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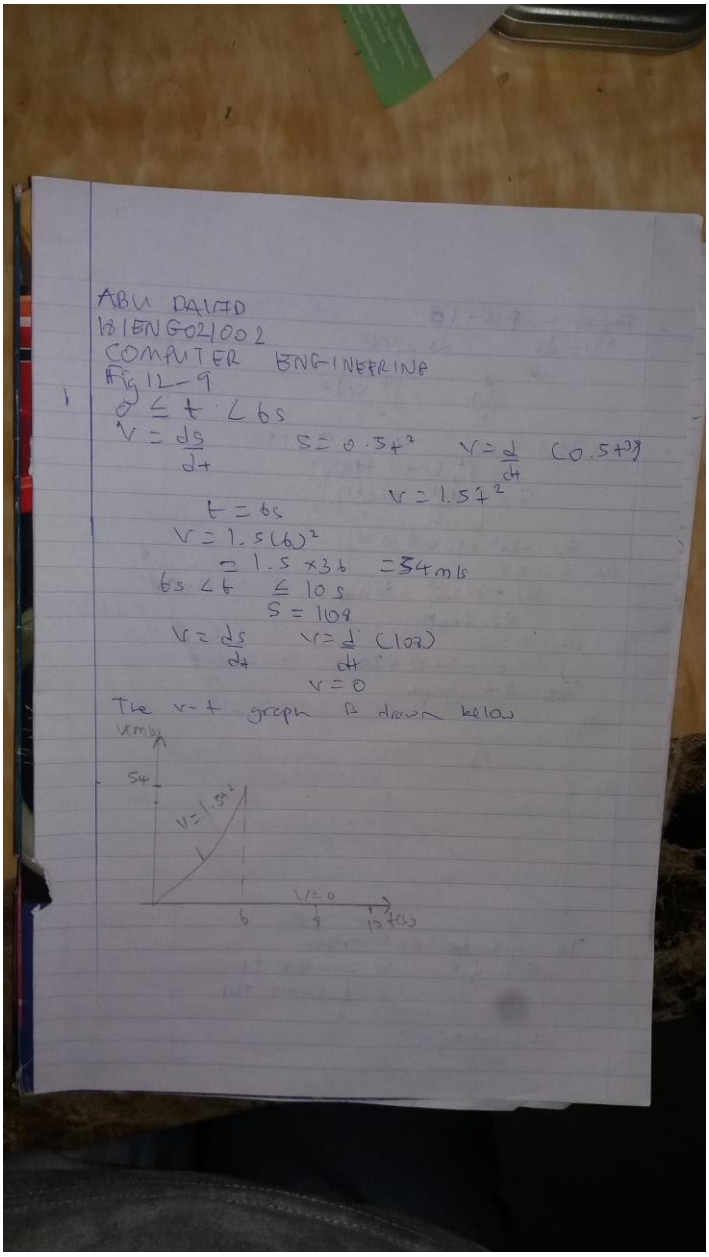
MARTIC NO: 18/ENG02/002

DEPT: COMPUTER ENGINEERING

MECHANICS ASSIGNMENT



2 ~~Fig 12~~ - F12-10

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

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

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

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

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

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

at $t = 20$

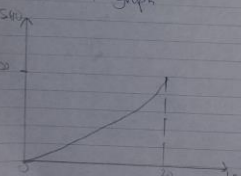
$s = -2(20)^2 + 80(20) = -800 + 1600$

$s = 800$ m

at $t = 0$

$s = -2(0)^2 + 80(0)$ $\quad s = 0$ m

The s-t graph



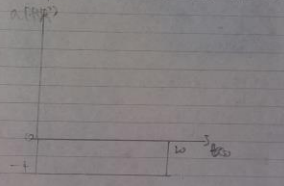
To get the a-t graph

$a = \frac{dv}{dt}$ $\quad v = -4t + 80$

$a = \frac{d}{dt}(-4t + 80)$

$a = -4\ m/s^2$

$a = -4t + 16$, so the car is decelerating



3) F12-11

$a\,ds = v\,dv$

$a = v\frac{ds}{dt}$ $\quad 0 \le s \le 40$ m, $v = 0.25s$

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

$a = 0.25s \times 0.25$ $\quad 0.25$

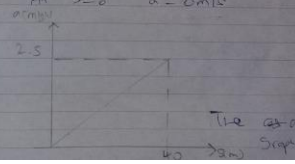
$a = 0.0625s\ (m/s^2)$

At $s = 40$ m

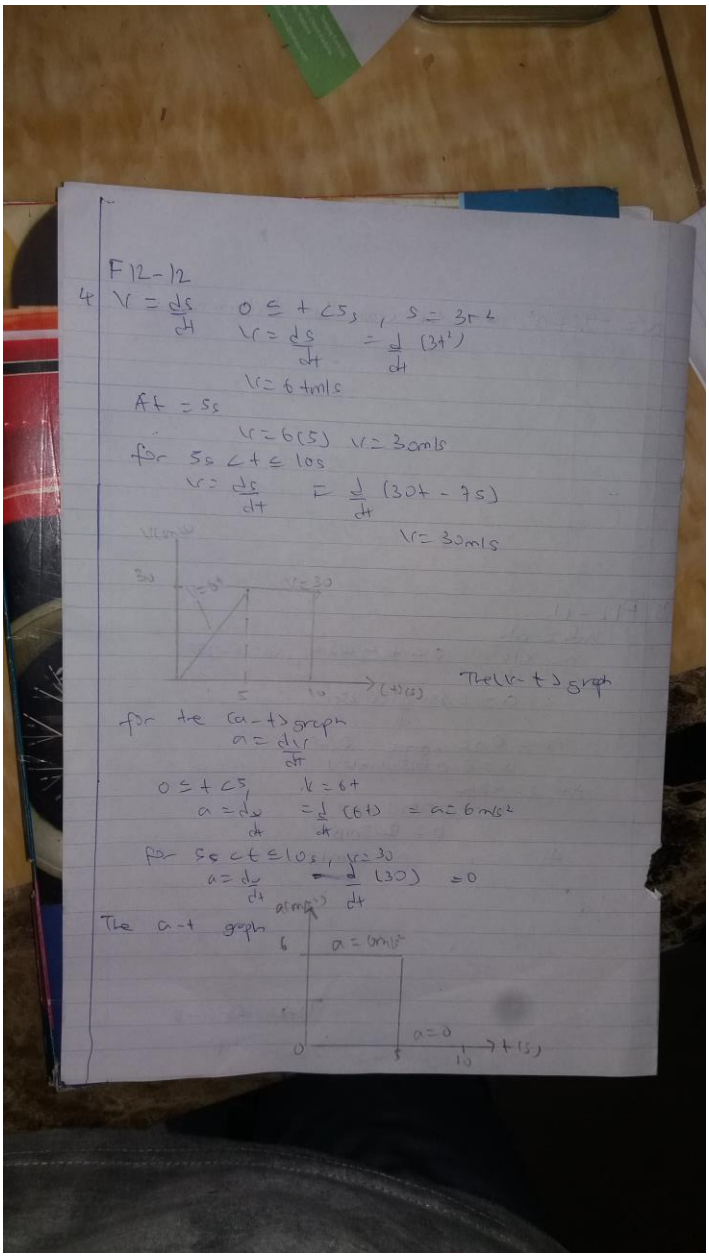
$a = 0.0625 \times 40$

$a = 2.5\ m/s^2$

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



The ~~a-t~~ a-s Graph



F12-12

4 $v = \frac{ds}{dt}$ $0 \le t < 5$, $s = 3t^2$

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

$v = 6t$ m/s

At $t = 5$s

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

for $5s < t \le 10s$

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

$v = 30$ m/s

v(m/s)

30

$v = 6t$ $v = 30$

5 10 t(s)

The v-t graph

for the a-t graph

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

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

$a = \frac{dv}{dt} = \frac{d}{dt}(6t) = a = 6\ m/s^2$

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

$a = \frac{dv}{dt} = \frac{d}{dt}(30) = 0$

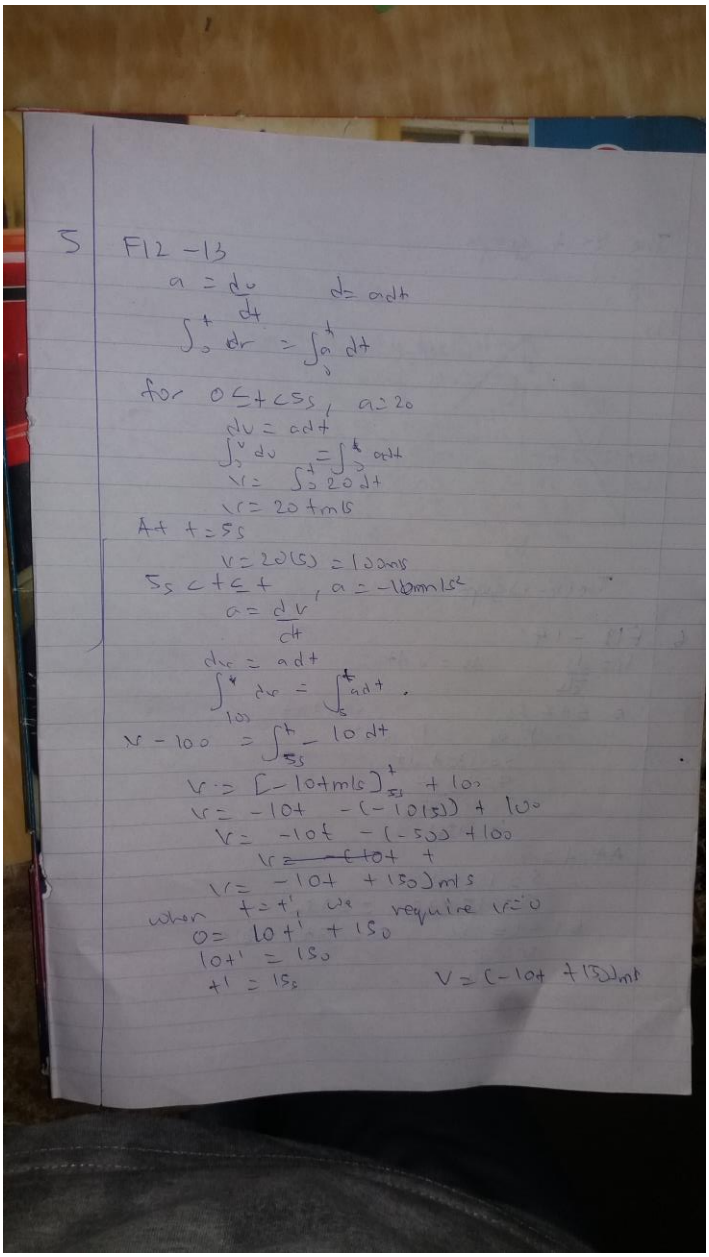
The a-t graph

a(m/s²)

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

$a = 0$

0 5 10 t(s)



5 F12-13

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

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

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

$dv = a\,dt$

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

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

$v = 20t\ m/s$

At $t = 5s$

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

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

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

$dv = a\,dt$

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

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

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

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

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

~~$v = -10t + 10t +$~~

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

when $t = t'$, we require $v = 0$

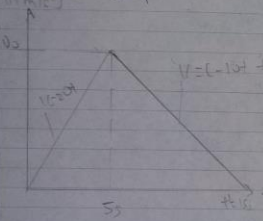
$0 = 10t' + 150$

$10t' = 150$

$t' = 15s$ $\qquad V = (-10t + 150)\ m/s$

The v- t graph

v(m/s)



The v-t graph

6 F12 -14

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

$0 \le t \le 5s$ $\quad v = 30t$

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

$S = \int 30t\,dt$

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

$S = 15t^2$ m

At $t = 5s$

$S = 15(5)^2$

$S = 15 + 25 = 375m$

$5s \le t \le 15s$, $v = 15t + 225$

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

$ds = v\,dt$

$\int_{375}^{s} ds = \int_5^t v\,dt$

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

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

$S - 375 = \left[-7.5t^2 + 225t\right]_5^t$

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

$S - 375 = -7.5t^2 + 225t - (-187.5 + 1125)$

$S = -7.5t^2 + 225t - (937.5) + 375$

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

At $t = 15s$

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

$S = -1687.5 + 3375 - 562.5$

$S = 1125m$

Total distance = 1125m

The S-t graph