

7.4 Applications of Linear Systems

When you try to solve story problems that involve more than one variable, it may be helpful to first decide if the situation calls for slope-intercept (one variable depends on the other) or standard form (the two quantities seem unrelated).

The more organized you are, the easier writing the equations will be.

Suppose an antique car club publishes a newsletter. Expenses are \$0.35 for printing and mailing each copy, plus \$770 total for research and writing. The price of the newsletter is \$0.55 per copy. How many copies of the newsletter must the club sell to break even? Does the number of copies depend on the amount of money, or does the money depend on the number of copies?

Then it's slope-intercept. $n = \text{newsletter}$
 $m = \text{money}$

$$\text{cost: } m = 0.35n + 770$$

$$\text{revenue: } m = (0.55n)$$

Substitution

$$\begin{array}{r} 0.55n = 0.35n + 770 \\ -0.35n \quad -0.35n \end{array}$$

$$\frac{0.2n}{0.2} = \frac{770}{0.2} \quad n = 3850 \text{ newsletters}$$

A plane takes about 6 hours to fly 2400 miles from NYC to Seattle. At the same time, your friend flies from Seattle to NYC. His plane travels with the same average flight speed, but his flight takes 5 hours. Find the average flight speed of the planes. Find the average wind speed. Does flight speed depend on wind speed, does wind speed depend on flight speed, or are they independent of each other? standard

$$d = rt$$

rate: air + wind when traveling w/wind
air - wind when wind is opposite plane

$$\begin{array}{r} \frac{1}{5}(2400 = (a+w)5) \\ \frac{1}{6}(2400 = (a-w)6) \end{array} + \begin{array}{r} 480 = a+w \\ 400 = a-w \\ \hline 880 = 2a \\ 440 = a \end{array} \quad \begin{array}{r} 480 = 440 + w \\ 40 = w \end{array}$$

Suppose you combine ingots (a metalworking term for chunk of metal) of 25% copper alloy and 50% copper alloy to create 40kg of 45% copper alloy. How many kilograms of each do you need? Does 25% depend on 50%, does 50% depend on 25%, or are the two alloys independent of each other? Standard

$$\begin{array}{l} \text{Weight: } t + f = 40 \\ \% \text{ copper: } (.25t + .5f = .45(40)) - 2 \end{array}$$

$$\begin{array}{r} t + f = 40 \\ -.5t - f = -36 \\ \hline .5t = 4 \\ t = 8 \end{array} \quad \begin{array}{r} t + f = 40 \\ 8 + f = 40 \\ f = 32 \end{array}$$