Math Diversion Problem 776

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> The sceptre shall not depart from Judah, nor a lawgiver
> from between his feet, until Shiloh come; and unto
> him shall the gathering of the people be.
> — Genesis 49:10
> (How mysterious!)

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Source: The Ether of great mathematical ideas
Title: Another Word Problem
 Presenter: Patrick
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1 Problem

Amanda drove 50 miles. Then she dropped her speed by 20 miles per hour and drove another 5 miles. If the entire trip took one hour and 30 minutes, what was Amanda's initial speed?

2 Solution

What are the totals for this problem? Total time and total distance. We'll begin our analysis with total time, but first we must make some reasonable assumptions.

1. Amanda drove at a constant speed V (in miles per hour) for the first part of her journey.
2. Then she would have driven at the constant speed of $V - 20$ during the second part of her journey.

So now we claim that the total time is the sum of all its parts, which were only two.

$$\text{Total time for jour.} = (\text{time for 1st part of jour.}) + (\text{time for 2nd part of jour.})\,. \quad (1)$$

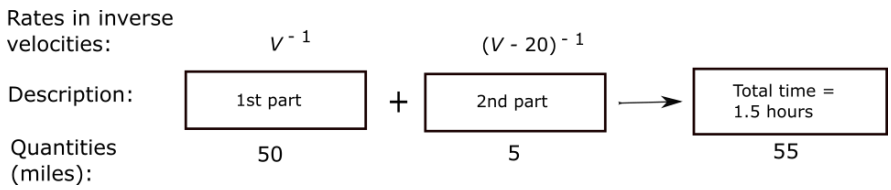

Figure 1. The total time is divided between the time traveled at speed V and the time traveled at speed $V - 20$.

This is a kinematics problem, meaning that it describes motion by four main variables: distance (S), time, velocity, and acceleration, though this last variable won't be needed in this problem. In kinematics, the fundamental equation relating the variables in a constant velocity (speed) problem is this

$$S = VT\,. \tag{2}$$

From which we get

$$T = V^{-1}S\,. \tag{3}$$

Now, we take the total time as the sum of its parts from (1) and from Figure 1:

$$1.5 = V^{-1}(50) + (V - 20)^{-1}(5)\,. \tag{4}$$

According to wolframalpha.com, when I input the line

`'1.5=V^{-1}(50)+(V-20)^{-1}(5) what is V'`

it returns that V has two possible answers:

$$V = 40 \qquad \text{or} \qquad V = 50/3\,. \tag{5}$$

The latter value is inconsistent with the implied constraint that $V - 20 > 0$. I got better results when I imput the line

`'Solve for V, [1.5 = V^{-1}(50)+ (V-20)^{-1}(5)]  and [V-20>0]'`

which returned the sole value $V = 40$. Thus the answer to the question is the initial speed is 40 miles per hour.