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18/ENG06/002
Mechanical Engineering
Mechanics (ENG 254)
Assignment

1 Given that

$s = 0.5t^3 m$

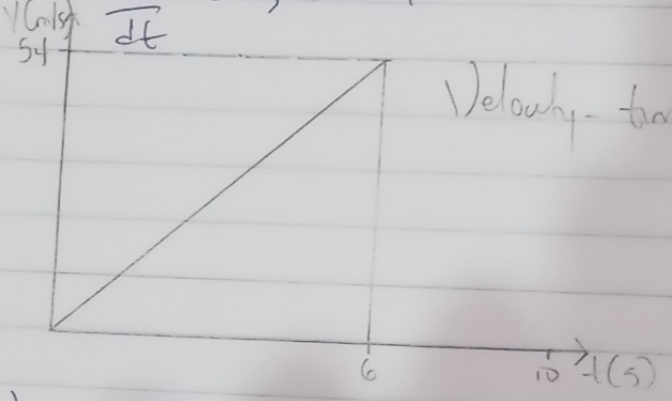
$V = \frac{ds}{dt}, \quad V_1 = 1.5t^2$

hence, at $t = 6$

$V = 1.5(6)^2 = 36 \times 1.5 = 54 \, m/s$

$s_2 = 108 m$

$V = \frac{ds}{dt} = 0, \quad V = 0 m/s$



Velocity - time graph

2 $V = -4t + 80$

$s = \int V dt$

$s = \int_0^{20} -4t + 80 \, dt$

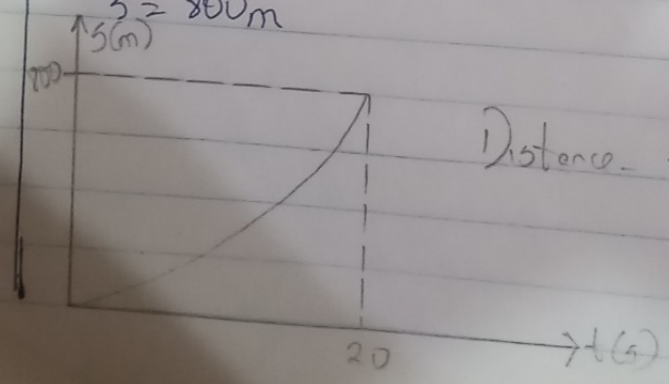
$s = [-2t^2 + 80t]_0^{20}$

hence at $t = 20$,

$s = [-2(20)^2 + 80(20)] - [-2(0)^2 + 80(0)]$

$s = -800 + 1600$

$s = 800 m$



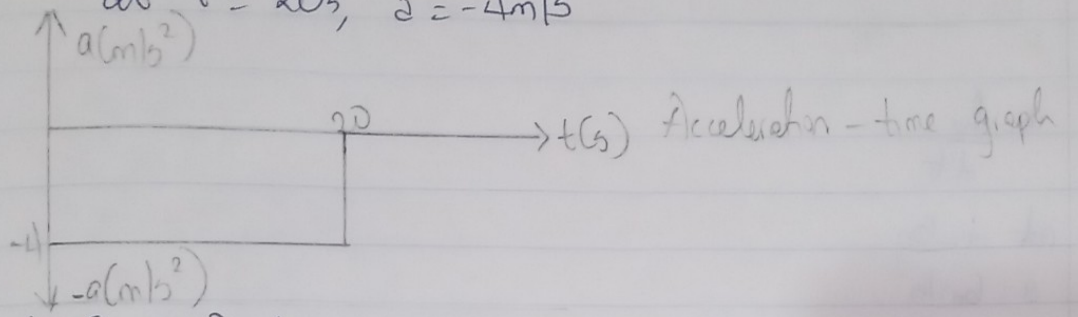
Distance - time graph

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

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

$a = -4 m/s^2$

at $t = 20s$, $a = -4 m/s$



Acceleration - time graph

3 $V = (0.25s)$ m/s

$a = v\left(\frac{dv}{ds}\right)$

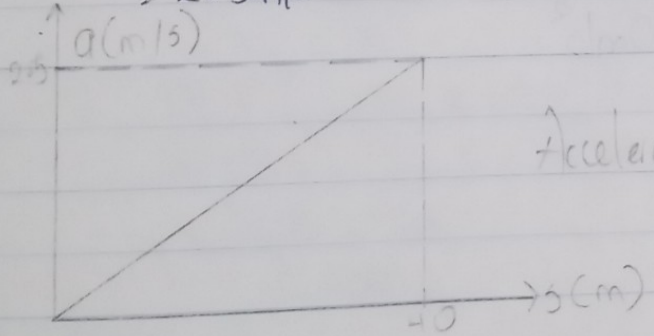
$a = 0.25s(0.25)$

$a = (0.625s) m/s^2$

hence, at $s = 40m$,

$a = (0.625 \times 40) m/s^2$

$= 2.5 m/s^2$



Acceleration - distance graph

4) $s = 3t^2$

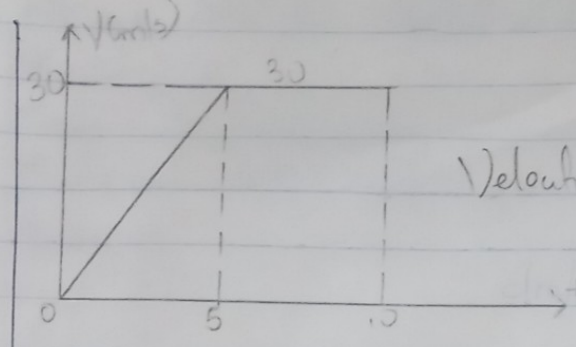
$v = 6t$

hence, At $t = 5$

$v = 6 \times 5 = 30 m/s$

At $t = 10$

$v = 30 m/s$



Velocity – time graph

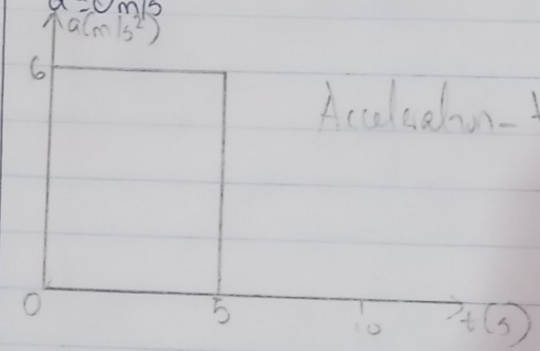
ii $a = \frac{dv}{dt}$

at $t = 5s$

$a = 6 m/s^2$

at $t = 10s$

$a = 0 m/s^2$



Acceleration – time

5 $a = 20 m/s^2$, $a = -10 m/s^2$

$\int dv = \int a \cdot dt$

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

$v = 20t$

At $t = 5s$

$v = 100 m/s$

$\int_{100}^{v} dv = \int_5^t -10 \cdot dt$

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

$v - 100 = -10t + 50$

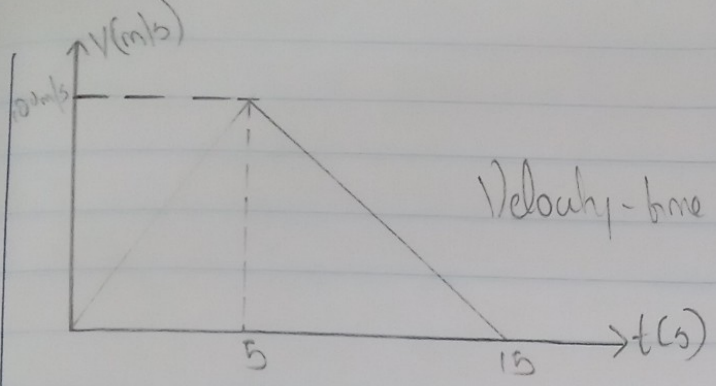
$v = (-10t + 150) m/s$

At $v = 0$

$0 = -10t + 150$

$-150 = -10t$

$t = 15 sec$ (time for car to come to rest)



Velocity-time graph

6. $0 \le t \le 5$

$V = 30t$

$\int_0^5 ds = \int_0^5 30t$

$s = 15t^2 \Big|_0^5$

$s = 15(5)^2 - 15(0)^2$

$s = 15 \times 25 = 375m$

$5_s \le t \le 15_s$

$V = -15t + 225$

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

$s - 375 = \frac{-15t^2}{2} + 225t \Big|_5^{15}$

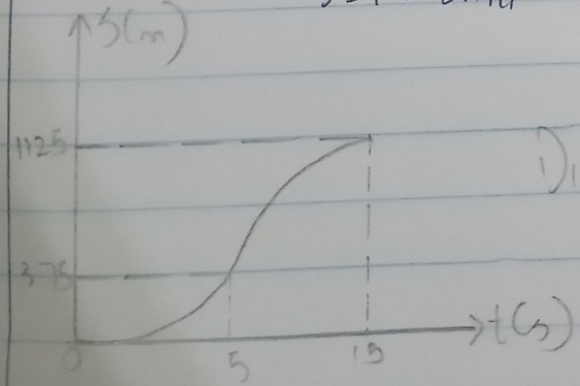
$s - 375 = \left[\frac{-15(15^2)}{2} + 225(15)\right] - \left[\frac{15(5)^2}{2} + 225(5)\right]$

$s - 375 = (-1687.5 + 3375) - (187.5 + 1125)$

$s - 375 = 1687.5 - 937.5$

$s - 375 = 750$

$s = 1125m_u$



Distance - time graph