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 → Profit is Zero.

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

a) E is earnings $h →$ the number of hotdogs

$$E = -50 + 3h$$

b) $E = 0 →$ $0 = -50 + 3h$

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

$$16.\bar{6} = h$$

He needs to sell 17 hotdogs

c) $E = 190$

$$190 = -50 + 3h$$

$$240 = 3h$$

$$80 = h$$

He needs to sell 80 hotdogs

SOLEs – Systems of Linear Equations

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

$x - 1^{st}$ number $y → 2^{nd}$ number

$$x - y = 5$$
$$+ \ x + y = 27$$
$$\overline{ 2x = 32}$$
$$x = 16$$

$$x - y = 5$$
$$16 - y = 5$$
$$-y = -11$$
$$y = 11$$

The numbers are 11 and 16.

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?

$c →$ price of cherry pie , $l →$ price of lemon meringue pie

$$8c + 8l = 152 \ →\ 8c + 8l = 152$$
$$4c + 6l = 100 \ \times 2 →\ 8c + 12l = 200$$
$$\overline{ -4l = -48}$$
$$l = 12$$

$$\therefore 8c + 8(12) = 152$$
$$8c + 96 = 152$$
$$8c = 56$$
$$c = 7$$

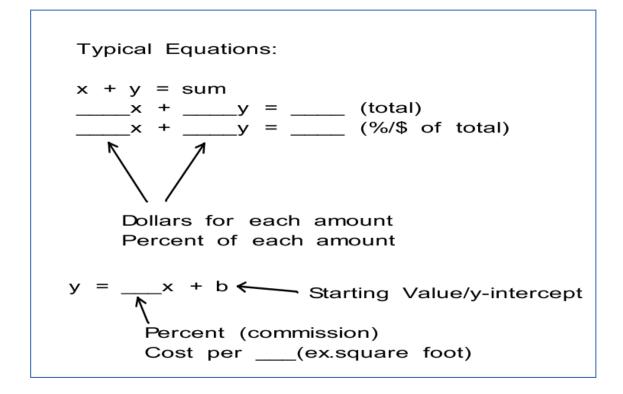The lemon meringue pie costs $12 and the cherry pie costs $7.

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.

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.

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?

$x \rightarrow$ grams of 30% fruit
$y \rightarrow$ grams of 15% fruit

$\%$ of y + $\%$ of g = $\%$ of g.

$0.30x + 0.15y = (0.21)600 \rightarrow 0.3x + 0.15y = 126$

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

$0.3(600-y) + 0.15y = 126$

$180 - 0.3y + 0.15y = 126$

$180 - 0.15y = 126$

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

$y = 360$

$\rightarrow x = 600 - 360$

$x = 240$

They need 240 grams of the 30% fruit and 360 grams of 15% fruit.

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?

x is Litres of 30% acid   and y is Litres of 50% acid

$$0.3x + 0.5y = 0.42(10) \rightarrow 0.3x + 0.5y = 4.2$$

$$x + y = 10 \rightarrow x = 10 - y$$

Substitution: $0.3(10-y) + 0.5y = 4.2$

$$3 - 0.3y + 0.5y = 4.2$$
$$0.2y = 1.2$$
$$y = 6 \quad \therefore x = 4$$

They need 4L of 30% acid and 6L of 50% 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?