Example: Calculating Average Speed

You drive at 100 km/hr for 10 minutes, and 50 km/hr for 20 minutes. What is your average speed?

Note: \( \frac{100 + 50}{2} = 75 \frac{\text{km}}{\text{hr}} \) is NOT correct!

\[ \Rightarrow \text{you spend longer going 50 km/hr, so it is weighted more.} \]

Correct solution: split the motion into segments:

\[ \begin{align*}
&d_1, \\
&\vec{v}_1 = 100 \frac{\text{km}}{\text{hr}}, \\
&t_1 = 10 \text{ min} \\
&\vec{v}_2 = 50 \frac{\text{km}}{\text{hr}}, \\
&t_2 = 20 \text{ min} \\
&\vec{v}_2 = \frac{d_2}{t_2}
\end{align*} \]

Total distance = \( d = d_1 + d_2 \)

Total time = \( t = t_1 + t_2 \)

Average speed = \( \bar{v} = \frac{d}{t} = \frac{d_1 + d_2}{t_1 + t_2} \)
\[ d_1 = v_1 \cdot t_1, \quad \text{lets convert } t_1 \text{ to hours} \]

\[ t_1 = 10 \text{min} \left( \frac{1 \text{hr}}{60 \text{min}} \right) \]

\[ t_1 = \left( \frac{10}{60} \right) \text{hr} = 0.16667 \text{hr} \]

\[ d_1 = 100 \frac{\text{km}}{\text{hr}} \left( 0.16667 \text{hr} \right) = 16.667 \text{ km} \]

\[ d_2 = 50 \frac{\text{km}}{\text{hr}} \left( 20 \text{min} \left( \frac{1 \text{hr}}{60 \text{min}} \right) \right) = 16.667 \text{ km} \]

\[ d = d_1 + d_2 = 33.333 \text{ km} \]

\[ \overline{v} = \frac{d}{t} = \frac{33.333 \text{ km}}{0.16667 + 0.332} = \frac{33.333 \text{ km}}{0.5 \text{ hr}} \]

\[ \overline{v} = 66.667 \frac{\text{km}}{\text{hr}} \]

\[ \boxed{\overline{v} = 67 \frac{\text{km}}{\text{hr}}} \]