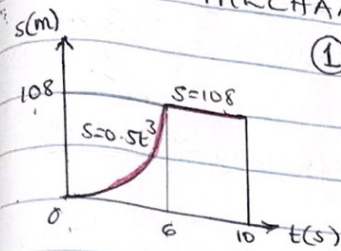


MECHATRONICS ENGINEERING

MATRIC NO: 18/ENG05/015

NAME: EJIM CHISOM PRECIOUS

MECHANICS (ENG 234) ASSIGNMENT



$$s = 0.5t^3$$

$$v = \frac{\delta s}{\delta t} = \frac{\delta (0.5t^3)}{\delta t} = 1.5t^2$$

$$v|_{t=6s} = 1.5 \times 6^2 = 54 \text{ m/s}$$

~~0 <= t < 6s, v = 54 m/s~~

$$6s < t < 10s,$$

$$v = \frac{\delta s}{\delta t} = \frac{\delta (108)}{\delta t} = 0$$

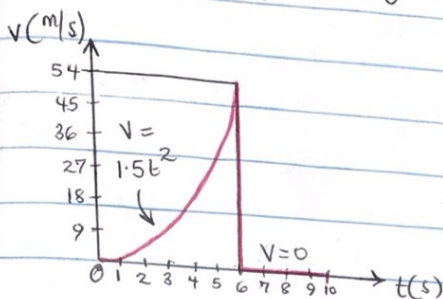
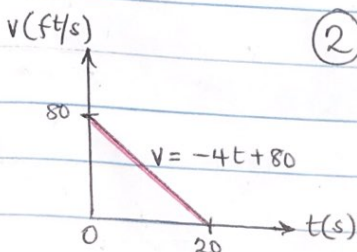


fig: v-t graph



To get s-t graph

$$\delta s = v \delta t$$

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

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

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

$$\text{at } t = 20, s = -2 \times 20^2 + 80 \times 20 = 800 \text{ ft}$$

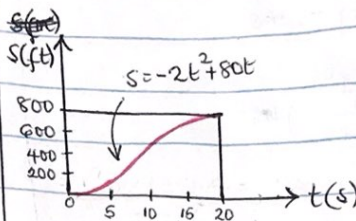


fig: s-t graph

To get the a-t graph

$$a = \frac{\delta v}{\delta t} = \frac{\delta (-4t + 80)}{\delta t} = -4 \text{ m/s} = -4 \text{ ft/s}^2 \text{ or } 4 \text{ ft/s}^2 \leftarrow$$

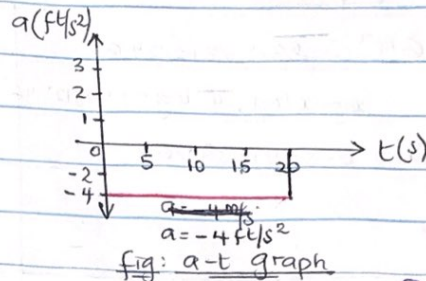
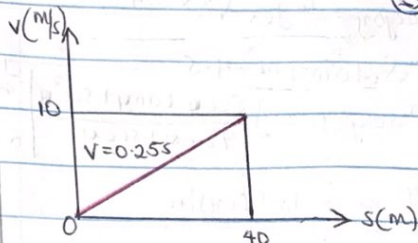


fig: a-t graph

③



To get the a-s graph

$$a \delta s = v \delta v, \quad a = v \frac{\delta v}{\delta s} \text{ but } v = 0.25s$$

$$a = 0.25s \frac{\delta (0.25s)}{\delta s} = 0.0625s$$

~~0 <= s < 40m,~~

$$a|_{s=40m} = 0.0625 \times 40 = 2.5 \text{ m/s}^2 \rightarrow$$

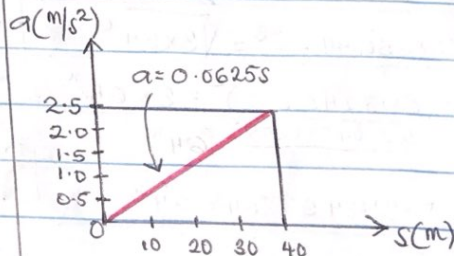
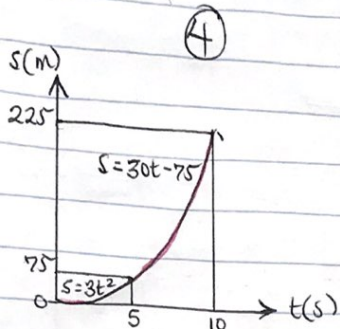


Fig: a-s graph



To get the v-t graph

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

$$v = \frac{\delta s}{\delta t} = \frac{\delta (3t^2)}{\delta t} = 6t \text{ m/s}$$

at $t = 5s$, ($v_{t=5s}$), $v = 6 \times 5 = 30 \text{ m/s}$

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

$$v = \frac{\delta s}{\delta t} = \frac{\delta (30t - 75)}{\delta t} = 30 \text{ m/s}$$

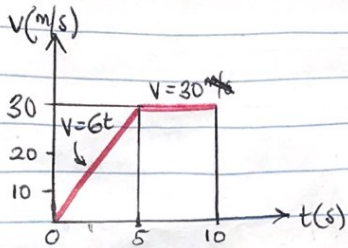


Fig: v-t graph

To get a-t graph,

$$0 \leq t < 5s, \quad v = 6t$$

$$a = \frac{\delta v}{\delta t} = \frac{\delta (6t)}{\delta t} = 6 \text{ m/s}^2$$

$$5s < t \leq 10s, \quad v = 30$$

$$a = \frac{\delta v}{\delta t} = \frac{\delta (30)}{\delta t} = 0$$

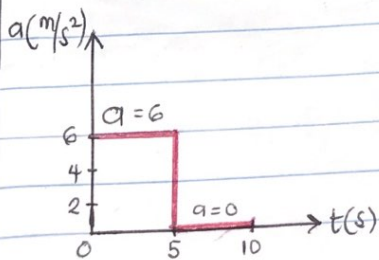
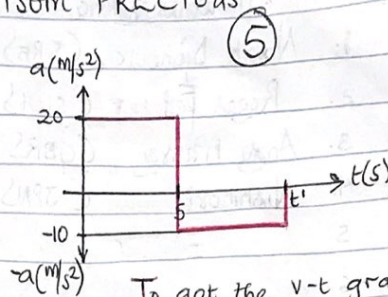


Fig: a-t graph



To get the v-t graph,

$$0 \leq t < 5s, \quad \delta v = a \delta t$$

$$\int_0^v \delta v = \int_0^t 20 \delta t, \quad v = 20t \text{ m/s}$$

at $t = 5s$, $v = 20 \times 5 = 100 \text{ m/s}$

$$5s < t \leq t', \quad \delta v = a \delta t$$

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

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

$$v = (150 - 10t) \text{ m/s}$$

If $t = t'$, $v = 0$, thus, $t' = 15s$

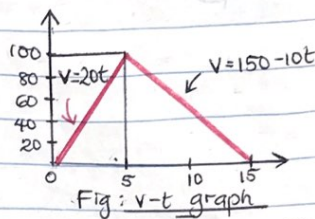
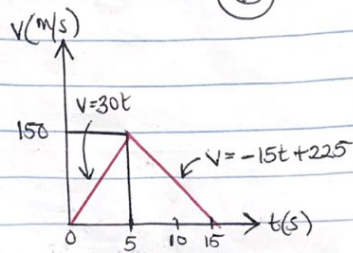


Fig: v-t graph



To get the s-t graph,

$$0 \leq t < 5s, \quad \delta s = v \delta t$$

$$\int_0^s \delta s = \int_0^t 30t \delta t$$

$$s = \frac{30}{2} t^2 = 15t^2$$

at $t = 5$, $s = 15 \times 5^2 = 375 \text{ m}$

$$5s < t \leq 15s, \quad v = -15t + 225$$

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

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CONTINUATION

$$S - 375 = -7.5t^2 + 225t \Big|_5^t$$

$$S - 375 = -7.5t^2 + 225t - \left(-\frac{375}{2} + 1125\right)$$

$$\cancel{S - 375} (-7.5t^2 + 225t - 562.5) \text{ m} = S$$

$$\text{At } t = 15\text{s}, \quad S = -7.5 \times 15^2 + 225 \times 15 - 562.5 = 1125 \text{ m}$$

To get total distance travelled during this time interval,

we find the area ^{under} the v-t graph

$$S = \frac{1}{2} \times b \times h = \frac{1}{2} \times 15 \times 150 = 1125 \text{ m}$$

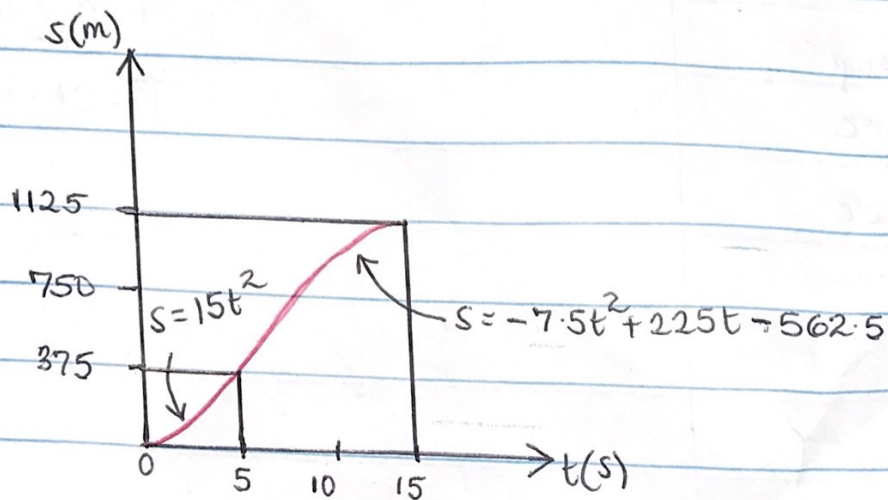


Fig: s-t graph