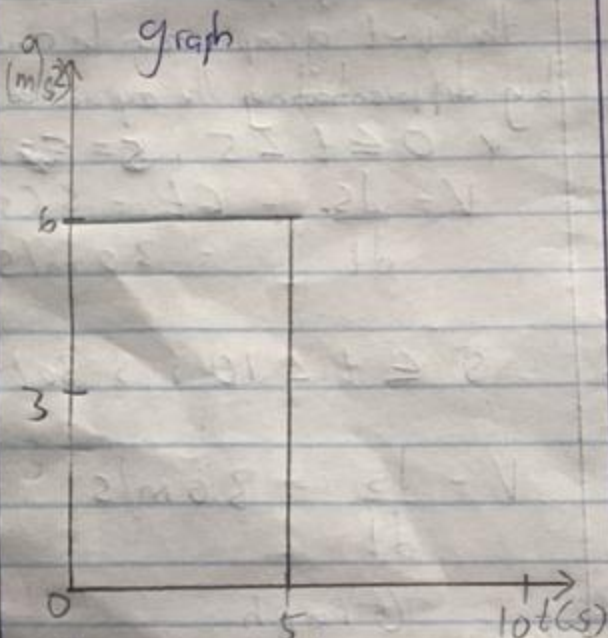


### a-t graph

The a-t graph can be determined by differentiating the v-t equations.

$$0 \leq t < 5, \quad v = 6t$$
$$a = \frac{dv}{dt} = 6 \text{ m/s}^2$$

$$5 \leq t < 10, \quad v = 30 \text{ m/s}$$
$$a = \frac{dv}{dt} = 0 \text{ m/s}^2$$



### v-t graph

The v-t graph can be determined by integrating the a-t equations.

$$0 \leq t < 5 \text{ s}$$
$$a = 20$$

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

Using this as the initial condition for the next time period we have  $5 \leq t < t'$

$$a = -10 \text{ m/s}^2$$

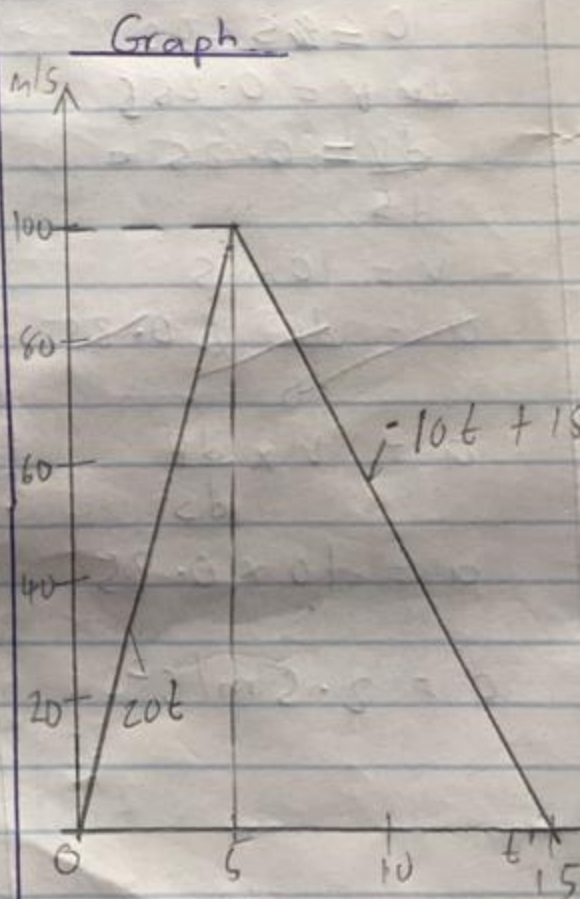
$$\int_{100}^v dv = \int_5^{t'} -10 dt$$

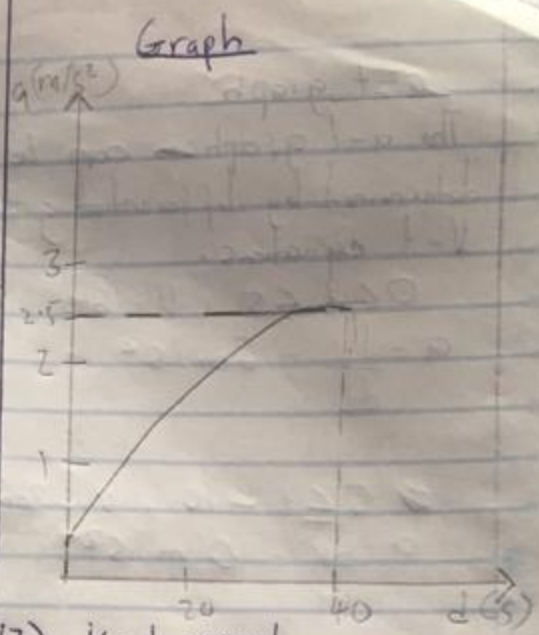
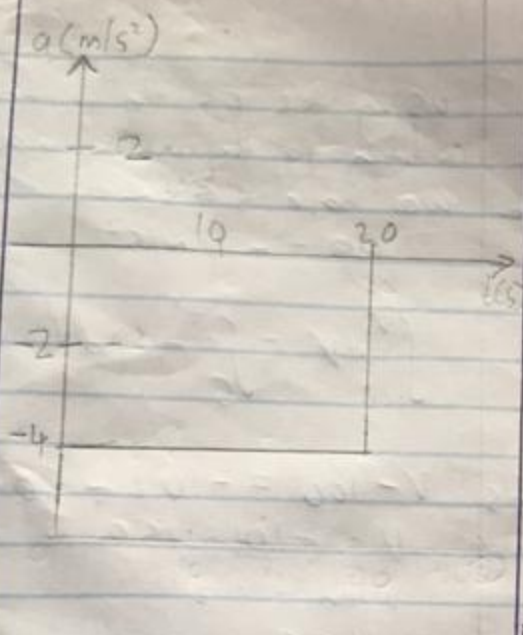
$$v - 100 = -10t + 50$$
$$v = -10t + 150$$

when  $t = t'$

$$v = 0$$

$$0 = -10t + 150$$
$$10t = 150$$
$$t' = 15 \text{ s}$$





(1) with the values of  $v$  and  $\frac{dv}{ds}$  known, the value of "a" can be calculated

$$0 \leq s < 40$$

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

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

$$v = 10 \text{ m/s}$$

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

$$a = v \times \frac{dv}{ds}$$

$$a = 10 \times 0.25$$

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

(2) v-t graph

the v-t graph can be constructed by differentiating the equations

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

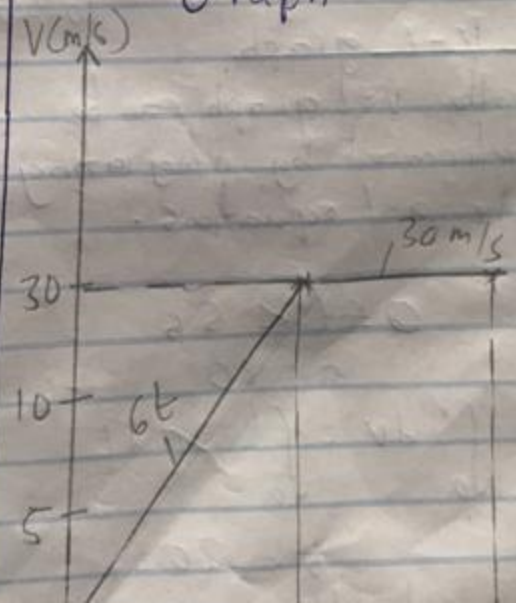
$$v = \frac{ds}{dt} = 6t = 6(s)$$

$$= 30 \text{ m/s}$$

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

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

Graph



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S-t graph

the S-t graph can be determined by integrating the equations

$$0 \leq t < 5s, v = 30t$$

$$\int_0^S S = \int_0^t 30t dt$$

$$S = 30 \cdot 15t^2 m$$

when  $t = 5s$

$$S = 15(5)^2$$

$$S = 375m$$

Using this initial conditions

$$5s \leq t < 15s$$

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

$$S - 375 = \frac{-15t^2 + 225t}{2}$$

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

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

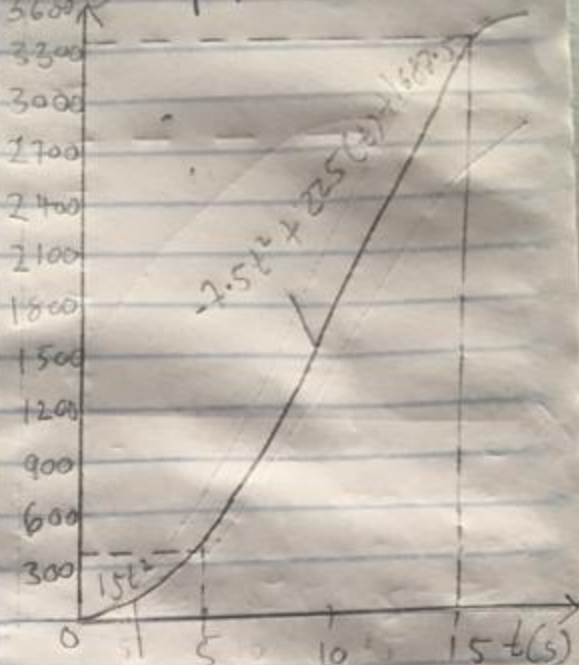
$$S = -7.5t^2 + 225t + 1687.5$$

when  $t' = 15s$

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

$$S = 3,375m$$

Graph



Nwachukwu Marshall

Mechatronics

18/ing05/036

1) Since  $v = \frac{ds}{dt}$  the  $v-t$

graph can be determined by

differentiating the equation

$$0 \leq t < 6s, s = 0.5t^3$$

$$v = \frac{ds}{dt} = 1.5t^2 \text{ m/s}$$

$$6 \leq t < 10s, s = 54t \text{ m/s}$$

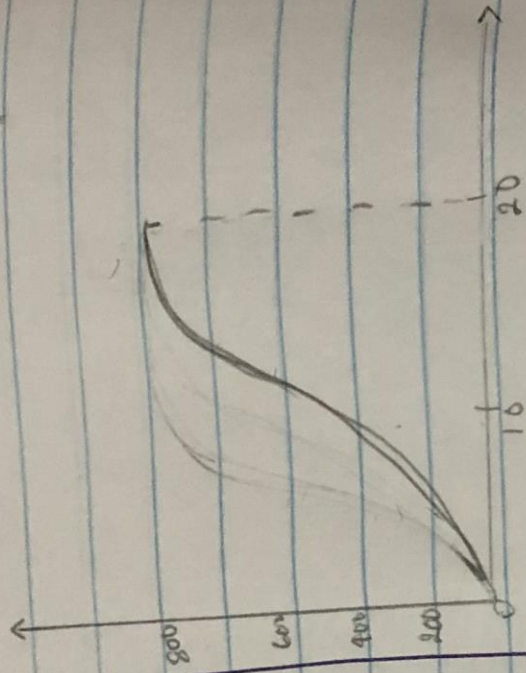
$$10 \leq t < 20s, s = 108$$

$$v = \frac{ds}{dt} = 0 \text{ m/s}$$

Graph

$$= 800 \text{ m}$$

Graph



a-t graph

the a-t graph is determined by differentiating the equation

$$0 \leq t < 20s, v = -40t + 80$$