Math Diversion 1035

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Without the Intuition of Morality, people
tend not believe in God. With it,
they're 90% there already.
—The Author

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Source: The Ether of Great Mathematical Ideas
Title: Ratios Problem
 Presenter: Patrick
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1 Problem

A, B, and C invested money in ratios $6 : 4 : 9$ and their interests from the first cycle were in the ratios $3 : 2 : 5$. Assuming that their interests were proportional to the times of their investments, show that their investment times were in the ratios $9 : 9 : 10$.

2 Solution

First, the investment principal ratios is given as

$$P_1 : P_2 : P_3 :: 6 : 4 : 9\,. \tag{1}$$

The interest on an investment is given as its principal times the time it is invested, or $I = PT$.Therefore, we have that

$$P_1T_1 : P_2T_2 : P_3T_3 :: 3 : 2 : 5\,. \tag{2}$$

Therefore, we can write from the first couple ratios of (1) and same for (2):

$$\frac{P_1}{P_2} = \frac{6}{4} \quad \text{and} \quad \frac{P_1T_1}{P_2T_2} = \frac{3}{2}\,, \tag{3}$$

from which we get

$$\frac{T_1}{T_2} = \frac{1}{1}\,, \tag{4}$$

Put into ratio form, we get

$$T_1 : T_2 :: 1 : 1\,. \tag{5}$$

Now we repeat this procedure for indices 1 and 3, say, to get

$$\frac{P_1}{P_3} = \frac{6}{9} \quad \text{and} \quad \frac{P_1 T_1}{P_3 T_3} = \frac{3}{5}\,, \tag{6}$$

from which we get

$$\frac{T_1}{T_3} = \frac{27}{30} = \frac{9}{10}\,, \tag{7}$$

Put into ratio form, we get

$$T_1 : T_3 :: 9 : 10\,. \tag{8}$$

Putting (5) and (8) together, we get

$$T_1 : T_2 : T_3 :: 9 : 9 : 10\,. \tag{9}$$