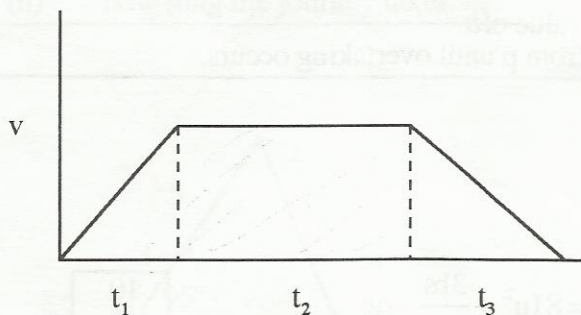1 (a) A train accelerates uniformly from rest to a speed v m/s. It continues at this constant speed for a period of time and then decelerates uniformly to rest. If the average speed for the whole journey is $\dfrac{5v}{6}$, find what fraction of the whole distance is described at constant speed.

$$\text{distance} = (\tfrac{1}{2}t_1 + t_2 + \tfrac{1}{2}t_3)v$$

$$\text{Average speed} = \frac{\text{distance}}{\text{time}}$$

$$\frac{5v}{6} = \frac{(\tfrac{1}{2}t_1 + t_2 + \tfrac{1}{2}t_3)v}{t_1 + t_2 + t_3}$$

$$\tfrac{2}{3}(t_1 + t_2 + t_3) = t_2$$

$$\text{fraction} = \frac{t_2 v}{(\tfrac{1}{2}t_1 + t_2 + \tfrac{1}{2}t_3)v}$$

$$= \frac{\tfrac{2}{3}(t_1 + t_2 + t_3)}{\tfrac{5}{6}(t_1 + t_2 + t_3)} = \frac{4}{5}$$

5

5

5

10

25

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