

P-817 at home t-V
18/ENG05/064

Mechatronics Engineering
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Engineering Mechanics.

(1) F12-9

$$V = 32 \frac{ds}{dt} = 1.5t^2 = 2$$

$$s = 0.5t^3 \text{ m}$$

$$\frac{ds}{dt} = v \Rightarrow 3(0.5)t^2 = \frac{v}{3}$$

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

$$\text{at } t = 6 \text{ s}$$

$$v = 1.5(6)^2 = 54 \text{ m/s}$$

$$v = 36 \times 1.5 = 54 \text{ m/s}$$

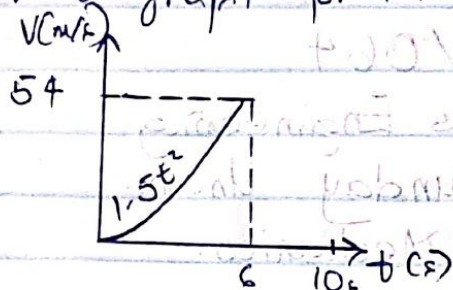
$$(0.5) 36^2 = (0.5) s = 2$$

$$\text{at } s = 108 \text{ m}$$

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

after 4s, $v = 0 \text{ m/s}$

V-t graph for F12-9



(2) F12-10

$$v = (-4t + 80) \text{ ft/s}$$

$$s = \int v dt = \frac{-4t^2}{2} + 80t$$

$$s = (-2t^2 + 80t) \text{ ft}$$

$$\frac{dv}{dt} = a, \quad v = (-4t + 80) \text{ ft/s}$$

$$a = \frac{dv}{dt} = -4 \text{ ft/s}^2$$

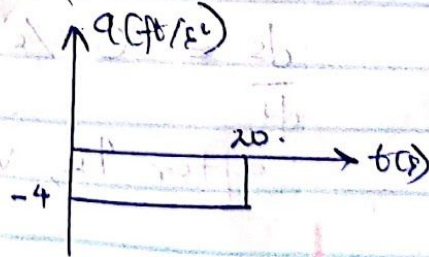
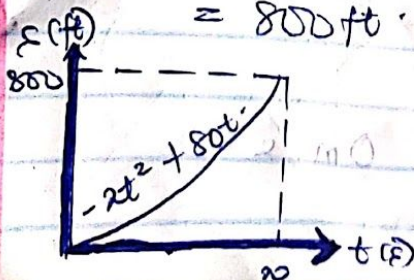
$$s = -2t^2 + 80t$$

$$\text{at } t = 20$$

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

$$= -800 + 1600 = 800$$

$$= 800 \text{ ft}$$



(3) F12-11

$$a ds = v dv$$

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

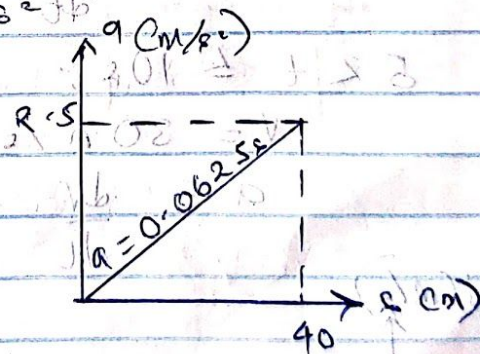
$$a = (0.25s) \left[\frac{d(0.25s)}{ds} \right]$$

$$a = 0.25s \times 0.25$$

$$a = 0.0625s$$

$$a \text{ at } s = 40 = 0.0625(40)$$

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



(4) F12-12

For $0 \leq t \leq 5$ s

$$s = 3t^2$$

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

at $t = 5s$

$v = 6(5) = 30 \text{ m/s}$

for $5s < t \leq 10s$

$$V(\approx \frac{\Delta s}{\Delta t}) = \frac{225m - 75m}{10s - 5s} = 30 \text{ m/s}$$

For a-t graph

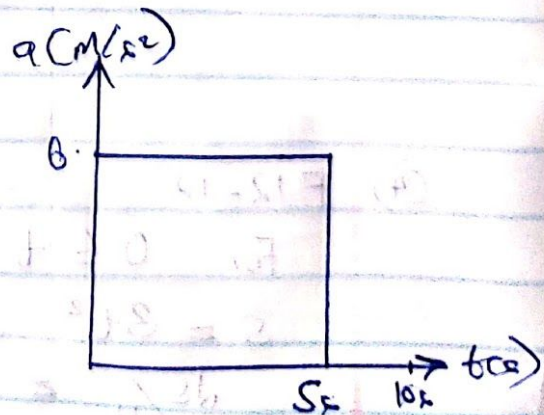
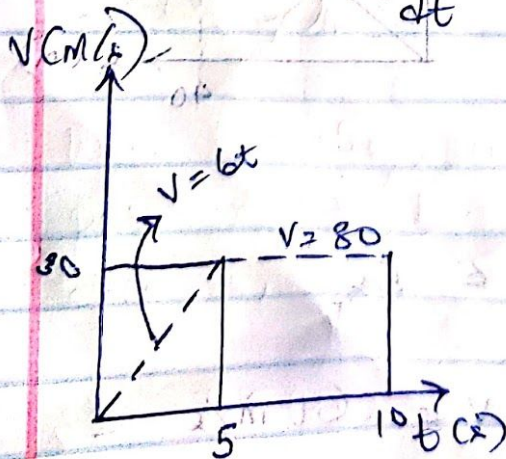
$0 < t < 5s \quad v = 6t \text{ m/s}$

$a = \frac{dv}{dt} = 6 \text{ m/s}^2$

$5 < t \leq 10s$

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

$a = \frac{dv}{dt} = 0 \text{ m/s}^2$



(5) F12-13

20 m/s^2 for 5 s
and then decelerates
at 10 m/s^2

$$dv = a dt$$

at $v = 0$ and $t = 0$

$$\Rightarrow 0 \leq t < 5 \text{ s}$$

$$a = 20 \text{ m/s}^2$$

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

$$v = 20t$$

when $t = 5 \text{ s}$,

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

$$\Rightarrow 5 \text{ s} < t \leq t'$$

$$\int_{100 \text{ m/s}}^v dv = \int_{5 \text{ s}}^t (-10) dt$$

$$v = (-10t + 50) + 100 \text{ m/s}$$

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

$$0 = A_1 + A_2 = Av$$

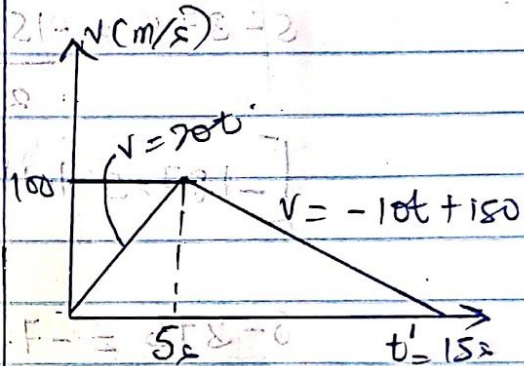
$$0 = (20 \text{ m/s}^2)(5) + (-10)(t' - 5 \text{ s})$$

$$0 = 100 + [-10t' +$$

$$50] - v$$

$$t' = \frac{-150}{-10}$$

$$t' = 15 \text{ s}$$



(6) F12-14

$$\Rightarrow 20 \leq t \leq 15 \text{ s}$$

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

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

$$s = 15t^2 \text{ m}$$

when $t = 5 \text{ s}$, $s = 15(5)^2$

$$s = 375 \text{ m}$$

$$t = 15 \text{ s}$$

$$v = (-15t + 225)$$

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

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

$$\left[-187.5 + 112.5 \right]$$

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

$$225t + 187.5$$

$$112.5 + 375$$

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

When $t = 15 \text{ s}$, the position (total distance s);

$$s = -7.5(15)^2 +$$

$$225(15) - 562.5$$

$$s = -1687.5 + 3375 - 562.5$$

$$s = 112.5 \text{ m}$$

$s-t$ graph.

