

Math Diversion Problem 612

P. Reany

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Good detective always look for something unusual.

— Charlie Chan

The YouTube video is found at:

Source: Many locations
Title: Final-ratio problem
Presenter: ---

1 The Problem

Two vessels A and B containing milk and water in ratios $4 : 3$ and $2 : 3$, respectively. In what ratio should they be added together so that their final mixture is in ratio $1 : 1$?

2 Conceptualizing the problem

Notice in Figure 1 that we used arbitrary volume units. One reason for this is that we weren't given a specific unit to work with, and the other is that we can choose any particular unit we please because in taking ratios the units will cancel.

milk : water	4 : 3	2 : 3	1 : 1		
fraction of milk in total	4 / 7	2 / 5	1 / 2		
Description:	<div style="border: 1px solid black; display: inline-block; padding: 2px 10px;">A</div>	+	<div style="border: 1px solid black; display: inline-block; padding: 2px 10px;">B</div>	→	<div style="border: 1px solid black; display: inline-block; padding: 2px 10px;">final mixture</div>
Quantities in arbitrary volume units:	x		y		$x + y$

Figure 1. We need to solve for the ratio of x and y .

Now, we've already shown the conservation of volume in the bottom line. We need now only one more equation in x, y to solve for their ratios (hopefully). For that, we show the conservation of milk on both sides.¹

$$(\text{milk in } A) + (\text{milk in } B) = (\text{milk in final mixture}). \quad (1)$$

3 Solution 8.3.2: Solving the problem

From (1) we get

$$\frac{4}{7}x + \frac{2}{5}y = \frac{1}{2}(x + y). \quad (2)$$

The variable we need to solve for is x/y , and to do this efficiently, let's divide the last equation through by y , to get

$$\frac{4}{7}x/y + \frac{2}{5} = \frac{1}{2}(x/y + 1). \quad (3)$$

Let's make one more simplification and substitute $\lambda = x/y$ to get

$$\frac{4}{7}\lambda + \frac{2}{5} = \frac{1}{2}(\lambda + 1), \quad (4)$$

with solution $\lambda = 7/5$. Therefore $x : y :: 7 : 5$.

¹The figure was setup to show the conservation of milk, but we could just as easily have shown the conservation of water.