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DEPT: BIOMEDICAL ENGINEERING

Fig-9

Slope of s-t curve gives velocity, from s-t curve

$$s = 0.5t^3 \quad \text{---} \quad 0 \leq t \leq 6$$

$$s = 108 \text{ m} \quad \text{---} \quad 6 \leq t \leq 10$$

∴ for time interval, $0 \leq t \leq 6$,

$$v = \frac{ds}{dt} = \frac{d(0.5t^3)}{dt}$$

$$\therefore v = 0.5 \times 3t^2$$

$$v = 1.5t^2 \quad \text{---} \quad 0 \leq t \leq 6$$

at $t=0$, $v=0$

at $t=6 \text{ sec}$, $v = 1.5 \times 6^2 = 54 \text{ m/s}$

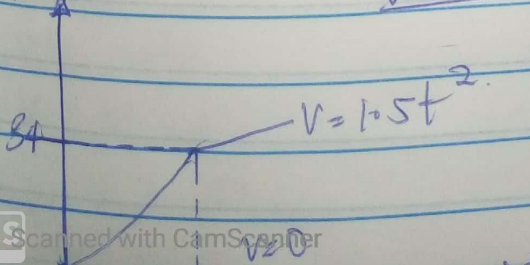
during the time interval

$$6 \leq t \leq 10$$

displacement, $s = 108$ [s is constant]

$$\therefore v = \frac{ds}{dt} = 0$$

v(m/s) at



s-t curve

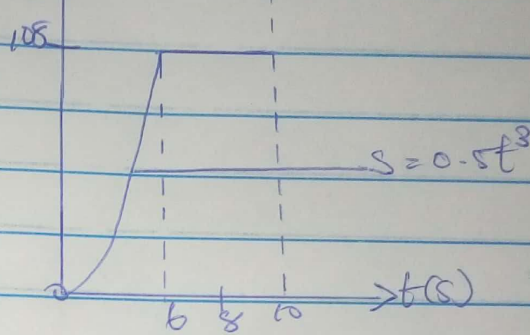


Fig-10

Given $v = -4t + 80$, $\frac{ds}{dt} = -4t + 80$

$$ds = (-4t + 80) dt$$

$$\int ds = \int (-4t + 80) dt$$

$$s = -2t^2 + 80t + c$$

also given $s=0$ for $t=0$

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

(1) $s = 0$, at $t = 0$

(2) $s = 0 \Rightarrow 2t^2 = 80t$

$$\therefore t = 40 \text{ sec}$$

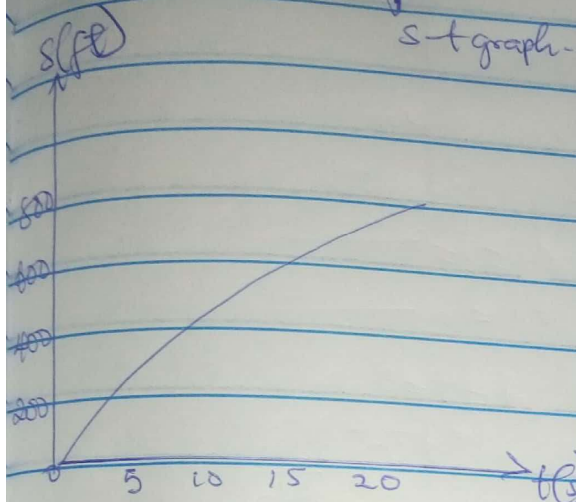
(3) $\frac{ds}{dt} = 0 \Rightarrow -4t = -80$

$$t = 20 \text{ s}$$

$$s|_{t=20} = -2x(20)^2 + 80 \times 20$$

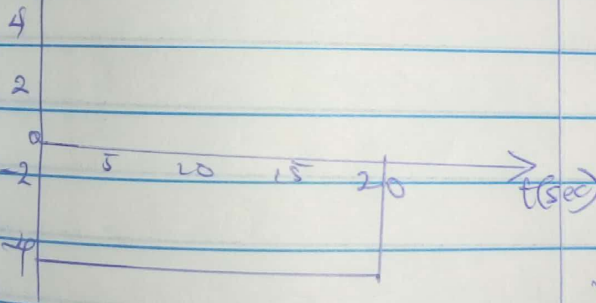
$$= -800 + 1600$$

$$= 800 \text{ ft.}$$



$$\frac{dv}{dt} = a = -4$$

a (ft/s²)



Fl2-11

$$v dv = a ds$$

$$v = 0.25 s$$

$$\frac{dv}{ds} = 0.25$$

$$dv = 0.25 ds$$

$$a ds = v dv$$

$$a ds = (0.25s) \times (0.25 ds)$$

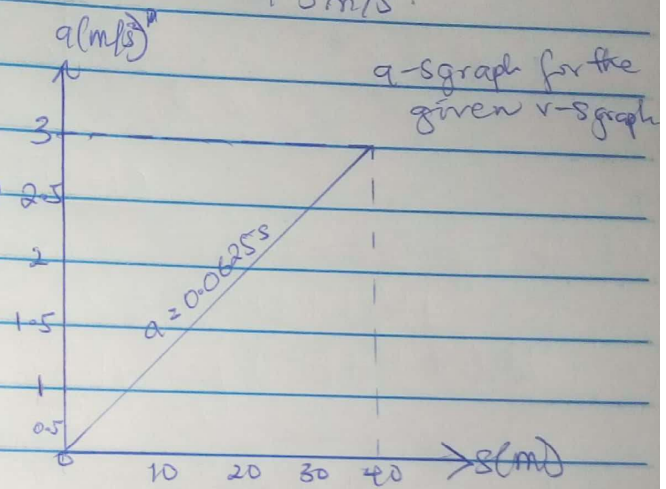
$$a = 0.25s \times 0.25$$

$$a = 0.0625s$$

at $s = 40$.

$$a = 0.0625 (40)$$

$$a = 2.5 \text{ m/s}^2$$



Fl2-12

$$0 \leq t \leq 5 \text{ s}, s = 3t^2$$

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

$$5 < t \leq 10, s = 30t - 75$$

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

$$v = \frac{\Delta s}{\Delta t} = \frac{225 - 25}{10 - 5} = 40 \text{ m/s}$$

v graph

for a/c graph
 $0 \leq t \leq 5s, v = at \text{ (m/s)}$
 $a = \frac{dv}{dt} = 6 \text{ m/s}^2$

$5 \leq t \leq 10s, v = 30 \text{ m/s}$
 $a = \frac{dv}{dt} = 0$

a graph

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

$$v = 20t$$

at $t = 5s,$
 $v = 20(5) = 100 \text{ m/s}$
 at $5 \leq t \leq t'$
 $a = -10$

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

$$\frac{v}{100} = -10t \Big|_5^{t'}$$

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

$$v = -10t + 150$$

at $t = t', v = 0$
 $\therefore t = 0 - \frac{-150}{-10} = 15s$

Fig-13
 at $0 \leq t \leq 5$
 $dv = a dt$

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Pr - 14

$v = 30t$ for $0 \leq t < 5s$
 $v = -15t + 225$ for $5s < t \leq 15s$
 $\therefore v = \frac{ds}{dt}$

$ds = v dt$ — (1)

The equation for the distance travelled between $0 \leq t < 5s$ is

$v = 30t$
 $ds = v dt$
 $ds = 30t dt$

$\int_0^5 ds = \int_0^5 30t dt$
 $\int_0^5 ds = \int_0^{5sec} 30t dt$

$S = \left[30 \times \frac{t^2}{2} \right]_0^5$
 $S = 15 \times (5)^2$
 $S = 375m$

equation for distance travelled between $5s < t \leq 15s$

$\int_{375}^S ds = \int_5^t (-15t + 225) dt$

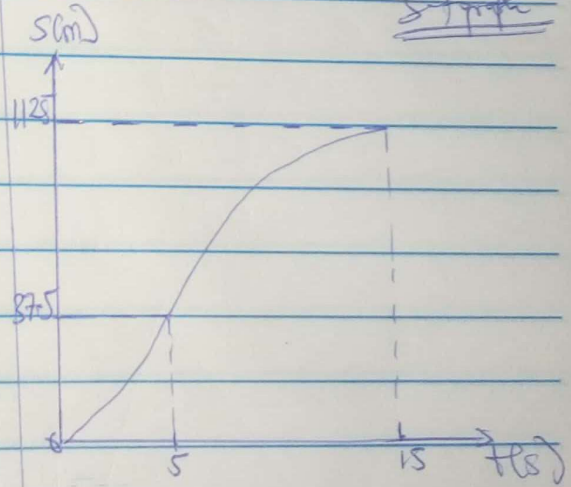
$\left[S - 375 \right] = \left[\frac{-15t^2}{2} + 225t \right]_5^t$

$\left[S - 375 \right] = \left[\frac{-15t^2}{2} + 225t \right]_{5}^t$
 $-\left[\frac{-15 \times 5^2}{2} + 225 \times 5 \right]$

$S - 375 = (-7.5t^2 + 225t) - 937.5$
 $S = [-7.5t^2 + 225t - 562.5]_{5}^{15}$

substitute $t = 15 sec =$
 equation (2)

$S = [-7.5(15)^2 + 225(15) - 562.5]_{5}^{15}$
 $S = 1125m$



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