MAT NO: 18/ENG01/014

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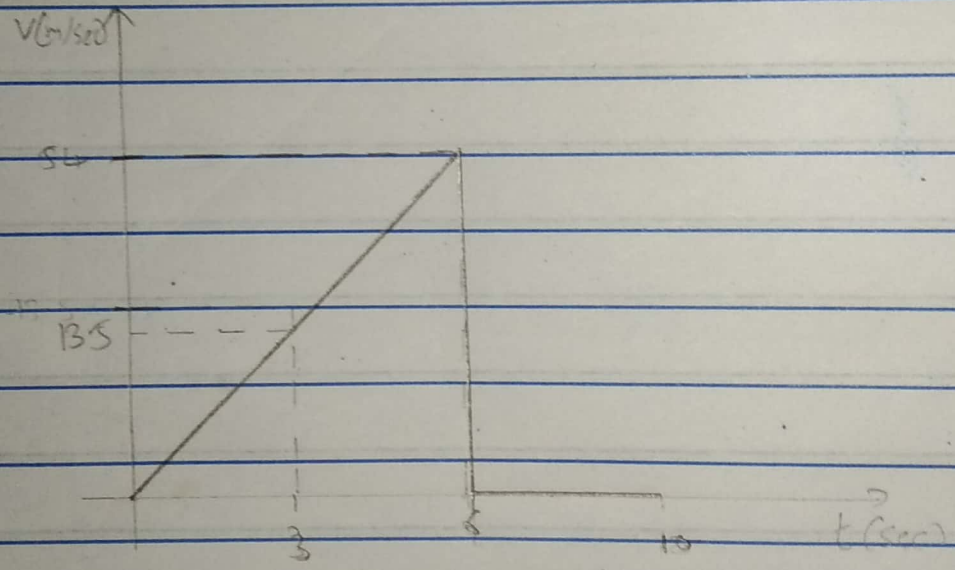
(1) When $0 \leq t \leq 6$ $\quad S = 0.5t^3$

$\frac{ds}{dt} = v \quad \therefore \quad V = 0.5 \times 3 \times t^2 = 1.5t^2$

$\therefore$ when $t = 3 \quad V = 1.5 \times 3^2 = 1.5 \times 9 = 13.5 m/sec$

When $6 \leq t \leq 10 \quad S = 108m$

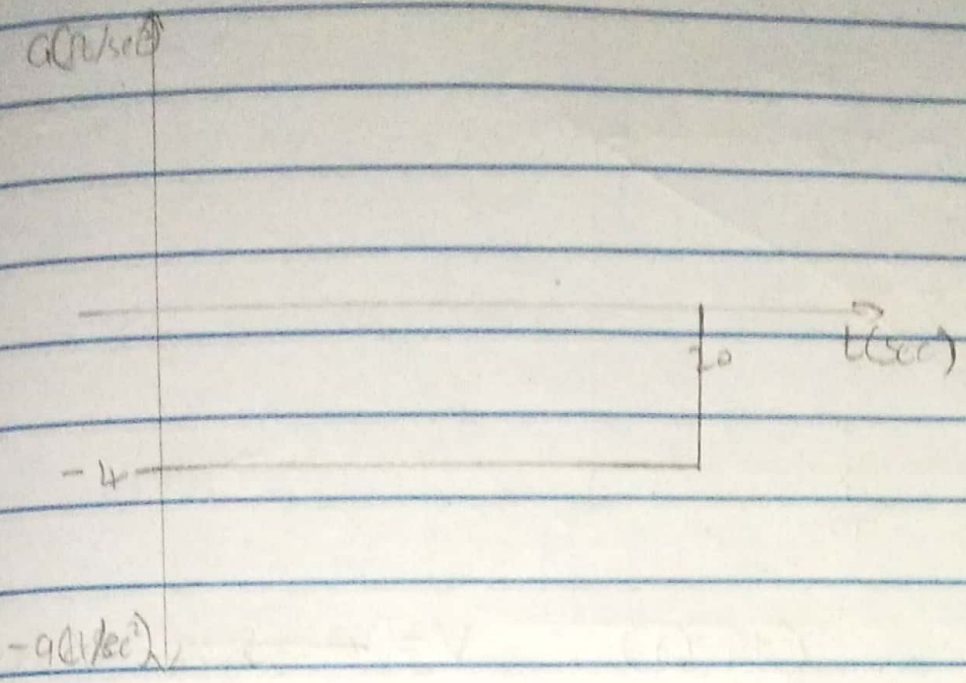
$\frac{ds}{dt} = V \quad \therefore \quad V = 0$



(2) $V = -4t + 80$

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

$a = \cancel{-4 m/sec^2} \quad -4 ft/sec^2$



$V = -4t + 80$

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

$\int ds = \int V dt$

$s = \int V dt$

$s = \int -4t + 80\, dt$

$s = \left[-2t^2 + 80t\right]_0^2$

$s = [(-2t^2 + 80t) - (-2(0)^2 + 80 \times 0)$

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

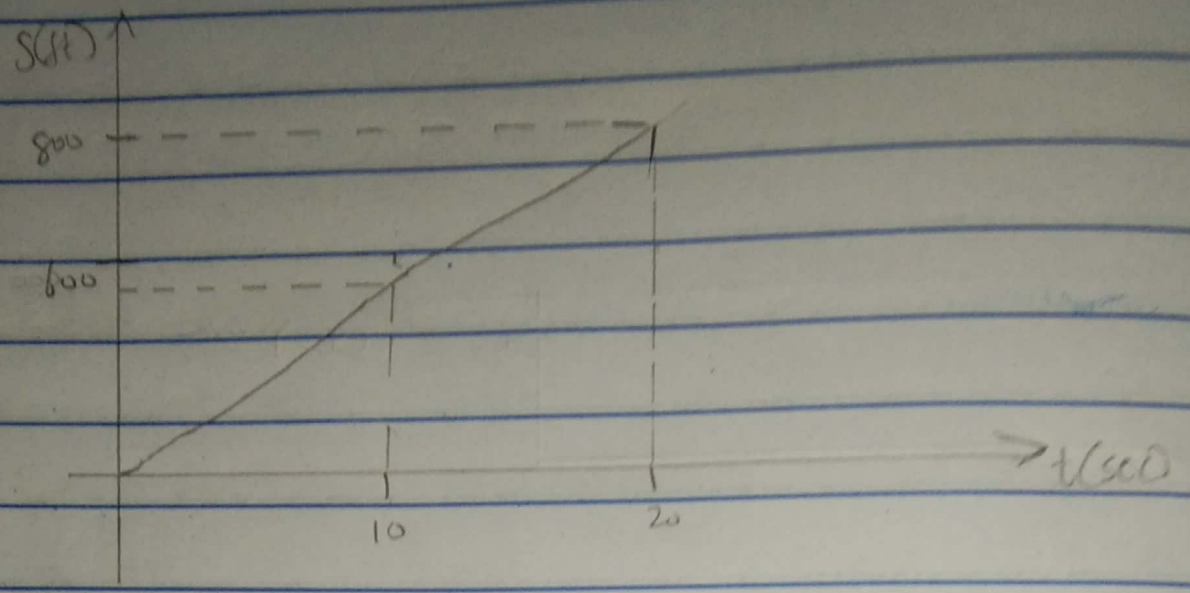
$\therefore$ When $t = 10$

$s = -2 \times 10^2 + (80 \times 10)$

$s = -200 + 800 = 600ft$

When $t = 20sec$

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



(3) $V = \frac{ds}{dt}$ — equ (i) $V = 0.25$ ~~0.25m/sec~~

$dt = \frac{ds}{V}$ ... equ (ii)

$a = \frac{dv}{dt}$ — equ (iii)

Substitute equ (ii) in equ (iii)

$a = dv \div \frac{ds}{V} = \frac{dv}{} \times \frac{V}{ds}$

$a = \frac{dv\,V}{ds}$

recall that $V =$ ~~0.25m/sec~~ $0.25s$

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

$a = 0.25 \times 0.25s$

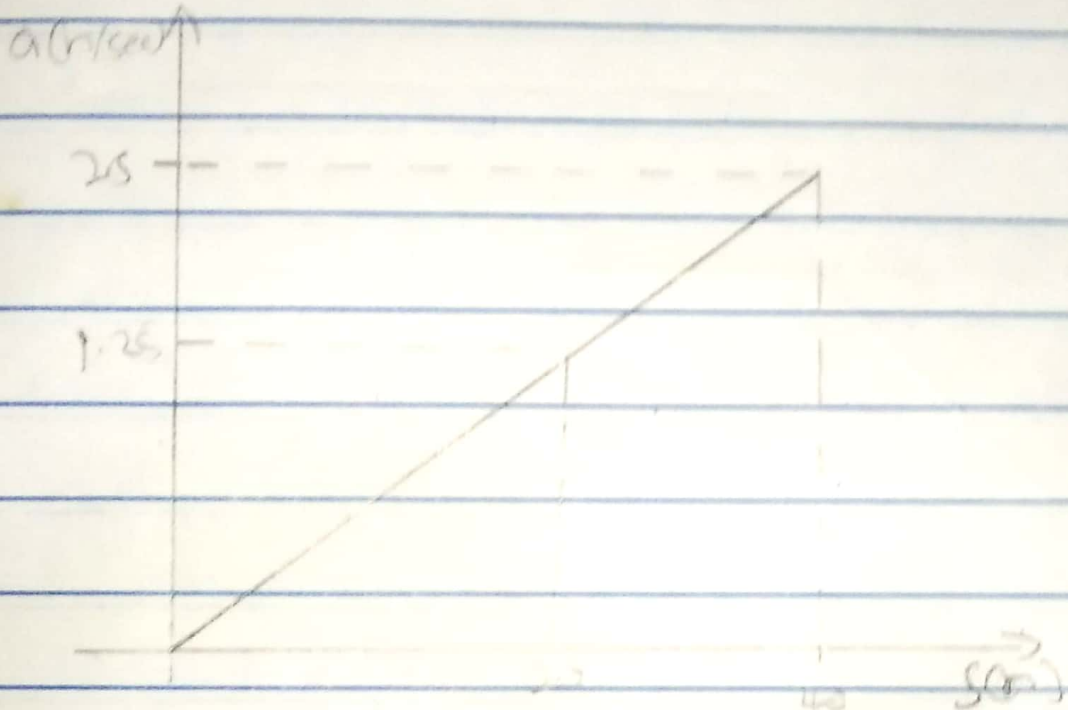
$= 0.0625$

When $S = 20$

$a = 0.0625 \times 20 = 1.25 \text{ m/sec}^2$

When $S = 40$

$a = 0.0625 \times 40 = 2.5 \text{ m/sec}^2$



(ii) When $0 \leq t \leq 5$ $\quad S = 3t^2$

$V = \frac{ds}{dt} = 6t$

$\therefore$ When $t = 2$ $\quad V = 6 \times 2 = 12 \text{ m/sec}$

When $t = 5$ $\quad V = 6 \times 5 = 30 \text{ m/sec}$

When $5 \leq t \leq 10$ $\quad S = 30t - 75$

$V = \frac{ds}{dt} = 30 \text{ m/sec}$

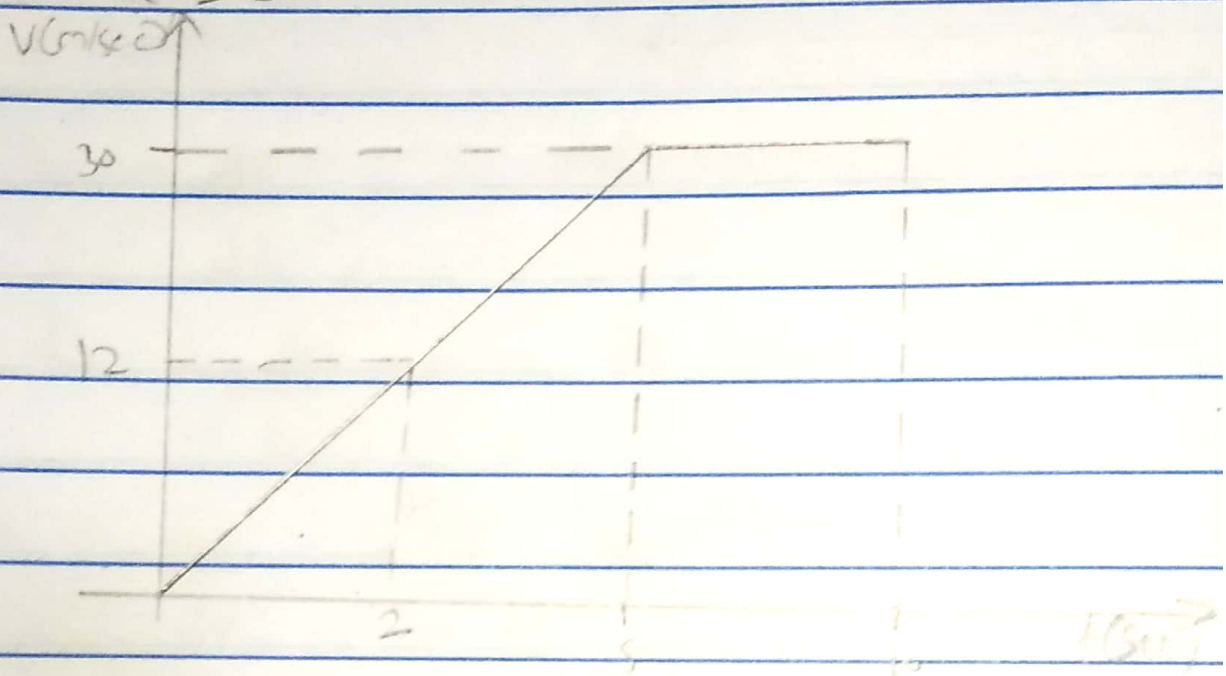
When $0 \leq t \leq 5$ $\quad V = 6t$

$$a = \frac{dv}{dt} = 6 m/sec$$

$5 \leq t \leq 10$

$V = 30 m/sec$

$a = 0$



(5) When $0 \leq t \leq 5$ $\quad a = 20$

When $5 \leq t \leq t'$ $\quad a = -10$

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

$$\int a\,dt = \int dv$$

$$V = \int a\,dt$$

$$V = \int_0^t 20\,dt$$

$$V = \int_0^t 20t \left[20t\right]_0^t$$

$$V = 20t$$

~~When t=2 V = 20×2 = 40 m/sec~~

When $t=2$ $V = 20\times 2 = 40$ m/sec

When $t=5$ $V = 20\times 5 = 100$ m/sec

$$\int_{100}^{V} dv = \int_{5}^{t} -10\, dt$$

$$V - 100 = -10(t-5)$$

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

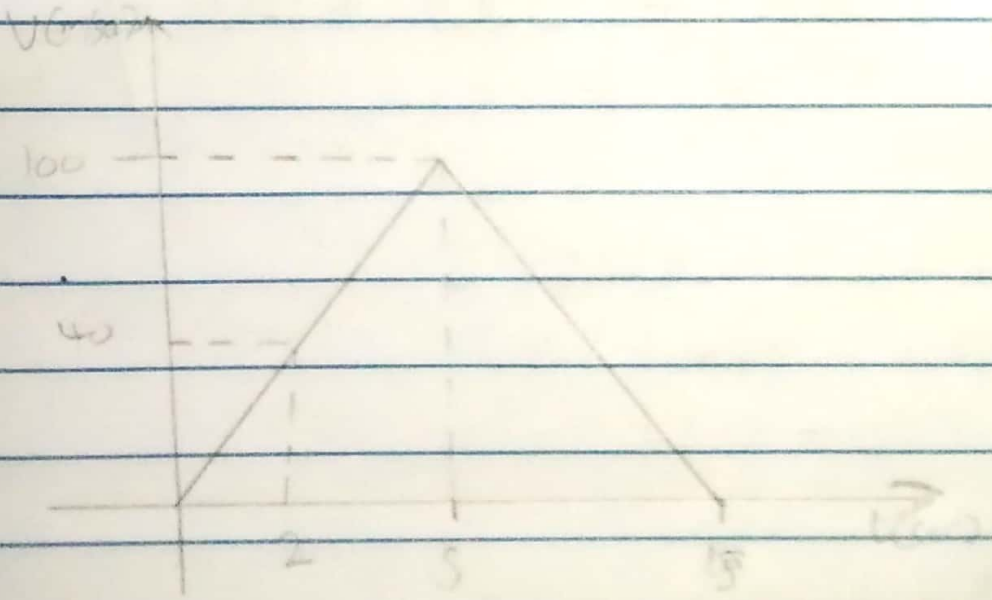
$$V = -10t + 50 + 100 = (-10t + 150)\ m/sec$$

~~When~~ At $V = 0$

$$0 = -10t + 150$$

$$-150 = -10t$$

$t = 15$ sec ∴ $t = 15$ sec is when the car comes to a



(b) $v = 30t$

$\int ds = \int v\,dt$

$\int_0^s ds = \int_0^t (30t)\,dt$

$s = 15t^2$

When $t = 5$

$s = 15(5)^2 = 375m$

$v = -15t + 225$

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

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

$s - 375 = \left[\frac{-15t^2}{2} + 225t\right] - \left[\frac{-15(5)^2}{2} + 225(5)\right]$

$s - 375 = -7.5t^2 + 225t - 937.5$

$s = -7.5t^2 + 225t - 937.5 + 375$

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

At $t = 15s$

$s = \frac{-15(15)^2}{2} + 225(15) - 562.5$

$= 1125m$