

4.4: Applications of Linear Systems

4.4.1

Note Title

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Example: Diane has \$0.95 in dimes and nickels.

She has a total of 11 coins. How many of each does she have?

d = number of dimes

n = number of nickels

system of 2 eqns

$$d + n = 11$$

$$0.10d + 0.05n = 0.95$$

value of dimes

value of nickels

total value

$$\begin{array}{rcll} d + n = 11 & \xrightarrow{(100)} & d + n = 11 & \xrightarrow{(-10)} \\ 0.10d + 0.05n = 0.95 & \xrightarrow{(100)} & 10d + 5n = 95 & \xrightarrow{(-10)} \\ & & & \begin{array}{r} -10d - 10n = -110 \\ 10d + 5n = 95 \\ \hline 0 - 5n = -15 \\ -5n = -15 \\ \frac{-5n}{-5} = \frac{-15}{-5} \\ n = 3 \end{array} \end{array}$$

Put $n = 3$ into $d + n = 11$

$$\begin{array}{r} d + 3 = 11 \\ -3 \quad -3 \\ \hline d = 8 \end{array}$$

She has 3 nickels and 8 dimes.

4.4.2

Ex: Don bought three large pizzas and two orders of garlic bread for \$26.75. Donna bought four large pizzas and four orders of garlic bread for \$39.00. Find the cost of one large pizza and the cost of an order of garlic bread.

Let x = cost of a large pizza

y = cost of an order of garlic bread

Don:

$$3x + 2y$$

$$= \$26.75$$

Donna:

$$4x + 4y$$

$$= \$39.00$$

$$\begin{array}{rcl} 3x + 2y = 26.75 & \xrightarrow{(-2)} & -6x - 4y = -53.50 \\ 4x + 4y = 39.00 & \xrightarrow{\quad} & 4x + 4y = 39.00 \end{array}$$

$$\begin{array}{rcl} \text{Add: } -6x - 4y & = & -53.50 \\ 4x + 4y & = & 39.00 \\ \hline -2x & = & -14.50 \\ \frac{-2x}{-2} & = & \frac{-14.50}{-2} \\ x & = & 7.25 \end{array}$$

$$3x + 2y = 26.75$$

$$x = 7.25 \Rightarrow 3(7.25) + 2y = 26.75$$

$$\begin{array}{rcl} 21.75 + 2y & = & 26.75 \\ -21.75 & & -21.75 \end{array}$$

$$2y = 5.00$$

$$\frac{2y}{2} = \frac{5}{2}$$

$$y = \$2.50$$

A large pizza costs \$7.25 and an order of garlic bread costs \$2.50.

H.4.3

Ex.: A coin collection contains half-dollars and quarters. There are 30 coins. The number of quarters is 2 more than 6 times the number of half-dollars. How many of each type of coin are there?

h = number of half-dollars
 q = number of quarters

$$h + q = 30$$

$$q = 6h + 2$$

Substitution: Solve $h + q = 30$ for h :

$$h = 30 - q$$

Put $h = 30 - q$ into $q = 6h + 2$

$$q = 6(30 - q) + 2$$

$$q = 180 - 6q + 2$$

$$q = 182 - 6q$$

$$+6q \quad +6q$$

$$7q = 182$$

$$\frac{7q}{7} = \frac{182}{7}$$

$$q = 26$$

$$\begin{array}{r} 26 \\ 7 \overline{) 182} \\ \underline{14} \\ 42 \\ \underline{42} \\ 0 \end{array}$$

Put $q = 26$ into $h + q = 30$
 $h + 26 = 30$
 $h = 4$

There are 26 quarters
 and 4 half-dollars.