

Solving Word Problems with a System of Equations

If you read a word problem and there are 2 variables you will need 2 equations

Steps:

1. DEFINE THE VARIABLES
2. SET UP THE TWO EQUATIONS
3. SOLVE USING ELIMINATION
4. STATE YOUR SOLUTION IN A COMPLETE SENTENCE
- ★ 5. CHECK YOUR SOLUTION

There are generally two ways to set up a system of equations from a word problem. Some questions will ask you "HOW MANY" of something; and others might ask about the "COST" of something.

The "HOW MANY" Problems (you already know the cost; and need to know how many)	
Equation 1	$X + Y = \text{TOTAL NUMBER OF THINGS}$
Equation 2	$\text{COST } X + \text{COST } Y = \text{TOTAL MONEY}$

Example one: You are selling tickets for a high school basketball game. Student tickets cost \$3 and general admission tickets cost \$5. You sell 350 tickets and collect \$1450. How many of each type of ticket did you sell?

$X = \text{STUDENT TICKETS}$
 $Y = \text{GENERAL ADMISSION}$

$$\begin{aligned}x + y &= 350 \\ 3x + 5y &= 1450\end{aligned}$$

← THIS EQUATION IS ABOUT THE TOTAL NUMBER OF TICKETS. NO MONEY HERE!

→ THIS EQUATION IS ABOUT ALL THE MONEY.

NOW SOLVE!

$$\begin{array}{r}3(x + y = 350) \\ -1(3x + 5y = 1450) \\ \hline-2y = -400 \\ \boxed{y = 200}\end{array}$$

$$\begin{aligned}3x + 3(200) &= 1050 \\ 3x + 600 &= 1050 \\ 3x &= 450 \\ \boxed{x = 150}\end{aligned}$$

150 STUDENT TICKETS WERE SOLD AND
200 GENERAL ADMISSION TICKETS WERE SOLD

Example 2: You are selling hamburgers and corndogs at the concession stand. The hamburgers cost \$3.50 and the corndogs cost \$1.50. The concession stand collects \$1300 in sales and determines there were a total of 600 items were sold. How many hamburgers were sold?

X = HAMBURGERS
Y = CORN DOGS

$$\begin{aligned} -1.5(x+y=600) \\ 1(3.5x+1.5y=1300) \end{aligned}$$

$$\begin{aligned} -1.5x - 1.5y &= -900 \\ 3.5x + 1.5y &= 1300 \end{aligned}$$

$$2x = 400$$

$$x = 200$$

$$200 + y = 600$$

$$y = 400$$

200 HAMBURGERS WERE SOLD

The "COST" Problems (you already total cost but need to know the individual prices)

Equation 1	NUMBER OF X + NUMBER OF Y = TOTAL COST OF FIRST
Equation 2	NUMBER OF X + NUMBER OF Y = TOTAL COST OF SECOND

Example three: At an Italian bistro, the costs of 2 plates of spaghetti and 1 salad is \$27.50. The cost for 4 plates of spaghetti and 3 salads is \$59.50. Find the cost of a plate of spaghetti and a salad.

X = SPAGHETTI
Y = SALAD

$$\begin{aligned} -3(2x+y=27.50) \\ 1(4x+3y=59.50) \end{aligned}$$

YOU CAN REPHRASE THIS AS 2 SPAGHETTIS AND A SALAD COST \$27.50

$$\begin{aligned} -6x - 3y &= -82.5 \\ 4x + 3y &= 59.5 \end{aligned}$$

$$-2x = -23$$

$$x = 11.5 = \$11.50$$

$$2(11.5) + y = 27.50$$

$$23 + y = 27.50$$

$$y = 4.5 = \$4.50$$

A PLATE OF SPAGHETTI COSTS \$11.50

A SALAD COSTS \$4.50

Example four: You are going to Disney World! The hotel is offering two different vacation packages. Plan A has 3 nights in the hotel and 2 tickets to Disney World for \$580. Plan B has 5 nights in the hotel with 3 tickets to Disney World for \$945. What is the cost of each night in the hotel and each ticket?

X = HOTEL NIGHTS
Y = DISNEY TICKETS

$$\begin{aligned} 3(3x+2y=580) \\ -2(5x+3y=945) \end{aligned}$$

$$9x + 6y = 1740$$

$$-10x - 6y = -1840$$

$$-x = -150$$

$$x = 150$$

$$9(150) + 6y = 1740$$

$$1350 + 6y = 1740$$

$$-1350 \quad -1350$$

$$6y = 390$$

$$y = 65$$

ONE HOTEL NIGHT COSTS \$150 AND ONE TICKET COSTS \$65