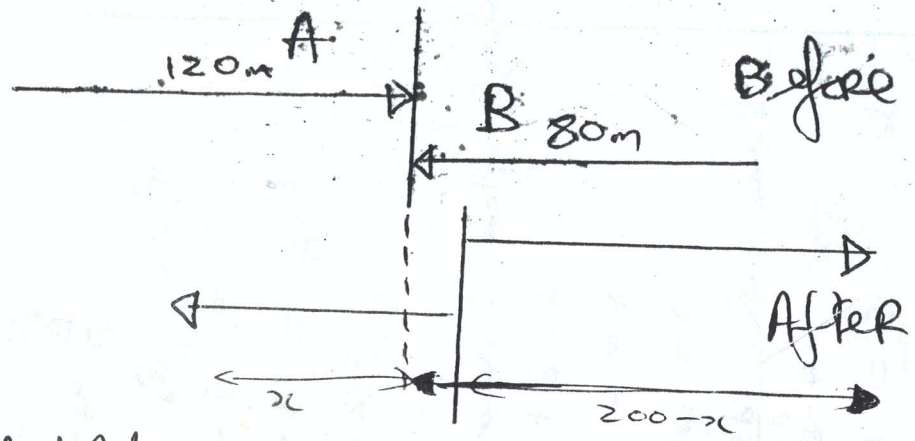
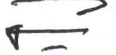
Kinematics (H) 1983.

Q1.



As both trains are moving neither train travels the full 200m while passing. If the 80m train had covered x m then the other train will have covered $200-x$ m.

To calculate the time to pass



Consider B at rest.

$u_A = 20$ $\quad u_B = -25\ ms^{-1}$

$a_A = 1$ $\quad a_B = -1.5\ ms^{-2}$

$u_{AB} = u_A - u_B = 20-(-25) = 45\ ms^{-1}$

$a_{AB} = a_A - a_B = 1-(-1.5) = 2.5\ ms^{-2}$

$s_{AB} = 200$ for trains to pass

Find t $\quad s = ut + \frac{1}{2}at^2$

$200 = +45t + \frac{1}{2}(2.5)t^2$.

$\Rightarrow t^2 + 36t - 160 = 0$.

$\Rightarrow (t+40)(t-4) = 0$

$\Rightarrow \boxed{t = 4 \text{ secs}}$

If time was increased by $12\frac{1}{2}\%$ then the new time of passing is 4.5 seconds.

$s = 200$ (still) $\quad s = ut + \frac{1}{2}at^2$

$u = 45$ still

$a = ?$ $\quad 200 = (45)(4.5) + \frac{1}{2}(a)(4.5)^2$

$\Rightarrow 200 = 202.5 + 10.125\,a$

$\Rightarrow -2.5 = 10.125\,a$.

$\Rightarrow a = \frac{-2.5}{10.125}$

$a = -0.2469\ ms^{-2}$.

So old relative accel $= 2.5\ ms^{-2}$

new relative accel $= -(0.25)\ ms^{-2}$

So change in rel. accel $= 2.5 - (-0.2$

$= 2.75\ ms^{-2}$

Now as one of the accelerations has remained unchanged this change occurs to one of the accelerations.

So the decrease in acceleration is of size $2.75\ ms^{-2}$.