the second variable by substituting the value for the first variable into one of the original equations.
- Verify your answer by substituting each value into both original equations.

Ex. Solve $3a - 5b = -9$
$4a + 5b = 23$

(1) $7a = 14$
$a = 2$

(2) $4(2) + 5b = 23$
$8 + 5b = 23$
$5b = 15$
$b = 3$

(3) Ch
$3(2) - 5(3) = -9$
$6 - 15 = -9$
$-9 = -9$ ✓

$4(2) + 5(3) = 23$
$8 + 15 = 23$
$23 = 23$ ✓

$(2, 3)$

Ex. Solve $y = 4x + 11$
$x - y = 1$

(1) $-4x + y = 11$
(2) $x - y = 1$
$-3x = 12$
$x = -4$

(3) $-4 - y = 1$
$+4 \quad +4$
$-y = 5$
$y = -5$

$(-4, -5)$

Ex. Connor downloaded two orders of games and songs. The first order consisted of five games and four songs for $26. The second order consisted of three games and two songs for $15. All games cost the same amount and all songs cost the same amount. Write a system of linear equations. Then, determine the cost of one song and the cost of one game.

Let g = cost of game Let s = cost of song

$5g+4s=26 \rightarrow 5g+4s=26$

$3g+2s=15 \xrightarrow{\times -2} -6g-4s=-30$

$-1g=-4$

$g=\$4$

$3(4)+2s=15$

$12+2s=15$

$2s=3$

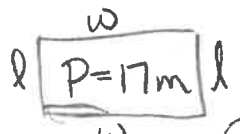
$s=\frac{3}{2}$

$s=\$1.50$

1 game = $4

1 song = $1.50

Ex. The perimeter of a rectangular garden is 17 m. Triple the length is 2.46 m longer than five times the width. Sketch and label a diagram. Create a system of linear equations to determine the dimensions of the rectangle. Solve the system using elimination.



Let l = length of garden

w = width

① $2l+2w=17 \rightarrow (2l+2w=17) \times 3$

② $3l=5w+2.46 \rightarrow (3l-5w=2.46) \times -2$

③ $6l+6w=51$

$-6l+10w=4.92$

$16w=46.08$

$w=2.88$ m

④ $2l+2(2.88)=17$

$2l+5.76=17$

$2l=11.24$

$l=5.62$ m

Practice: pg. 488/ # 1 – 11, 15, 16 5 checks