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18/ENG02/081
Computer Engineering

Q1) $0 \le t < 6s$

$v = ds/dt$ $s = 0.5t^2$ $v = d/dt(0.5t^2)$

$v = 1.5t^2$

$t = 6s$

$v = 1.5(6)^2$

$= 1.5 + 36 = 34 m/s$

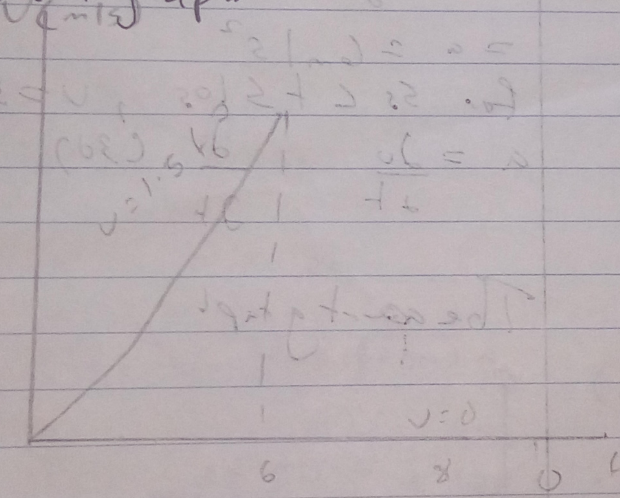
$6s < t \le 10s$

$s = 108$

$v = ds/dt$ $v = d/dt(108)$

$v = 0$

The v-t graph



(2)

$v = ds/dt$ $ds = v\,dt$

$\int_2^{s} ds = \int_0^t v\,dt$

$0 \le t \le 20$ $v = -4t + 80$

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

$s = \left[-\frac{4t^2}{2} + \frac{80t}{1} \right]_0^t$

$s = -2t^2 + 80 + 0$

at $t = 20$

$s = -2t^2 + 80t - 0$

at $t = 20$

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

$-800 + 1600$

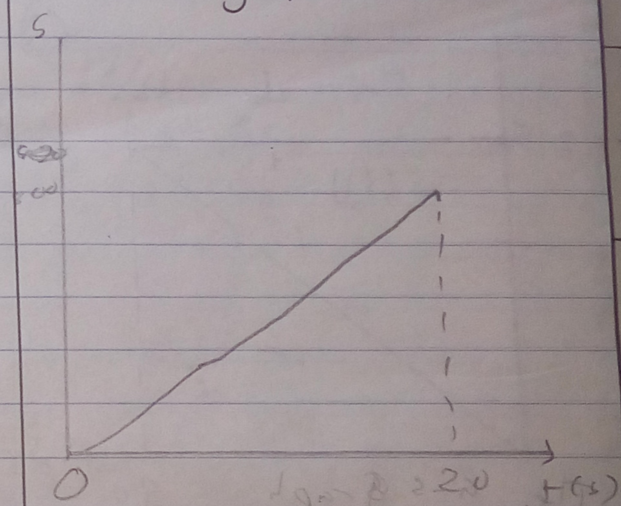
$s = 800t$

at $t = 0$

$s = -2(0)^2 + 80(0)$

$s = 0 + t$

The s-t graph



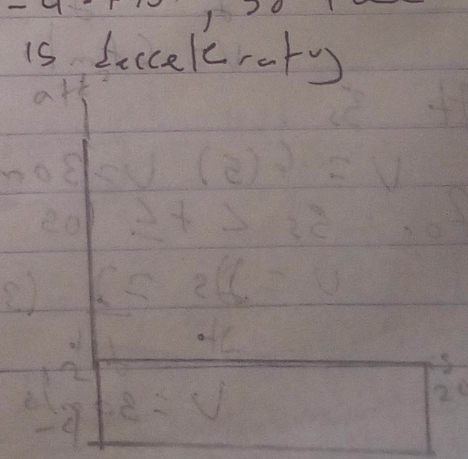
To get the a-t graph

$a = dv/dt$ $v = -4t + 10$

$a\ d/dt(-4t + 80)$

$a = -4t + (s)^2$

$a = -4 + 15^2$, so the car is decelerating



3

$a\,ds = v\,dv$

$a = v\frac{dv}{ds}$ $\quad 0 \le s \le 90m,\ v = 0.25s$

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

$a = 0.25s \times 0.25$

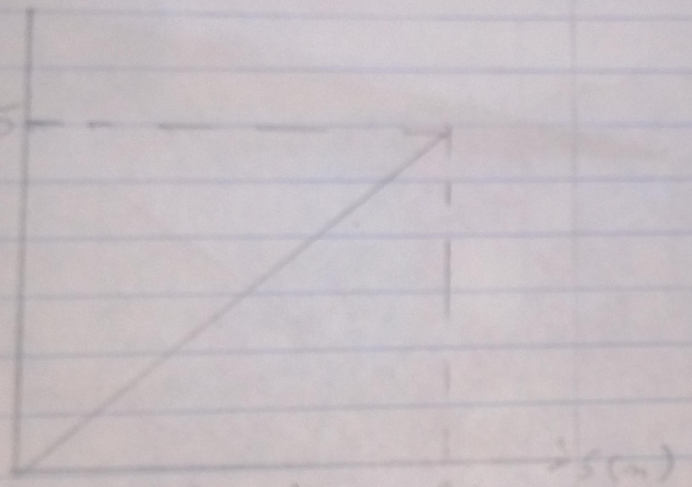
$a = 0.0625s\ (m/s^2)$

At $s = 90m$

$a = 0.0625 \times 90$

$a = 2.5 m/s^2$

At $s = 0$ $\quad a = 0 m/s^2$



The a-s graph

(4)

$v = \frac{ds}{dt}$ $\quad 0 \le t < 5s$ $\quad s = 3t^2$

$v = \frac{ds}{dt} = \frac{d}{dt}(3t^2)$

$v = 6t\ m/s$

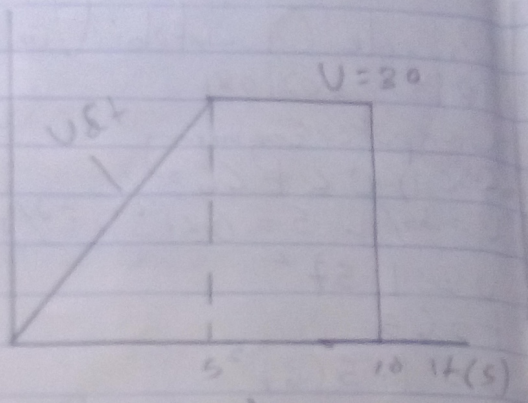
At 5s

$v = 6(5)$ $\quad v = 30 m/s$

For $5s < t \le 10s$

$v = \frac{ds}{dt} = \frac{d}{dt}(30t - 75)$

$v = 30 m/s$



For the (a-t) graph

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

$0 < t < 5$ $\quad v = 6t$

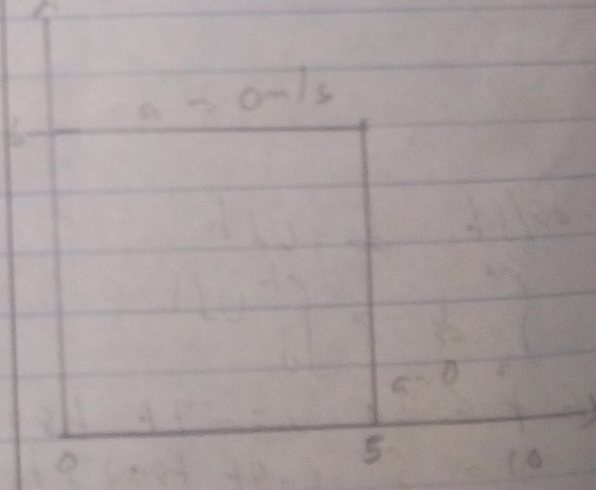
$a = \frac{dv}{dt}$ $\quad \frac{d}{dt}(6t)$

$\Rightarrow a = 6 m/s^2$

For $5s < t \le 10s$, $v = 30$

$a = \frac{dv}{dt}$ $\quad \frac{d}{dt}(30)$

The a-t graph



5

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

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

for $0 \le t < 5s$, $a = 20$

$dv = a\,dt$

$\int_{v_1}^{v} dv = \int_0^t a\,dt$

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

$v = 20t\ m/s$

At $t = 5s$

$v = 20(5) = 100\ m/s$

$5s < t \le t$ $\quad a = -10\ m/s^2$

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

$dv = a\,dt$

$\int_{100} dv = \int_5^t a\,dt$

$v - 100 = \int_{5s}^{t} -10\,dt$

$v = [-10t\ m/s]_{5s}^{t} + 100$

$v = -10t - (-10(5)) + 100$

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

$v = (-10t + 150)\ m/s$

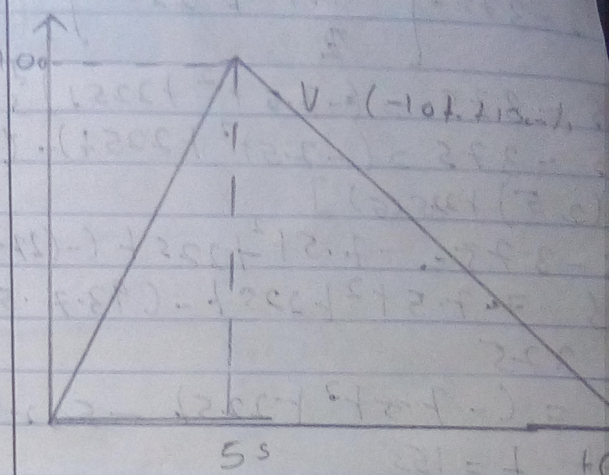
when $t = t_1$ we require $v = 0$

$0 = 10t_1 + 150$

$10t' = 150$

$t' = 15s$ $\quad v = (-10t + 15)\ m/s$

The v-t graph



The (v-t) graph

(6)

$v = ds/dt$ $\quad ds = v\,dt$

$0 \le t \le 5s$

$\int_0^s ds = \int_0^t v\,dt$

$s = \int 30t\,dt$

$s = \frac{30t^2}{2}\ m$

$s = 15t^3\ m$

At $t = 5s$

$s = 15(5)^2$

$s = 15 * 25 = 375\ m$

$5s < t \le 15s$ $\quad v = 15t + 3$

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

$ds = v\,dt$

$\int_{375}^{s} ds = \int_{5s}^{t} v\,dt$

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

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

$$S - 375 = (-7.5t^2 + 225t)_5^t$$

$$S - 375 = (-7.5t^2 + 225t) - (-(7.5(25) + 225(5)))$$

$$S - 375 = -7.5t^2 + 225t - (-(187.5 + 125))$$

$$S = -7.5t^2 + 225t - (93.75) + 375$$

$$S = (-7.5t^2 + 225t - 562.5)\,m$$

At $t = 15s$

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

$$S = -1687.5 + 3375 - 562.5$$

$$S = 1125\,m$$

Total distance 1125 m

The S-t graph