Module 6
Applications of Systems of Linear Equations in Two Variables
Things to Know

- To solve a word problem using a system,
  - Identify the two unknown quantities and assign a variable to each.
  - Write two equations that relate these variables together.
  - Solve the resulting system using substitution or elimination.
Solving a word problem involving a sum and another simple relationship using a system of linear equations (Section 4.3, Obj. 4)

A textbook store sold a combined total of 246 psychology and sociology textbooks in a week. The number of psychology textbooks sold was two times the number of sociology textbooks sold. How many textbooks of each type were sold?

Number of psychology textbooks sold: $P$
Number of sociology textbooks sold: $A$

\[ P = \# \text{ of psychology books} \]
\[ A = \# \text{ of sociology books} \]

\[ \begin{align*}
P + A &= 246 \\
2A + A &= 246 \\
3A &= 246 \\
A &= 82 \\
P &= 2(82) = 164
\end{align*} \]
The sum of two numbers is 46 and the difference is 6. What are the numbers?

Larger number: 26
Smaller number: 20

\[
\begin{align*}
x + y &= 46 \\
x - y &= 6
\end{align*}
\]

\[
\begin{align*}
2x &= 52 \\
x &= 26
\end{align*}
\]

\[
\begin{align*}
x + y &= 46 \\
26 + y &= 46 \\
y &= 20
\end{align*}
\]
Solving a value mixture problem using a system of linear equations (Section 4.4, Obj. 1)

A delivery truck is transporting boxes of two sizes: large and small. The large boxes weigh 60 pounds each, and the small boxes weigh 20 pounds each. There are 120 boxes in all. If the truck is carrying a total of 4600 pounds in boxes, how many of each type of box is it carrying?

\[ l = \text{large boxes} \]
\[ a = \text{small boxes} \]

\[ 60l + 20a = 4600 \]

\[ -60(l + a = 120) \]

\[ 60l + 20a = 4600 \]

\[ -60l - 60a = -7200 \]

\[ 60l + 20a = 4600 \]

\[ -40a = -2600 \]

\[ a = 65 \]

55 large, 65 small
A phone company charges a different rate for a local call than a long distance call. A local call costs $0.10 per minute and a long distance call costs $0.35 per minute. Last month a customer made 310 minutes of calls. If the total cost of the calls was $73.50, how many minutes of each type of call did the customer make?

\[ l = \text{min. of local} \]
\[ d = \text{min. of long distance} \]

\[ l + d = 310 \]
\[ 10l + .35d = 73.50 \]

\[-10 \begin{align*} l + d &= 310 \\ 10l + 35d &= 7350 \end{align*} \]

\[ -10l - 10d = -3100 \]
\[ 10l + 35d = 7350 \]
\[ 25d = 4250 \]
\[ d = 170 \text{ min.} \]

\[ l = 140 \text{ min.} \]
Solving a percent mixture problem using a system of linear equations (Section 4.4, Obj. 3)

A chef is using a mixture of two brands of Italian dressing. The first brand contains 9% vinegar, and the second brand contains 14% vinegar. The chef wants to make 290 milliliters of a dressing that is 11% vinegar. How much of each brand should she use?

\[ \begin{align*}
9x + 14y &= 3190 \\
9x + 14y &= 3190
\end{align*} \]

\[ \begin{align*}
9x + 14y &= 3190 \\
-9x - 9y &= -2610
\end{align*} \]

\[ 5y = 580 \]
\[ y = 116 \]

\[ x = 174 \]
\[ 174 \text{ ml of 9\%} \]
\[ 116 \text{ ml of 14\%} \]
Tammy is looking at two accounts in which to invest her money. If she invests $3000 in the first account and $7000 in the second account, then her total investment of $10,000 will receive $860 in interest at the end of one year. If she invests $1000 in the first account and $9000 in the second account, then her total investment of $10,000 will receive $820 in interest at the end of one year.

For each account, what percentage of the investment is received in interest after one year?

\[
\begin{align*}
I &= Prt \\
I &= Pr
\end{align*}
\]

\[
\begin{align*}
f &= \text{rate of first acct} \\
s &= \text{rate of second acct}
\end{align*}
\]
Solving a tax rate or interest rate problem using a system of linear equations (Section 4.4, Obj. 2)

Austin bought a desktop computer and a laptop computer. Before finance charges, the laptop cost $200 less than the desktop. He paid for the computers using two different financing plans. For the desktop the interest rate was 5% per year, and for the laptop it was 7% per year. The total finance charges for one year were $250. How much did each computer cost before finance charges?

\[ a = \text{cost of desktop} \]
\[ l = \text{cost of laptop} \]

\[ \begin{aligned}
  \ell &= d - 200 \\
  0.05d + 0.07\ell &= 250 \\
  0.05d + 0.07(d - 200) &= 250 \\
  0.05d + 0.07d - 14 &= 250 \\
  0.12d - 14 &= 250 \\
  0.12d &= 264 \\
  d &= 2200
\end{aligned} \]