

Name: _____

Date: _____

MODELING WITH SYSTEMS OF EQUATIONS!

Many real world scenarios can be modeled using systems of equations. In fact, when we have two quantities that are related and two ways in which those quantities are related, then we can often set up and solve a system.

Do Now: Jonathan has nine bills in his wallet that are all either five-dollar bills or ten-dollar bills.

(a) Fill out the following table to see the dependence of the two variables and how they then determine how much money Jonathan has.

Number of fives, f	Number of tens, t	Amount of Money, \$
0	9	\$90
1	8	\$85
2	7	\$80
3	6	\$75

(b) If f represents the number of \$5 bills and t represents the number of \$10 bills, then what does the following expression calculate? Explain.

$5f + 10t$

$$5(2) + 10(7) = 80$$

How much \$\$\$ Jonathan has in his wallet.

Stop! We are going to set up the system together.

(c) If Jonathan has a total of \$55, set up a system of equations involving f and t that could be used to determine how many of each bill he has. Solve the system. Remember that he has 9 total bills.

$$\begin{aligned} \textcircled{1} \quad & 5f + 10t = 55 \\ \textcircled{2} \quad & f + t = 9 \end{aligned}$$

$f = 7$
 $t = 2$

$$\begin{array}{r} 5f + 10t = 55 \\ -5(f + t) = (9) - 5 \\ \hline f + 5t = 50 \\ f + 5t = 45 \\ \hline 5t = 10 \\ t = 2 \end{array}$$

There are many different problems that can be modeled with linear systems. Let's try another one where we use information given to determine **unit prices**.

Exercise #2: Samantha went to a concession stand and bought three pretzels and four sodas and paid a total of \$11.25 for them. Raza went to the same stand and bought five pretzels and two sodas and paid a total of \$8.25.

(a) Could pretzels have cost \$1.75 each and sodas \$1.50 each? How can you evaluate based on the information given?

SAM

$$3(1.75) + 4(1.50) = 11.25$$

RAZA

$$5(1.75) + 2(1.50) = 8.75 + 3.00 = 11.75$$

(b) Letting x equal the **unit cost** of a pretzel and letting y equal the **unit cost** of a soda, write a system of equations that models the information given.

$$\begin{aligned} \textcircled{1} \quad & 3x + 4y = 11.25 \\ \textcircled{2} \quad & 5x + 2y = 8.25 \end{aligned}$$

(c) Solve the system of equations using the elimination method.

$$\begin{aligned} 3x + 4y &= 11.25 \\ 5x + 2y &= 8.25 \end{aligned}$$

\$.75 per pretzel
\$ 2.25 per soda

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	$\begin{bmatrix} 1 & 0 & / \\ 0 & 1 & 2 \end{bmatrix}$
5*1.75	
	8.75
2*1.5	
	3
rref([A])	$\begin{bmatrix} 1 & 0 & .75 \\ 0 & 1 & 2.25 \end{bmatrix}$

Exercise #3: A rectangle has a perimeter of 204 feet. It's length is six feet longer than twice its width. If L stands for the length of the rectangle and W stands for its width, write a system of equations that models the information given in this problem and solve it to find the length and width of this rectangle.

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MODELING WITH SYSTEMS OF EQUATIONS
HOMEWORK

1. A local theater is showing an animated movie. They charge \$5 per ticket for a child and \$12 per ticket for an adult. They sell a total of 342 tickets and make a total of \$2550. We want to try to find out how many of each type of ticket they sold. Let c represent the number of children's tickets sold and a represent the number of adult tickets sold.
 - (a) Write an equation that represents the fact that 342 total tickets were sold.
 - (b) Write an equation representing the fact that they made a total of \$2550.

(c) Solve the system you created in (a) and (b) by the Method of Elimination.

2. A catering company is setting up tables for a big event that will host 764 people. When they set up the tables they need 2 forks for each child and 5 forks for each adult. The company ordered a total of 2992 forks. Set up a system of equations involving the number of adults, a , and the number of children, c , and solve to find out how many of each attended the event.