Problem of the Week
Problem A and Solution
Baking Cakes

Problem

Todd has a great recipe for a cake. Here is a list of the ingredients and amounts needed to bake one cake:

> 1 cup white sugar
>
> $\frac{1}{2}$ cup butter
>
> 2 eggs
>
> 2 teaspoons vanilla extract
>
> $1\frac{1}{2}$ cups all-purpose flour
>
> 2 teaspoons baking powder
>
> $\frac{1}{2}$ cup milk

Todd would like to bake four cakes for his classmates. He already has the following ingredients and amounts at home:

> 6 cups of white sugar
>
> 3 cups of butter
>
> 8 eggs
>
> 9 teaspoons of vanilla extract
>
> 5 cups of all-purpose flour
>
> 8 teaspoons of baking powder
>
> 2 cups of milk

Does he have enough of each ingredient to make the four cakes? If not, which ingredient(s) does he not have enough of? How much more does he need?

Solution

First we can determine how much of each ingredient Todd needs for four cakes. For each ingredient, we can either add the amount needed for one cake to itself four times, or multiply it by 4. The calculations are shown in the following table.

Ingredient	Amount Needed for One Cake	Calculations	Amount Needed for Four Cakes
white sugar	1 cup	1×4	4 cups
butter	$\frac{1}{2}$ cup	$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}$	2 cups
eggs	2 eggs	2×4	8 eggs
vanilla extract	2 teaspoons	2×4	8 teaspoons
all-purpose flour	$1\frac{1}{2}$ cups	$1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} = 4 + 2$	6 cups
baking powder	2 teaspoons	2×4	8 teaspoons
milk	$\frac{1}{2}$ cup	$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}$	2 cups

When comparing the amounts needed to make four cakes with the amounts Todd has already, we can see that he has enough of all the ingredients except all-purpose flour. Todd needs 6 cups of flour to make four cakes, but he has only 5 cups. Therefore, he needs $6 - 5 = 1$ cup more of all-purpose flour to have enough ingredients to make four cakes.