NAME: **SAMPSON SOPHIA**

MATRIC NO: **19/ENG08/009**

DEPARTMENT: **BIOMEDICAL ENGINEERING**

COURSE CODE: **ENG 234**

:COURSE TITLE: **ENGINEERING MECHANICS**
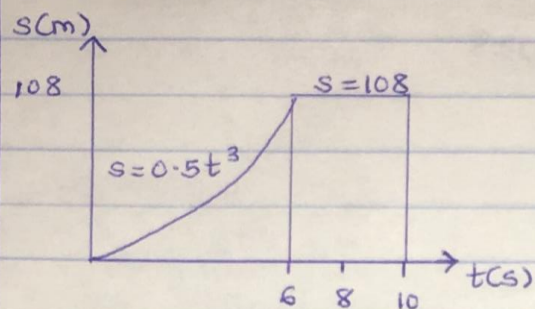
NAME: SAMPSON SOPHIA

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1. F12-9

   s-t graph

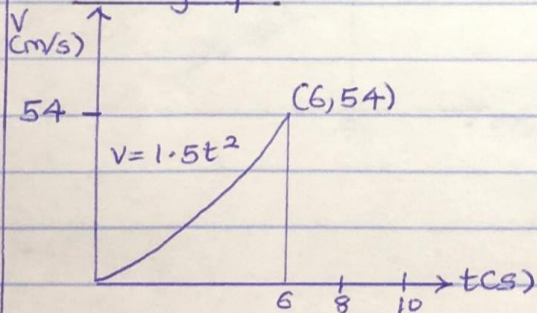Solution

$S = 108$ when $t = 6$; $s = 0.5t^3$

$V = ds/dt$

$V = 0.5t^3 = 1.5t^2$
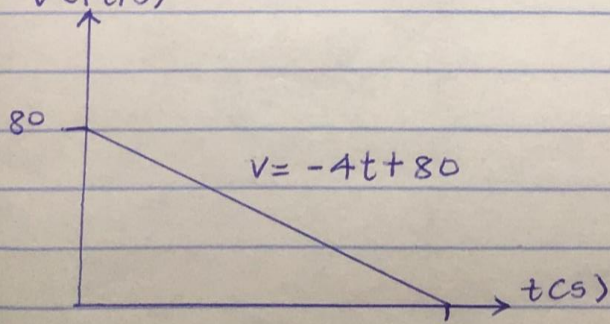
at $t = 6$

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

At time : $6 \leq t \leq 10$; distance is constant so velocity is equal to zero.

   v-t graph

2. F12-10

   v (ft/s)

s-t graph

Since $ds = vdt$; To get s, we will integrate both sides:

Initial conditions : $s=0$ when $t=0$

$0 \leq t \leq 20s$; $V = -4t + 80$ ft/s

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

$$S = \frac{-4t^2}{2} + 80t$$
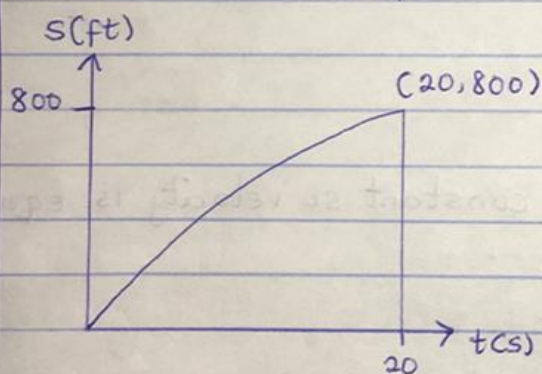
$$S = -2t^2 + 80t \ (ft)$$

when $t = 20s$,

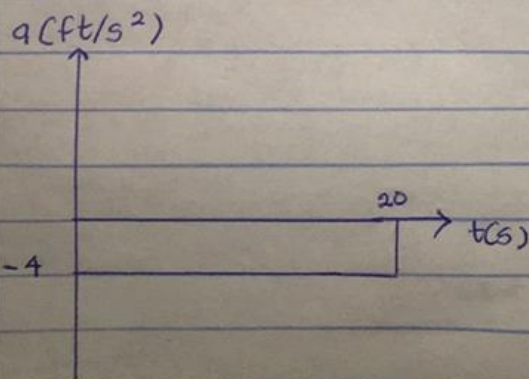$$S = -2(20)^2 + 80(20)$$
$$= -800 + 1600$$
$$= 800 \, ft$$

a-t graph.

$a = dv/dt$
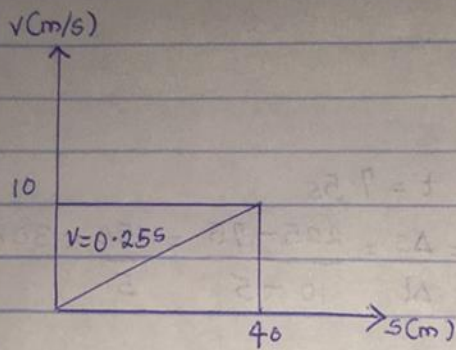
$V = -4t + 80$

$a = dv/dt = -4 \, ft/s^2$

3. F12-11

v(m/s)

10

$v = 0.25s$

40 →s(m)

a-s graph

$a\,ds = v\,dv$

$a = \dfrac{v\,dv}{ds}$

$0 \leqslant s \leqslant 40\,m$ $\qquad V = 0.25s$ $\qquad V = 10\,m/s$

$a = 0.25s \times \dfrac{d\,(0.25s)}{ds}$

$= 0.25s \times 0.25$

$a = 0.0625s$

a(m/s²)

$a = 0.0625 \times 40$

$= 2.5\,m/s^2$

2.5

$a = 0.0625s$

40 →s(m)

4. F12-12

s(m)

225

$s = 30t - 75$

75

$s = 3t^2$

o   5   10 →t(s)
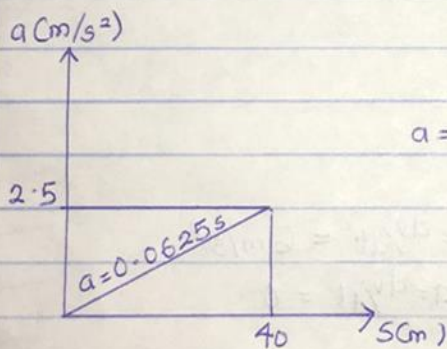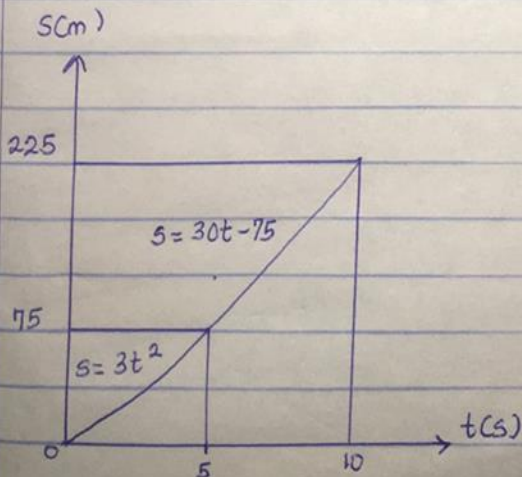
Solution

v-t graph

$v = ds/dt$

$0 \leq t < 5s$;

$\quad S = 3t^2 \text{ (cm)}$

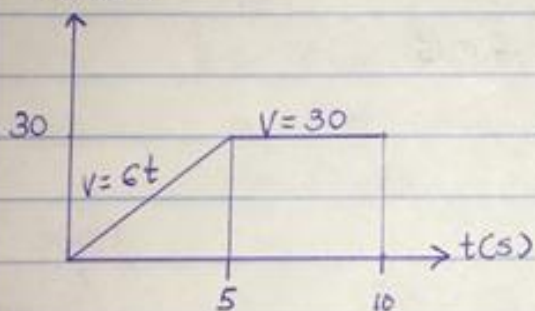$\quad v = \dfrac{ds}{dt} = 6t \text{ m/s}$

At $t = 7.5s$

$\quad v = \dfrac{\Delta s}{\Delta t} = \dfrac{225 - 75}{10 - 5} = \dfrac{150}{5} = 30 \text{ m/s}$

❷ $5s < t \leq 10s$;

$\quad S = 30t - 75 \text{ m}$

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

v (m/s)

a-t graph

$a = dv/dt$

$0 \leq t < 5s$; $\qquad v = 6t \text{ m/s} \qquad a = \dfrac{dv}{dt} = 6 \text{ m/s}^2$

$5s < t \leq 10s$; $\qquad v = 30 \text{ m/s} \qquad a = \dfrac{dv}{dt} = 0$

a (m/s²)

5 F12-13

$a\,(m/s^2)$
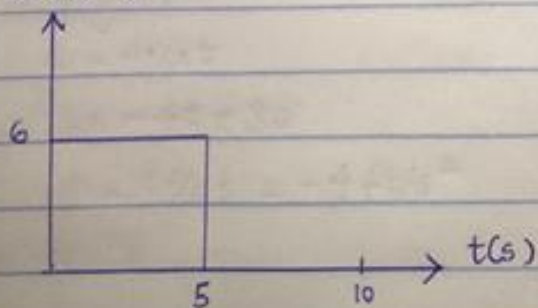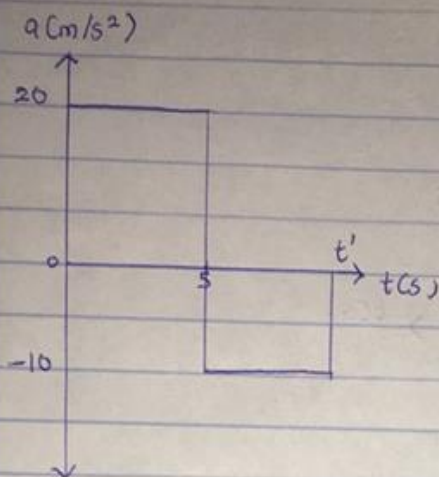
Solution

v-t graph

Since $dv = a\,dt$

Initial conditions : $v = 0$ when $t = 0$

$0 \leqslant t < 5s$; $a = 20\,m/s^2$

$$\int_0^v dv = \int_0^t a\,dt \qquad\qquad v = 20t$$

When $t = 5s$, $v = 20(5) = 100\,m/s^2$

$5s \leqslant t \leqslant t'$; $a = -10\,m/s^2$

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

$v - 100 = [-10t]_5^t$
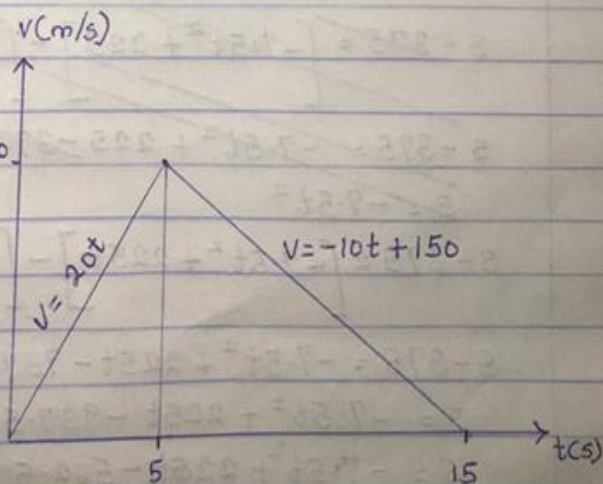
$v - 100 = -10t + 50$

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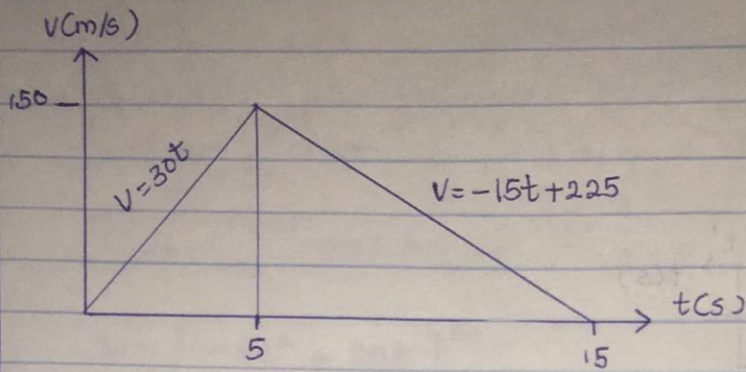
$v = -10t + 150$

$v\,(m/s)$

At t' ; $v = 0$

$0 = -10t + 150$

$10t = 150$

$t = 15\,secs$

6. F12-14

v(m/s)

150 —

$v = 30t$

$v = -15t + 225$

t(s)

5

15

Solution

s-t graph   Initially $s = 0$ when $t = 0$

$ds = v \, dt$

$0 \le t \le 5s$; $v = (30t) \, m/s$

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

$$s = \int_0^t 30t \, dt$$

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

$$s = 15(5)^2 = 375m \quad \text{when } t = 5s$$

when

$5s \le t \le 15s$; $v = (-15t + 225) \, m/s$

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

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

$$s - 375 = \left[-7.5t^2 + 225 \right] - \left[-187.5 + 225 \right]$$

$$s - 375 = -7.5t^2 + 225 - 37.5$$

$$s = -7.5t^2$$

$$s - 375 = \left[-7.5t^2 + 225t \right] - \left[-187.5 + 1125 \right]$$

$$s - 375 = -7.5t^2 + 225t - 937.5$$

$$s = -7.5t^2 + 225t - 937.5 + 375$$
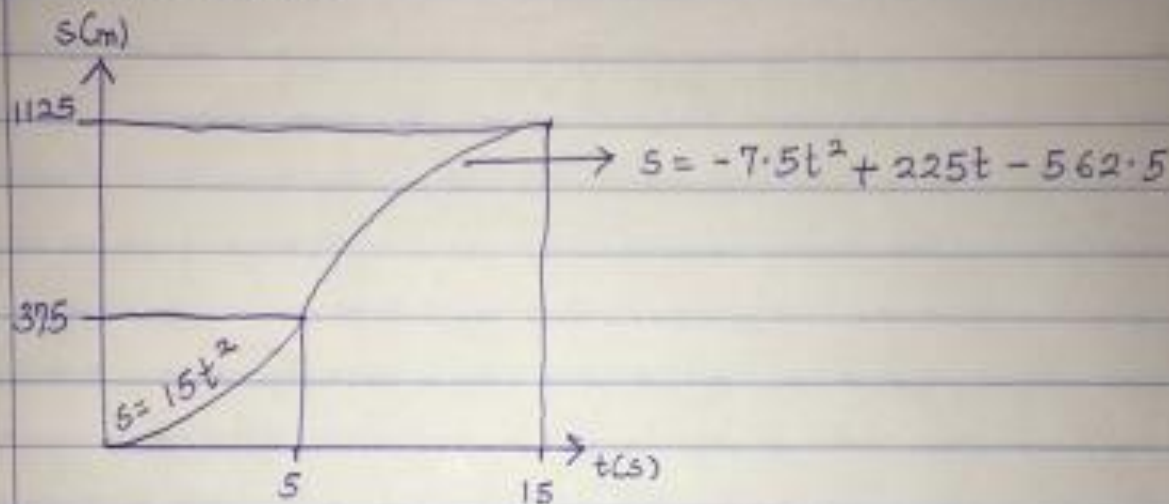
$$s = -7.5t^2 + 225t - 562.5$$

When $t = 15$

$$S = -7.5t^2 + 225t - 562.5$$
$$= -7.5(15)^2 + 225(15) - 562.5$$
$$= -1687.5 + 3375 - 562.5$$
$$S = 1125m$$

$$S = -7.5t^2 + 225t - 562.5$$

You can also get the total distance by finding area under graph.

$$Area = \frac{1}{2}bh$$
$$= \frac{1}{2} \times 15 \times 150$$
$$= \frac{2250}{2} = 1125m$$