Application Problems Involving Linear Systems

Single Equation

Frank is a hot dog vendor. He pays the city $50 everyday to set up infront of the town hall. He makes $3 on each hot dog.

a) Write an equation to describe his earnings.

b) Use the equation to find out how many hot dogs he needs to sell to break-even ⇒ Earnings = 0

c) How many hot dogs does he need to sell in order to make $190?

a) $E = 3x - 50$

x is the number of hot dogs

b) $0 = 3x - 50$

$\frac{50}{3} = \frac{3x}{3}$

$16.\overline{6} = x$ He needs to sell 17 hot dogs

c) $190 = 3x - 50$ (+50)

$\frac{240}{3} = \frac{3x}{3}$

$80 = x$

He needs to sell 80 hot dogs.

SOLEs – Systems of Linear Equations

The difference of two numbers is 5. Their sum is 27. What are the numbers?

Let x be the 1st number

Let y be the 2nd number

$x - y = 5$

$-[x + y = 27]$

$0x - 2y = -22$

$\frac{-2y}{-2} = \frac{-22}{-2} \Rightarrow y = 11$

$x - y = 5$

$x - 11 = 5$

$x = 16$

The numbers are 16 and 11.

Trevon and Jose are selling pies for a school fundraiser. Customers can buy cherry pies and lemon meringue pies. Trevon sold 8 cherry pies and 8 lemon meringue pies for a total of $152. Jose sold 4 cherry pies and 6 lemon meringue pies for a total of $100. What is the cost each of one cherry pie and one lemon meringue pie?

Let c be the cost of cherry pies and m be the cost of lemon meringue.

$8c + 8m = 152 \rightarrow 8c + 8m = 152$

$[4c + 6m = 100] \times 2 \rightarrow -[8c + 12m = 200]$

$-4m = -48$

$\frac{-4m}{-4} = \frac{-48}{-4}$

$m = 12$

$\therefore 8c + 8(12) = 152$

$8c + 96 = 152$

$8c = 56$

$c = 7$

The cherry pie costs $7 and the lemon costs $12

The school that Shreya goes to is selling tickets to a fall musical. On the first day of ticket sales the school sold 9 senior citizen tickets and 1 child ticket for a total of $122. The school took in $113 on the second day by selling 6 senior citizen tickets and 7 child tickets. Find the price of a senior citizen ticket and the price of a child ticket.

Let x be the price of the senior citizen ticket and y be the price of the child ticket.

Day ①: $9x + y = 122 \rightarrow y = -9x + 122$

Day ②: $6x + 7y = 113$

$6x + 7(-9x + 122) = 113$

$6x - 63x + 854 = 113$

$-57x = -741$

$\frac{-57x}{-57} = \frac{-741}{-57}$

$x = \$13$

$\rightarrow y = -9(13) + 122$

$y = \$5$

The price of a senior ticket is $13 and a child is $5.

Jennifer and Adam are selling pies for a school fundraiser. Customers can buy apple pies and pumpkin pies. Jennifer sold 1 apple pie and 5 pumpkin pies for a total of $120. Adam sold 14 apple pies and 11 pumpkin pies for a total of $500. Find the cost each of one apple pie and one pumpkin pie.

Let a be the cost of an apple pie, and p be the cost of a pumpkin pie..

$a + 5p = 120$ ✓

$14a + 11p = 500$ ✓ now, solve

One type of granola is 30% fruit and another type is 15% fruit. What mass of each type of granola should be mixed to make 600 g of granola that is 21% fruit?

Let x be the grams of 30% fruit and y the grams of 15% fruit

$x + y = 600 \longrightarrow x = 600 - y$

$0.30x + 0.15y = 0.21(600)$

$\therefore 0.30(600 - y) + 0.15y = 126$

$180 - 0.3y + 0.15y = 126$

$\frac{-0.15y}{-0.15} = \frac{-54}{-0.15}$

$y = 360 \Rightarrow x = 600 - 360$

$x = 240$

$\therefore$ They need 240 grams of 30% and 360 grams of 15%..

A chemistry teacher needs to make 10L of 42% sulphuric acid solution. The acid solutions available are 30% sulphuric acid and 50% sulphuric acid, by volume. How many litres of each solution must be mixed to make the 42% solution?

50%
40%
30%

Let x be the Litres of 50%
Let y be the Litres of 30%

$$\begin{aligned} x + y &= 10 \quad \times 0.5 \Rightarrow 0.50x + 0.50y = 5 \\ 0.50x + 0.30y &= 0.42(10) \Rightarrow 0.50x + 0.30y = 4.2 \end{aligned}$$

$$\begin{aligned} 0x + 0.20y &= 0.8 \\ \frac{0.20y}{0.20} &= \frac{0.8}{0.20} \\ y &= 4 \end{aligned}$$

$x + 4 = 10$
$x = 6$

We need 6 L. of 50% and 4 L. of 30% acid.

Typical Equations:

x + y = sum
_____x + _____y = _____ (total)
_____x + _____y = _____ (%/$ of total)

Dollars for each amount
Percent of each amount

y = ____x + b ← Starting Value/y-intercept

Percent (commission)
Cost per ____(ex.square foot)

Challenge Problem: The sum of the digits of a certain two-digit number is 13. When you reverse its digits you increase the number by 27. What is the number?