Math Diversion Problem 842

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> If there is to be a brave new world, our generation is going to have the hardest time living in it.
> — Chancellor Gorkon (Star Trek VI, The Undiscovered Country)

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Source: https://www.algebra.com/
Title: An ultralight plane had been flying
  Presenter:  Patrick
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1 Problem

An ultralight plane has been flying for 40 minutes when a change in wind direction doubles its ground speed. If the entire trip of a 160 miles took 2 hours, how far did the plane travel during the first 40 minutes? [Appeared on http://www.algebra.com]

2 Solution

We begin by identifying two kinematic laws:

$$D_1 = V_1 T_1, \quad D_2 = V_2 T_2\,, \tag{1}$$

and two 'totals=sum of their parts':

$$T = T_1 + T_2, \quad D = D_1 + D_2\,. \tag{2}$$

Then we were given four relations:

$$T = 2, \quad T_1 = 2/3[hr], \quad D = 160, \quad V_2 = 2V_1\,. \tag{3}$$

Perhaps the simplest next thing to do is to get T_2:

$$T_2 = T - T_1 = 4/3[hr]\,. \tag{4}$$

So that the ratio of T_2 to T_1 is

$$\frac{T_2}{T_1} = \frac{4/3}{2/3} = 2\,. \tag{5}$$

Next, from $V_2 = 2V_1$, we have that

$$\frac{D_2}{T_2} = 2\frac{D_1}{T_1}\,, \tag{6}$$

from which we get

$$D_2 = 2\frac{T_2}{T_1}D_1 = 4D_1\,. \tag{7}$$

Now we have that

$$160 = D_1 + D_2 = 5D_1\,. \tag{8}$$

And finally that

$$D_1 = \frac{160}{5} = 32\,[\text{miles}]\,. \tag{9}$$