

# Applications, Part 1

**Example 1.** Sandra put forth a riddle to her kids: “I have a total of 38 animals — some are kittens and some are chicks. They have a total of 98 legs. How many kittens and how many chicks are there?”

This type of problem is easily solved by using two variables, and writing two equations from the given information.

Let  $x$  be the number of kittens and  $y$  be the number of chicks. Then, we know that  $x + y = 38$ . Since each kitten has 4 legs, the kittens have a total of  $4x$  legs. Similarly, the chicks have  $2y$  legs.

So, the other equation we get is  $4x + 2y = 98$ .

Now let's solve our system of equations!

$$\begin{cases} (1) & x + y = 38 \\ (2) & 4x + 2y = 98 \end{cases}$$

Since the top equation has  $y$  by itself, we will use the substitution method, and solve  $y$  from the top equation.

$$\begin{aligned} (1) \quad x + y &= 38 \\ y &= 38 - x \end{aligned}$$

Then we substitute  $38 - x$  in place of  $y$  in the second equation, and get that  $x = 11$ . In other words, there are 11 kittens.

Then it's easy to find out that there are  $38 - 11 = 27$  chicks.

This checks, because  $4 \cdot 11 + 2 \cdot 27 = 44 + 54 = 98$  legs.

$$\begin{aligned} (2) \quad 4x + 2y &= 98 \\ 4x + 2(\mathbf{38 - x}) &= 98 \\ 4x + 76 - 2x &= 98 \\ 2x + 76 &= 98 & \quad \left| \begin{array}{l} - 76 \\ \hline \end{array} \right. \\ 2x &= 22 & \quad \left| \begin{array}{l} \div 2 \\ \hline \end{array} \right. \\ x &= 11 \end{aligned}$$

1. An amusement park sells tickets for children for \$45 and for adults for \$70. When a group of 15 people (some adults, some children) went to the park, the total cost was \$900. How many adults and how many children were in the group?

2. Ice skating at a local skating ring costs \$5 per hour, but weekends are costlier, \$7 per hour. Last February, Suzie skated a total of 26 hours, and her total cost was \$142. How many hours did she skate during weekends?

3. A piggy bank has a total of 76 coins, in dimes and nickels, and they're worth \$5.00. Jamie wrote the following equations for this problem:

Are they correct? If not, correct one or both of them. Then find out how many dimes and how many nickels there are.

$$d + n = 76$$

$$10d + 5n = 5$$

4. Lily's piggy bank has only quarters and dimes. The bank contains 44 coins and they're worth \$6.65. How many quarters and how many dimes does she have?