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DEPT: MECHANICAL ENGINEERING
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1) F12-9

$V = ds/dt$

$S = 0.5t^3 m$

$\frac{ds}{dt} = V = 3(0.5)t^2$

$V = 1.5t^2 m/s$

at $t = 6s$

$V = 1.5(6)^2$

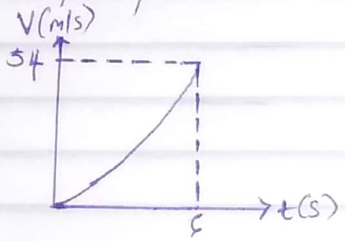
$V = 36 \times 1.5 = 54 m/s$

at $S = 108m$

$ds/dt = 0 m/s$

∴ after 4s, $V_s = 0 m/s$

V-t graph for F12-9



2) F12-10

$V = (-4t + 80) m/s$

$S = \int V dt = \frac{-4t^2}{2} + 80t$

$S = (-2t^2 + 80t) ft/s$

$dv/dt = a$, $V = (-4t + 80) ft/s$

$a = dv/dt = -4 ft/s^2$

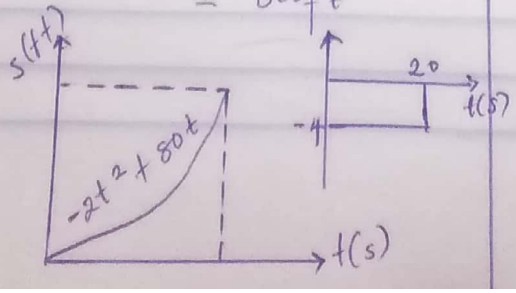
$S = -2t^2 + 80t$

at $t = 20$

$S = -2(20)^2 + 80(20)$

$= -800 + 1600$

$= 800 ft$



3) F12-11

$a ds = V dV$

$a = V \frac{dV}{ds}$

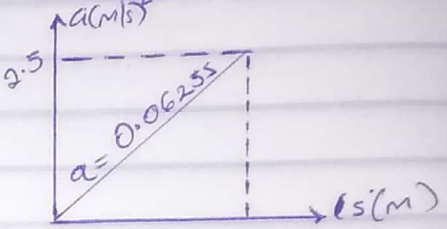
$a = (0.25s)\left[\frac{d}{dv}(0.25s)\right]$

$a = 0.255 \times 0.25$

$a = 0.0625 s$

a at $S = 40 = 0.0625(40)$

$a = 2.5 m/s^2$



(4) F12-12

for $0 \leq t \leq 5s$

$S = 3t^2$

$ds/dt = V = 6t m/s$

at $t = 5s$

$V = 6(5) = 30 m/s$

For $5s < t \leq 10s$

$V = \frac{\Delta s}{\Delta t} = \frac{225m - 75m}{10s - 5s} = 30 m/s$

For a-t graph

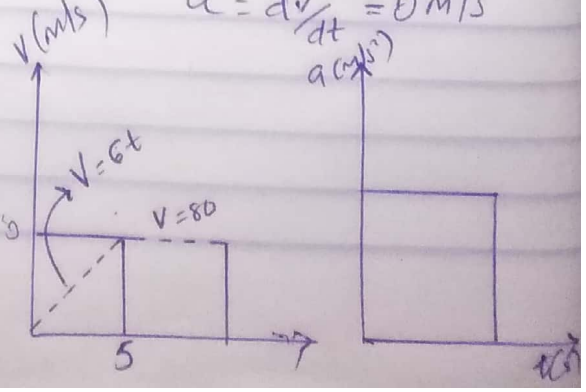
$0 \leq t < 5s$ $V = 6t m/s$

$a = dv/dt = 6 m/s^2$

$5 < t \leq 10s$;

$V = 30 m/s$

$a = dv/dt = 0 m/s^2$



5) F12-13

$20\,m/s^2$ for 5s and then decelerates at $10\,m/s$

$dv = a\,dt$

at $V=0$ and $t=0$

$\Rightarrow 0 \le t < 5s$;

$a = 20\,m/s^2$

$\int_0^v dv = \int_0^t 20\,dt$

$\therefore V = 20t$

When $t = 5s$;

$V = 20(5) = 100\,m/s$

$\Rightarrow 5s < t_1 \le t$

$\int_{100m/s}^{v} dv = \int_{5s}^{t} (-10)\,dt$

$V = (-10t + 50) + 100\,m/s$

$V = -10t + 150\,m/s$

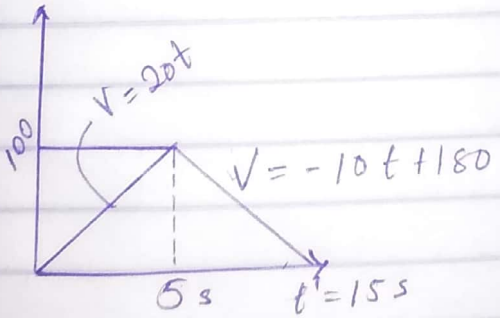
$0 = A_1 + A_2 = Av$

$0 = (20\,m/s^2)\,5 + (-10)(t - 5s)$

$0 = 100 + [-10t + 50)$

$t' = -150/-10$

$t' = 15s$



6) F12-14

$\Rightarrow 0 \le t \le 15s$

$V = 30t\,m/s$

$\int_0^s ds = \int_0^t 30t,$

$S = 15t^2 m$

When $t = 5s$, $S = 15(5)^2$

$= 375m$

$5s \le t \le 15s$;

$V = (-15t + 225)$

$\int_{375}^{s} ds = \int_{5s}^{t} (-15t + 225)\,dt$

$s - 375 = \frac{-15t^2}{2} + 225t$

$[-187.5 + 1125]$

$s - 375 = -7.5t^2 + 225t + 1875$

-1125 $+375$

$\therefore s = (-7.5t^2 + 225t$ ~~$+1875$~~

$t - 562.5)m$

When $t' = 15s$, the position total distance is;

$s = -7.5(15)^2 + 225(15) - 562.5$

$S = -1687.5 + 3375 - 562.5$

$S = 1125m$