Math Diversion 1080

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April 27, 2026

"Can I have a motorcycle when I get old enough?"
"If you take care of it."
"What do you have to do?"
"Lot's of things. You've been watching me."
"Will you show me all of them?"
"Sure."
"Is it hard?"
"Not if you have the right attitudes. It's having the right attitudes that's hard."
— Robert Pirsig to his son, from *Zen and the Art of Motorcycle Maintenance*

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Source:  http://www.analyzemath.com/high_school
    _math/grade_12/problems.html
Title: A Mixed-Rate Problem
 Presenter: Patrick
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1 Problem

Two large and 1 small pumps can fill a swimming pool in 4 hours. One large and 3 small pumps can also fill the same swimming pool in 4 hours. How many hours will it take 4 large and 4 small pumps to fill the swimming pool. (We assume that all large pumps are similar and all small pumps are also similar.)

2 Solution

Let $\overline{v}$ stand for average speed and T stand for the total time of the hike.

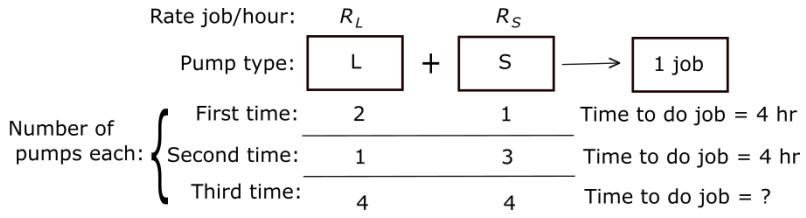

Figure 1. What will be the final time to fill the pool? (Each pump contributes to the total job being done.)

In the first scenario we get

$$(2R_L + R_S)(4\,\text{hrs}) = 1\,\text{job}\,. \tag{1}$$

In the first scenario we get

$$(R_L + 3R_S)(4\,\text{hrs}) = 1\,\text{job}\,. \tag{2}$$

The solution to these last two equations are $R_L = 1/10$ job / hour, and $R_S = 1/20$ job / hour. To determine the time it will take to fill the pool in the third scenario, we need to solve for T in

$$(4R_L + 4R_S)T = (4\frac{1}{10} + 4\frac{1}{20})T = 1\,\text{job}\,. \tag{3}$$

The solution for T in this last equation is $T = 1$ hour 40 minutes.