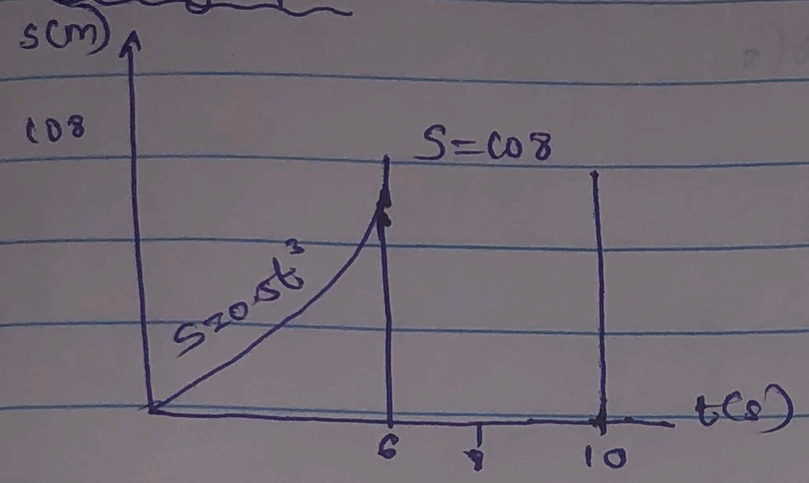
USMAN HABIBA LAMI
BIOMEDICAL ENGINEERING
18/ENG08/025

1. Fig 2-9

S-t graph



soln

S=108 when t=6 ; S=0.5t³

$v = \frac{ds}{dt}$

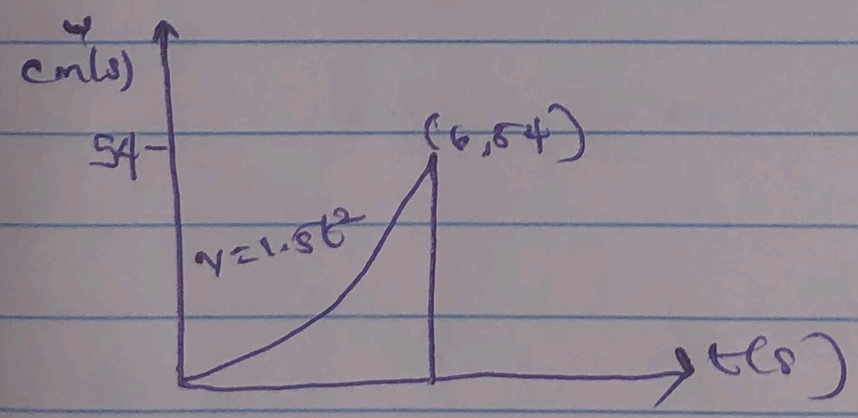
$v = 0.5t^3 = 1.5t^2$

at t = 6

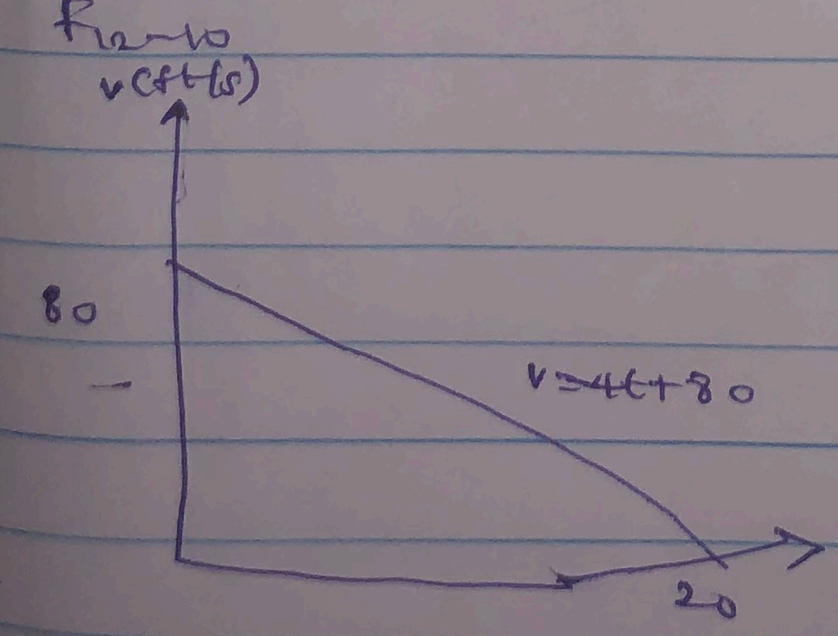
$v = 1.5(6)^2 = 54 m/s$

At time: $6 \leq t \leq 10$; distance is constant so velocity is equal to zero

V-t graph



2. Fig 2-10



S-t graph

Since $ds = v\,dt$; To get s, we will integrate both sides

Initial conditions $s = 0$ when $t = 0$

$0 \le t \le 20s$; $v = -4t + 80$ ft/s

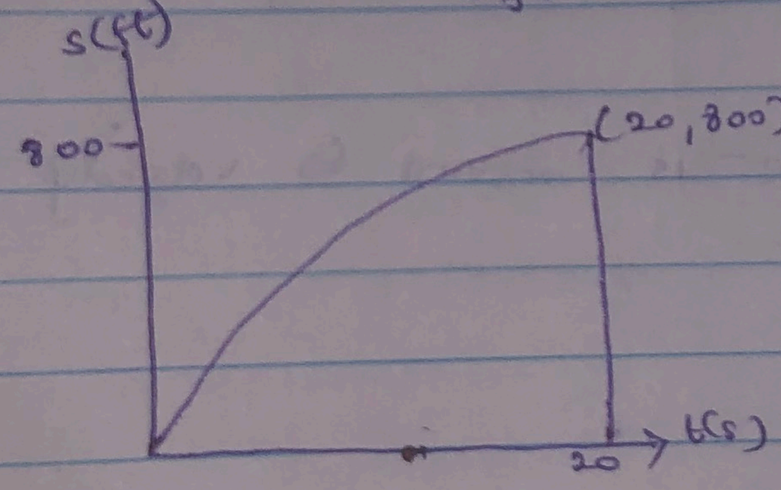
$$\int_0^s ds = \int_0^t -4t + 80\,dt$$

$$s = -\frac{4t^2}{2} + 80t$$

$$s = -2t^2 + 80t \text{ (ft)}$$

when $t = 20s$

$$s = -2(20)^2 + 80(20)$$
$$= -800 + 1600$$
$$= 800 ft$$

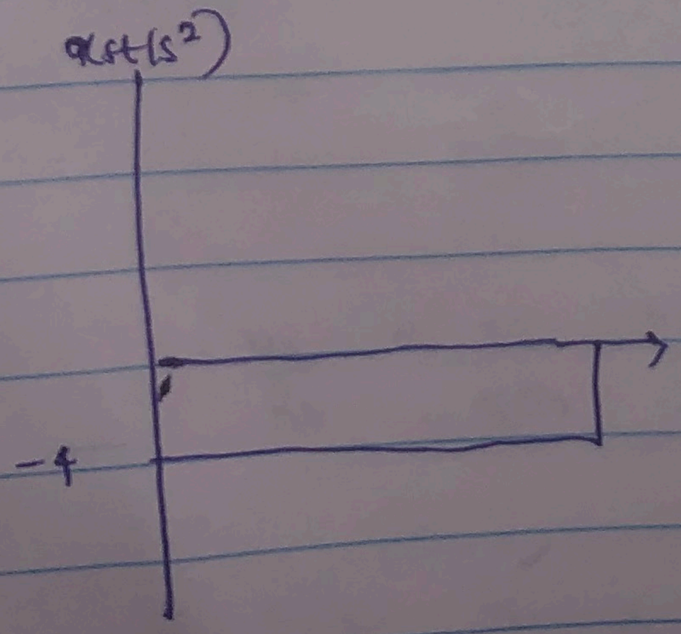


a-t graph

$a = dv/dt$

$v = -4t + 80$

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



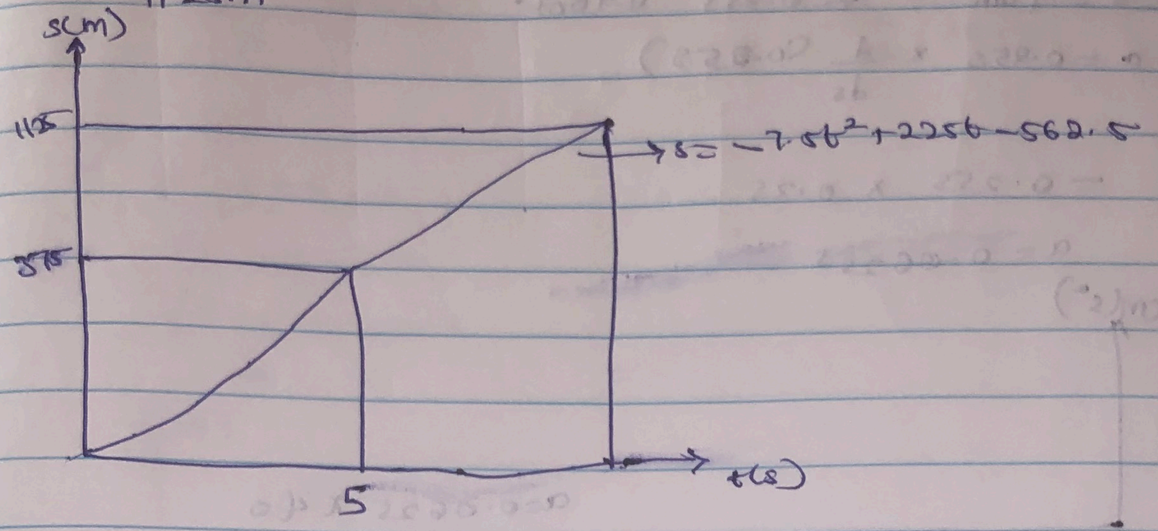
when $t = 15$

$s = -7.5t^2 + 225t - 562.5$

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

$= -1687.5 + 3375 - 562.5$

$= 1125m$



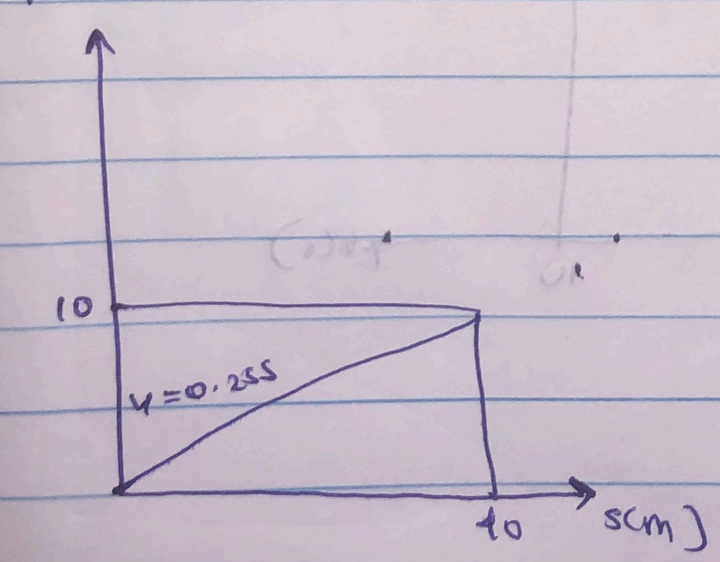
You can also get the total distance by finding area under graph

$\text{Area} = \frac{1}{2}bh$

$= \frac{1}{2} \times 15 \times 150$

$= \frac{2250}{2} = 1125m$

3 Fig 12-11



a-s graph

$a\,ds = v\,dv$

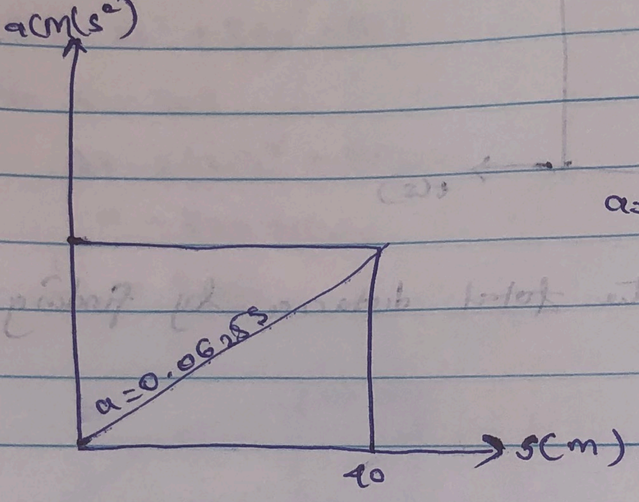
$a = v\frac{dv}{ds}$

$0 \le s \le 40m \qquad v = 0.25s \quad v = ms$

$a = 0.25s \times \frac{d}{ds}(0.25s)$

$= 0.25s \times 0.25$

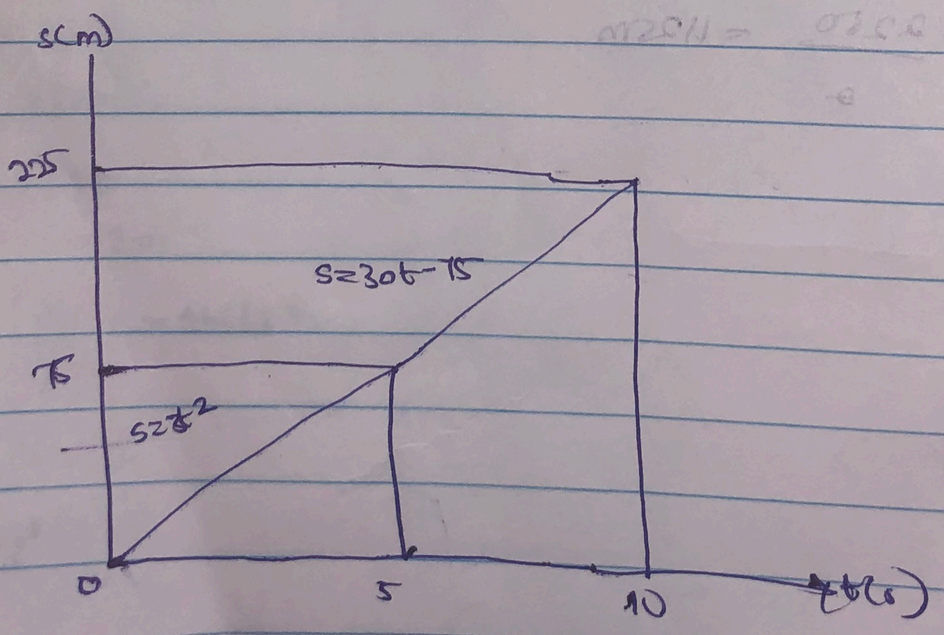
$a = 0.0625s$



$a = 0.0625 \times 40$

$= 2.5 m/s^2$

Q. — f12-12



Solution

v-t graph

$v = ds/dt$

$0 \le t < 5s$,

$s = 3t^2 (m)$

$v = \frac{ds}{dt} = 6t\ m/s$

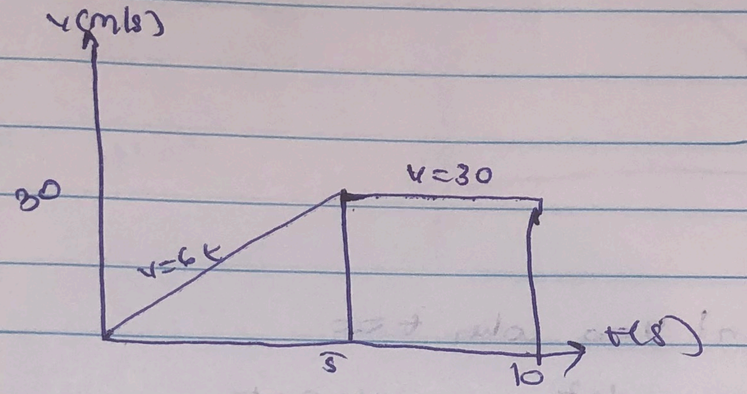
At $t = 7.5s$

$v = \frac{\Delta s}{\Delta t} = \frac{225 - 75}{10 - 5} = \frac{150}{5} = 30\ m/s$

$5s < t \le 10s$,

$s = 30t - 75m$

$v = \frac{ds}{dt} = 30\ m/s$

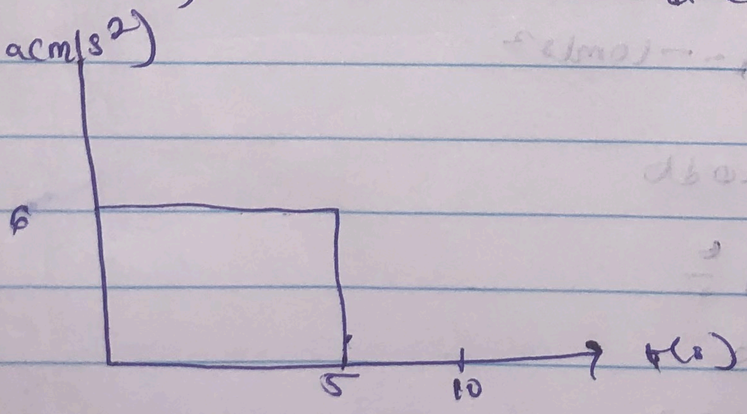


a-t graph

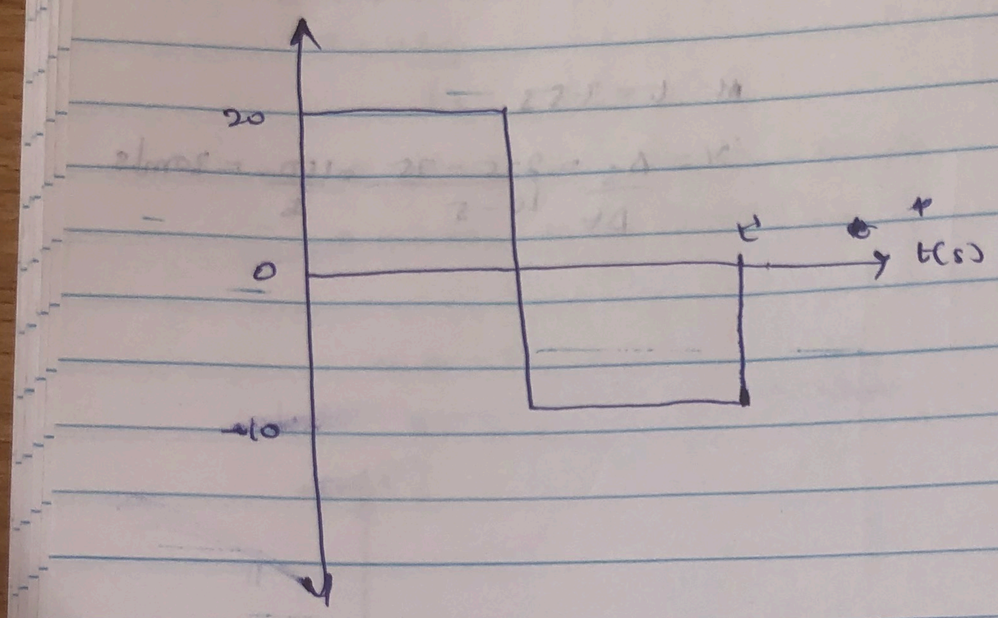
$a = \frac{dv}{dt}$

$0 < t < 5s$; $v = 6t\ m/s$ $a = \frac{dv}{dt} = 6\ m/s^2$

$5s < t \le 10s$; $v = 30\ m/s$ $a = \frac{dv}{dt} = 0$



5. f_{12-13}



Soln

v-t graph

since $dv = a\,dt$

Initial condition: $v = 0$, when $t = 0$

$0 \le t < 5s$; $a = 20 m/s^2$ $\quad v = 20t$

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

when $t = 5s$, $v = 20(5) = 100 m/s$

$5s \le t \le t'$; $a = -10 m/s^2$

$$\int_{100}^{v} dv = \int_5^{t'} -10\,dt$$

$$v - 100 = [-10t]_5^{t'}$$

$$v - 100 = -10t + 50$$

$$v = -10t + 50 + 100$$

$$v = -10t + 150$$

At t' : $v = 0$

$0 = -10t + 150$

$10t = 150$

$t = 15\,sec$