Calculating on the Way

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In looking through some old files I came across a math magazine I had bought in 1998. It was called *Quantum* and was published by the National Science Teachers Association in collaboration with the Russian magazine *Kvant* during the period 1990 to 2001 (coinciding with the Russian thaw, which in the following age of Putin seems eons ago). Fortunately, they are all online now. Besides some fascinating math articles the magazine contains a column of "Brainteasers." Here is one of them ([1]):

> Alice used to walk to school every morning, and it took 20 minutes for her from door to door. Once on her way she remembered she was going to show the latest issue of *Quantum* to her classmates but had forgotten it at home. She knew that if she continued walking to school at the same speed, she'd be there 8 minutes before the bell, and if she went back home for the magazine she'd arrive at school 10 minutes late. What fraction of the way to school had she walked at that moment in time? (S. Dvorianinov)

This is fairly straight-forward, but other problems in the magazine are a bit more challenging.

My Solution

Figure 1 gives a space-time diagram of the problem setup. We will assume without loss of generality that the school is 1 mile from home. Then the speed of Alice is $v = 1/20$ mi/min. The distance from home where she turns around is designated x.

Then we have the following equations.

$$v \cdot 20 = 1 \quad \text{and} \quad v \cdot 38 = 2x + 1$$

so $\quad 1 / 20 = (2x + 1) / 38$

or $\quad 19 = 20x + 10$

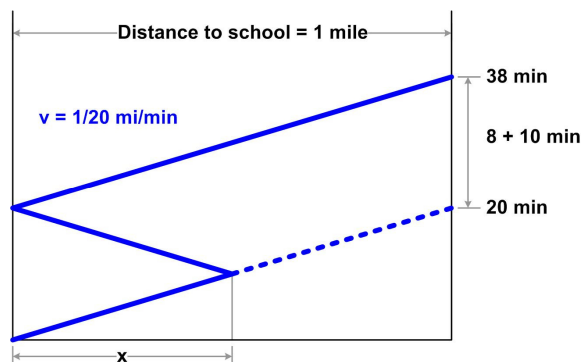or $\quad x = 9/20$ of the way to school.

Figure 1   Problem Setup

Quantum Solution

The difference between the time it would take to go back home and then to school and the time to go straight to school is $10 + 8 = 18$ minutes. The difference between the corresponding distances is simply twice the distance from the spot where Alice remembered about *Quantum* to her home. So this spot is 9 minutes away form home, which is 9/20 of the entire distance to school.

References

[1] "Brainteasers," *Quantum Magazine*, National Science Teachers Assoc., Springer-Verlag, Vol. 3 No.3, Jan/Feb 1993. p.17 Problem B74

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