

# Math Diversion Problem 687

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All my life I kept running into smart people.... In school there were lots of smarter kids. And when I first joined the force, sir, they had some very clever people there. And I could tell right away that it wasn't going to be easy making detective as long as they were around. What I figured that... if I worked harder than they did. Put in more time. Read the books. Kept my eyes open. Maybe I could make it happen. And I did!  
— Lt. Columbo to his prisoner  
(from the TV show *Columbo*)  
("The Bye Bye Sky High  
IQ Murder Case")

The problem is found at:

Source: The Ether of Great Mathematical Ideas  
Title: Mixed-Rate Problem  
Presenter: Patrick

## 1 The Problem

Martin and Wood are hired to do a copyreading job together. Working alone, Martin could do  $\frac{2}{3}$  rds of the job in 15 days. And Wood, working alone, could do the job in 9 days. If they work together (start to finish) how long will it take?

## 2 Solution

As usual,

$$1 \text{ job} = (\text{part of job done by Martin}) + (\text{part of job done by Wood}). \quad (1)$$

For our next refinement, we use the average rate  $R$  at which each copywriter completes the job and then multiply by the time he takes on the job.

$$1 = R_M T_M + R_W T_W, \quad (2)$$

where  $R_M$  can be determined by a proportion<sup>1</sup> (below),  $T_M = T_W \equiv T$ , and  $R_W = \frac{1}{9}$  job/day.

$$\frac{\frac{2}{3}\text{job}}{15 \text{ days}} = \frac{1[\text{job}]}{x} \quad (3)$$

Solving for  $x$ , we get  $x = \frac{45}{2}$  days. Therefore,  $R_M = \frac{2}{45}$  job/day. Substituting all this into (2), we get

$$1 = \left(\frac{2}{45} + \frac{1}{9}\right)T, \quad (4)$$

Solving this for  $T$ , we get  $T = \frac{45}{7}$  days. Or, 6 days 10 hours 17 minutes 8.571 seconds.<sup>2</sup> If you think about it, this result is strange. If Martin and Wood put in 8-hour work days, then how do we interpret the 10 hours? Maybe it's better just to roundup to 7 days to complete the job. This is a clear example of how imprecise given information on the problem can lead to an ambiguous result.

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<sup>1</sup>Searching the problem for a proportion was listed as one of the main searching points in the list of the Scheme procedures.

<sup>2</sup>I thank wolframalpha.com for assisting in this solution.