Flipping Physics Lecture Notes:
Example Problem: Finding Average Speed for Pole Position – Not as easy as you think

Example: During the 2010 Indy 500 Hélio Castroneves won pole position by averaging 228.0 miles per hour (mph) for four 2.500 mile laps. If he averaged 222.0 mph for the first 2 laps, what must his average speed have been for the last two laps? (you may assume the number of laps is exact)

Knowns: d_{lap} = 2.500 miles, s_1 = 222.0 mph, s_2 = ?, d_1 = 2 x 2.5 miles d_1 = 5 miles = d_2, s_t = 228.0 mph & d_t = 4 x 2.5 miles = 10 miles

$$Speed = \frac{distance}{time} \Rightarrow s = \frac{d}{t} \Rightarrow s(t) = \left(\frac{d}{t}\right)t \Rightarrow s(t) = d \Rightarrow \frac{s(t)}{s} = \frac{d}{s} \Rightarrow t = \frac{d}{s}$$

$$\Rightarrow t_1 = \frac{d_1}{s_1} = \frac{5}{222} = 0.0.0225225hr \;\&\; t = \frac{d}{s} \Rightarrow \frac{mi}{mi/hr} = \frac{mi}{1} \times \frac{hr}{mi} = hr$$

(flip the guy and multiply!!)

$$\Rightarrow t_t = \frac{d_t}{s_t} = \frac{10}{228} = 0.0438596hr \;\&\; t_t = t_1 + t_2 \Rightarrow t_2 = t_t - t_1 = 0.0438596 - 0.0225225 = 0.0213371hr$$

$$s_2 = \frac{d_2}{t_2} = \frac{5}{0.0213371} = 234.333 \approx 234.3\frac{mi}{hr}$$

Please notice that students will still want to say that:

$$s_t = \frac{s_1 + s_2}{2} \Rightarrow 228 = \frac{222 + s_2}{2} \Rightarrow 228(2) = 222 + s_2 \Rightarrow s_2 = 228(2) - 222 = 234.0\frac{mi}{hr}$$

Which is clearly not true because 234.0 ≠ 234.3 & that $s_t = \frac{s_1 + s_2}{2}$ is only true if the two speeds are for the same *time* not the same distance.

Please note that Castroneves' recorded average speed actually had 6 significant figures and was 227.970, however, we only used 4 significant figures so that it would be easier to show how people incorrectly predict the necessary speed. Also, there is no way that he could average 234 miles per hour for 2 laps, sorry.