

6.3 Solving Systems of Linear Equations by Elimination

Elimination Method:

Ex. Solve

$$\begin{array}{r} +5y \quad +5y \\ 6x = 24 - 5y \end{array} \rightarrow 6x + 5y = 24$$

$$3y + 4x = 12 \rightarrow 4x + 3y = 12$$

$$6x + 5y = 24 \Rightarrow 12x + 10y = 48$$

$$4x + 3y = 12 \Rightarrow 12x + 9y = 36$$

$$y = 12$$

$$6x = 24 - 5(12)$$

$$6x = 24 - 60$$

$$6x = -36$$

$$x = -6$$

$$\text{OR } (-6, 12)$$

- 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

$$3a - 5b = -9$$

$$4a + 5b = 23$$

$$\frac{7a}{7} = \frac{14}{7}$$

$$a = 2$$

$$4(2) + 5b = 23$$

$$8 + 5b = 23$$

$$5b = 15$$

$$b = 3$$

$$\text{OR } (2, 3)$$

Ex. Solve

$$y = 4x + 11 \rightarrow -4x + y = 11$$

$$x - y = 1 \rightarrow x - y = 1$$

$$\frac{-3x}{-3} = \frac{12}{-3}$$

$$x = -4$$

$$y = 4(-4) + 11$$

$$y = -16 + 11$$

$$y = -5$$

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.

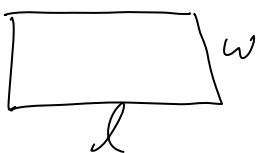
Let $x = \text{song cost}$
 $y = \text{game cost}$

$$\begin{array}{rcl} 5y + 4x = 26 & \rightarrow & 5y + 4x = 26 \\ 3y + 2x = 15 & \xrightarrow{\times 2} & 6y + 4x = 30 \\ \hline & & -y = -4 \\ & & y = 4 \end{array}$$

$$\begin{array}{r} 5(4) + 4x = 26 \\ 20 + 4x = 26 \\ -20 \quad -20 \\ \hline 4x = 6 \\ \frac{4x}{4} = \frac{6}{4} \\ x = \frac{3}{2} = 1.5 \end{array}$$

Games cost \$4 each
 + songs cost \$1.50 each

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.



$$\begin{array}{rcl} 2l + 2w = 17 & \xrightarrow{\times 3} & 6l + 6w = 51 \\ 3l = 5w + 2.46 & \xrightarrow{-5w} & 6l - 10w = 4.92 \\ \hline & & 16w = 46.08 \\ & & w = 2.88 \end{array}$$

$$2l + 2(2.88) = 17$$

$$\begin{array}{r} 2l + 5.76 = 17 \\ -5.76 \quad -5.76 \\ \hline 2l = 11.24 \\ \frac{2l}{2} = \frac{11.24}{2} \\ l = 5.62 \end{array}$$

The rectangle has
 dimensions 2.88m by
 5.62m