

Yet Another Race

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This is another race puzzle from the Maths Masters team, Burkard Polster (aka Mathologer) and Marty Ross ([1]) as part of their “Summer Quizzes” offerings for 2013.

In a 100 meter race, Jacob can beat Johann by 5 meters, and Johann can beat Nicolaus by 10 meters. By how much can Jacob beat Nicolaus?



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My Solution

Figure 1 provides a space-time diagram of the problem. Let v_1 , v_2 , and v_3 be Jacob’s, Johann’s, and Nicolaus’s speeds respectively. And let T_1 , T_2 , and T_3 be their respective times to finish the 100m race. Then we have the following equations, based on the “distance = rate x time” model.

$$v_1 T_1 = 100$$

$$v_2 T_1 = 95$$

$$v_2 T_2 = 100$$

$$v_3 T_2 = 90$$

$$v_3 T_3 = 100$$

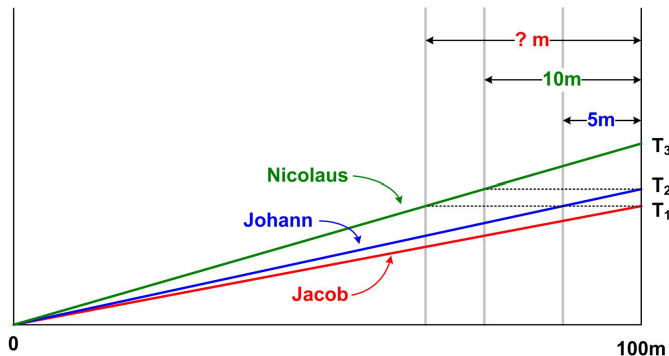


Figure 1

We are trying to find out how far Nicolaus has traveled when Jacob has finished the race, that is, the value of $v_3 T_1$.

The second and third equations yield

$$T_1 / T_2 = 95/100.$$

Therefore

$$v_3 T_1 = v_3 (95/100) T_2 = (95/100) 90 = 85.5 \text{ m.}$$

So Jacob beats Nicolaus by

$$100 - 85.5 = 14.5 \text{ m}$$

Maths Masters Solution

Answer: 14.5 meters.

Solution: Suppose Jacob runs at speed V . Then Johann runs at speed $19V/20$. Since Nicolaus runs at $9/10$ of the speed of Jacob, he runs at speed $171V/200$. So, when Jacob runs 100 meters, Nicolaus will have run 85.5 meters.

References

- [1] Polster, Burkard and Marty Ross, “The Maths Masters' Summer Quiz, Problem Hard 5”, *The Age*, 9 December 2013 <https://www.qedcat.com/summerquizzes/2013%20QUIZ.pdf>)

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