

## Writing Systems of Equations from Word Problems

**MGSE9-12.A.CED.3** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.

**MGSE9-12.A.CED.2** Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (The phrase “in two or more variables” refers to formulas like the compound interest formula, in which  $A = P(1 + r/n)^{nt}$  has multiple variables.)

**What am I learning today?**

How to write a system of equations from a scenario

**How will I show that I learned it?**

Write a system of equations and solve using my 3 techniques

Writing Systems of Equations:  $x = \# \text{ of } \dots$   
Step 1: Define the variables.  $y = \#$   
Step 2: Write 2 equations from the phrases.  
Step 3: Use substitution, elimination, or graphing to solve for variables.  
Step 4: Answer question using proper units.

## Slope Intercept Form

Scenarios that lend themselves to fit the  $y = mx + b$  format.

Example: You pay \$2 to ride in a taxi and \$.20 per mile.

$$y = .20x + 2$$

cost of ride

# of miles



## Total Items Form

Scenarios that deal with buying two or more types of items.

Example: You are buying cokes and sprites for 10 people.

$$\begin{array}{c} \nearrow \\ \# \text{ of} \\ \text{Cokes} \end{array} C + \begin{array}{c} \nearrow \\ \# \text{ of} \\ \text{Sprites} \end{array} S = 10$$



## Total Price Form

Scenarios that deal with buying two or more types of items and paying a total price.

Example: You are buying <sup>"d"</sup>hot dogs for \$2 each and hamburgers for \$3 each. You spend \$13 total.

$$2d + 3h = 13$$

*Handwritten annotations:*  
A blue arrow points from the text "# of hot dogs" to the variable  $d$ .  
A green arrow points from the text "# of hamburgers" to the variable  $h$ .



Ex. A The difference of two numbers is 7. The sum of the two numbers is 29. Find the two numbers.

$$\begin{cases} s - n = 7 \\ s + n = 29 \end{cases}$$

$$\begin{aligned} s &= \text{1st number} \\ n &= \text{2nd number} \end{aligned}$$

$$\begin{array}{r} 2s = 36 \\ \hline 2 \end{array} \quad s = 18$$

Elimination

$$\begin{aligned} 18 + n &= 29 \\ n &= 11 \end{aligned}$$

The two numbers are  
18 and 11.

Ex. B You have 25 coins in your pocket, all nickels and dimes. Total, the coins add up to \$2.10. How many of each do you have?

$$\begin{array}{l} \text{Total items} \\ \$ \end{array} \left\{ \begin{array}{l} 8 + d = 25 \quad d = 17 \\ n + d = 25 - n \\ .05n + .10d = 2.10 \end{array} \right. \begin{array}{l} n = \# \text{ of} \\ \text{nickels} \\ d = \# \text{ of} \\ \text{dimes} \end{array}$$

$$d = 25 - n$$

$$.05n + .10(25 - n) = 2.10$$

$$.05n + 2.50 - .10n = 2.10$$

$$\begin{array}{r} -.05n + 2.50 = 2.10 \\ \quad \quad \quad -2.50 \quad \quad -2.50 \\ \hline \end{array}$$

$$\begin{array}{r} -.05n = -.40 \\ \hline \end{array} \quad n = 8$$

We have 8 nickels and 17 dimes.



Ex. C You went to Pizza Hut. The first time, you bought 3 breadsticks and 2 pizzas; it cost you \$26. The second time, you bought 1 breadstick and 5 pizzas; it cost you \$39. How much does a single breadstick cost? How much does a single pizza cost?

$$\begin{cases} 2p + 3b = 26 \\ 5p + b = 39 \end{cases}$$

$$\begin{cases} -15p - 3b = -117 \\ 2p + 3b = 26 \end{cases}$$

$$-13p = -91$$

$$p = 7$$

Pizza cost \$7 and breadsticks are \$4

$$p = \text{cost of pizza}$$

$$b = \text{cost of breadstick}$$

$$\begin{aligned} 2(7) + 3b &= 26 \\ 14 + 3b &= 26 \\ 3b &= 12 \\ b &= 4 \end{aligned}$$

Ex. D You are selling tickets for a high school play. Student tickets cost \$4 and general admission tickets cost \$6. You sell 31 tickets and collect \$170. How many of each type did you sell?

$$\begin{array}{l}
 \text{Total Items} \left\{ \begin{array}{l} S + g = 31 \\ 4s + 6g = 170 \end{array} \right. \quad \begin{array}{l} S = \# \text{ of student} \\ \text{tix} \\ g = \# \text{ of gen adm} \\ \text{tix} \end{array} \\
 \$ \left\{ \begin{array}{l} 4s + 6g = 170 \\ -4s - 4g = -124 \end{array} \right. \quad \text{Elimination} \\
 \hline
 2g = 46 \\
 g = 23 \\
 \begin{array}{l} S + g = 31 \\ S + 23 = 31 \\ S = 8 \end{array}
 \end{array}$$

We sold 8 student ; 23 gen admission tickets.

Ex. E Two planes are currently landing at Hartsfield. One plane is descending at 300 feet per minute from 9000 feet. The other is descending at 200 feet per minute from 6000 feet. When will they be at the same height and at what time will that be?

Ex. F You are taking a trip cross-country. When you are flying to California, the plane is traveling at 528 mph with a headwind. When you are flying home to Georgia, the plane is traveling at 572 mph with a tailwind. What is the speed of the plane and what is the speed of the wind?