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Engineering Mechanics

1. Fig 12 - 9

$$v = ds/dt$$

$$s = 0.5t^3$$

$$v = d(0.5t^3)$$

dt

$$= 1.5t^2$$

at $t = 6s$

$$v = 1.5 \times 6^2$$

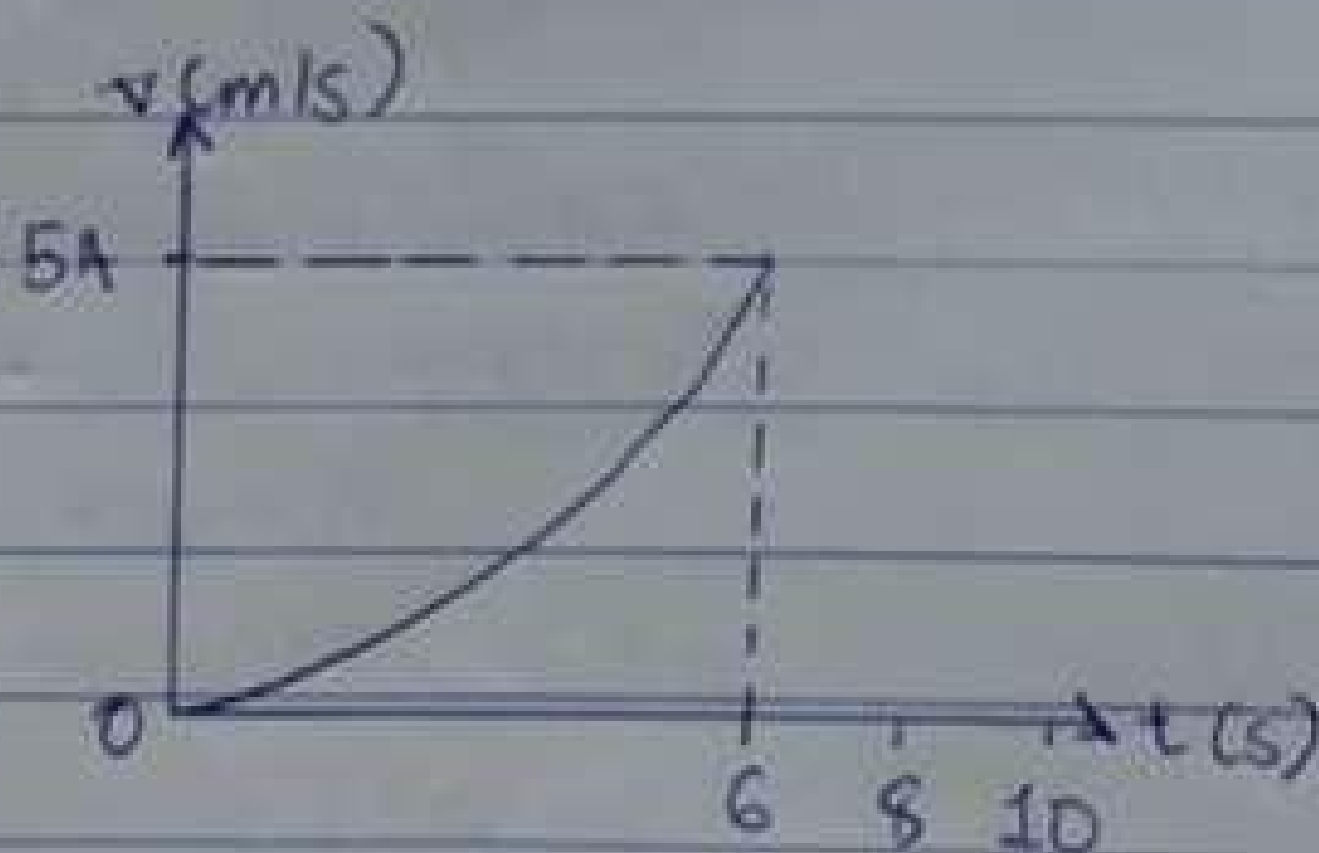
$$= 1.5 \times 36$$

$$v = 54 \text{ m/s}$$

Note from $t = 6s - 10s$, s remained 108

$$\therefore v = 0$$

v-t graph



2. Fig 12 - 10.

$$a. s = \int v dt$$

$$s = \int (-4t + 80) dt$$

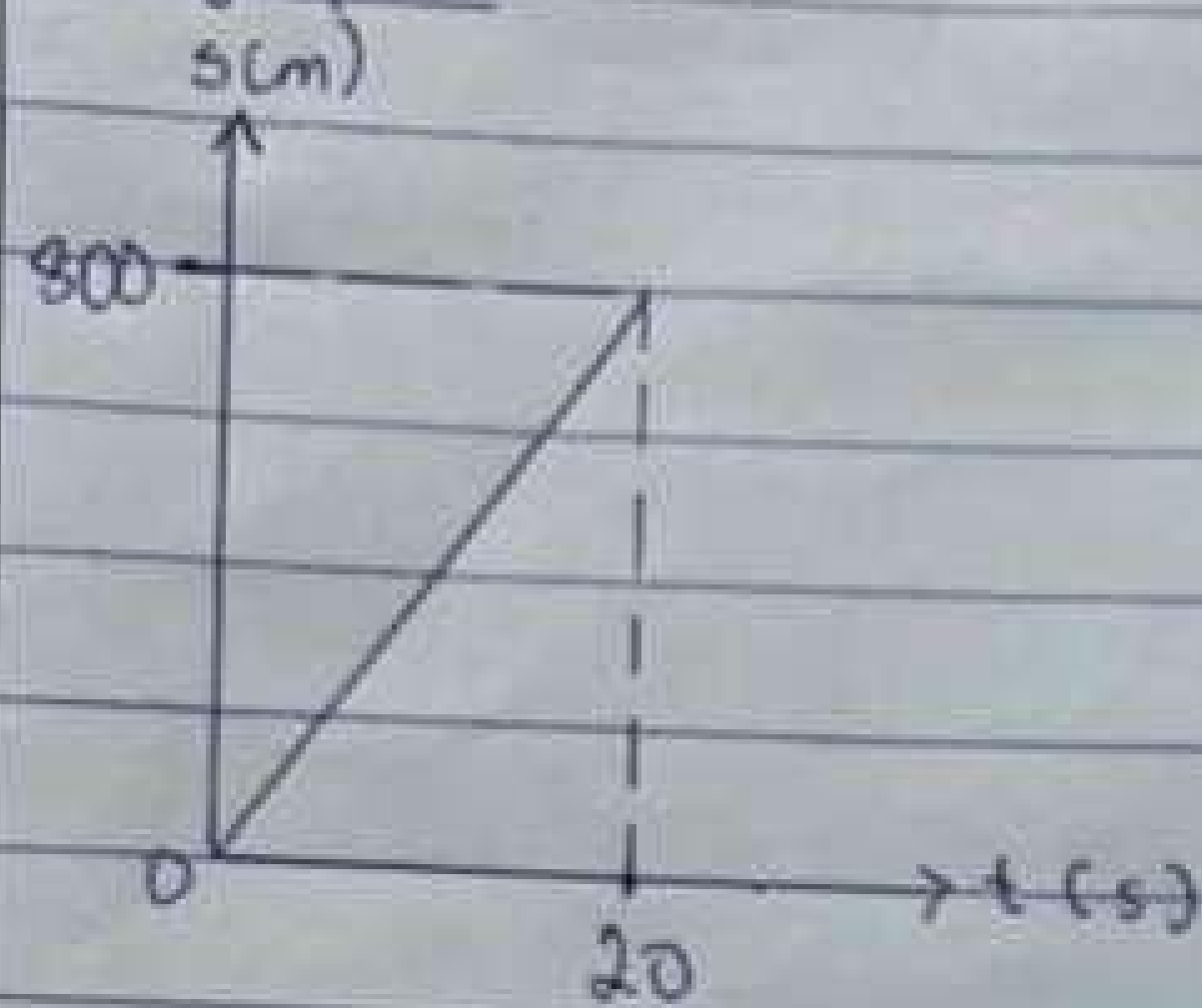
$$s = -2t^2 + 80t$$

at $t = 20s$

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

$$s = -800 + 1600 = 800 \text{ m}$$

s-t graph



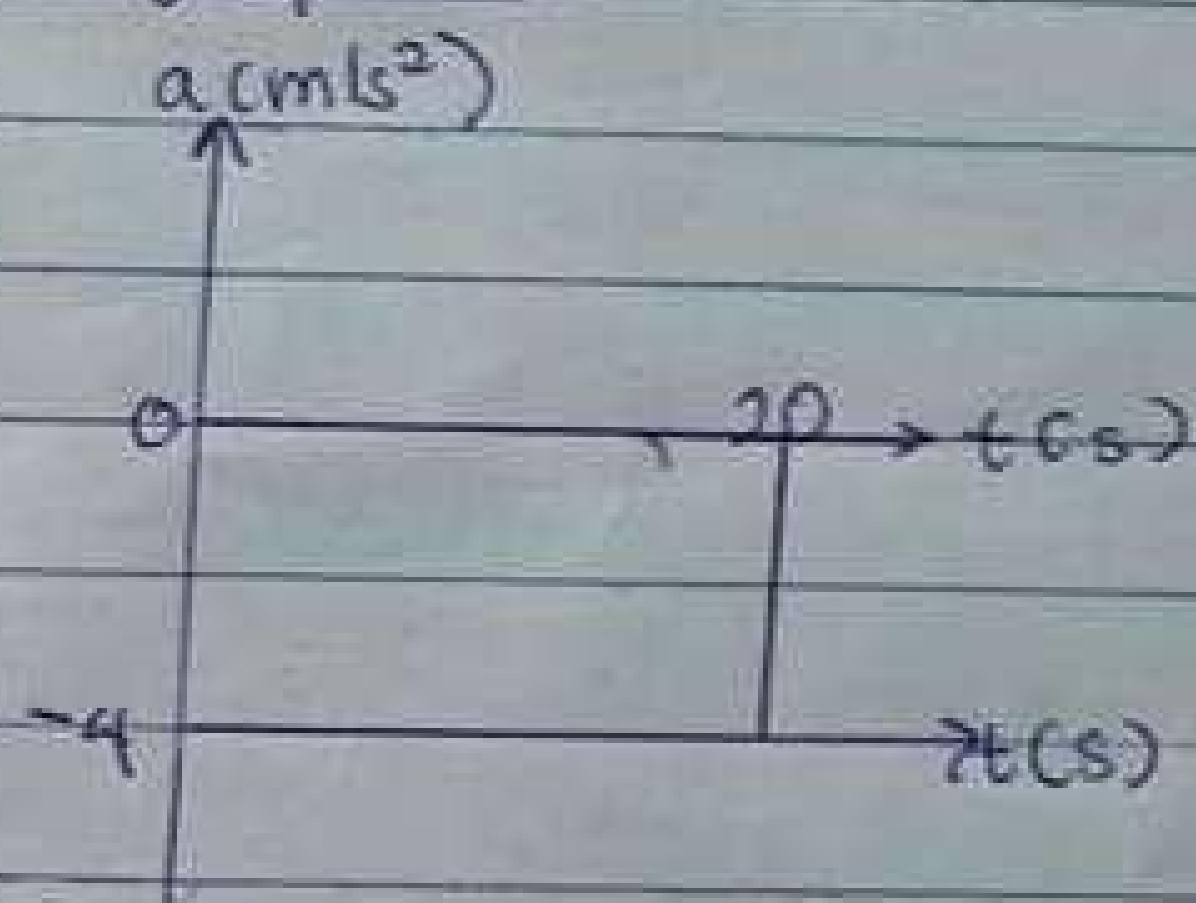
b. acceleration

$$a = \frac{dv}{dt}, \quad v = -4t + 80 \quad \frac{dv}{dt} = -4 \text{ m/s}^2$$

$$\therefore a = -4 \text{ m/s}^2$$

$$\text{at } t = 20 \text{ s, } a = -4 \text{ m/s}^2$$

a-t graph



3 Fig 12-11

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

$$v = 0.25s$$

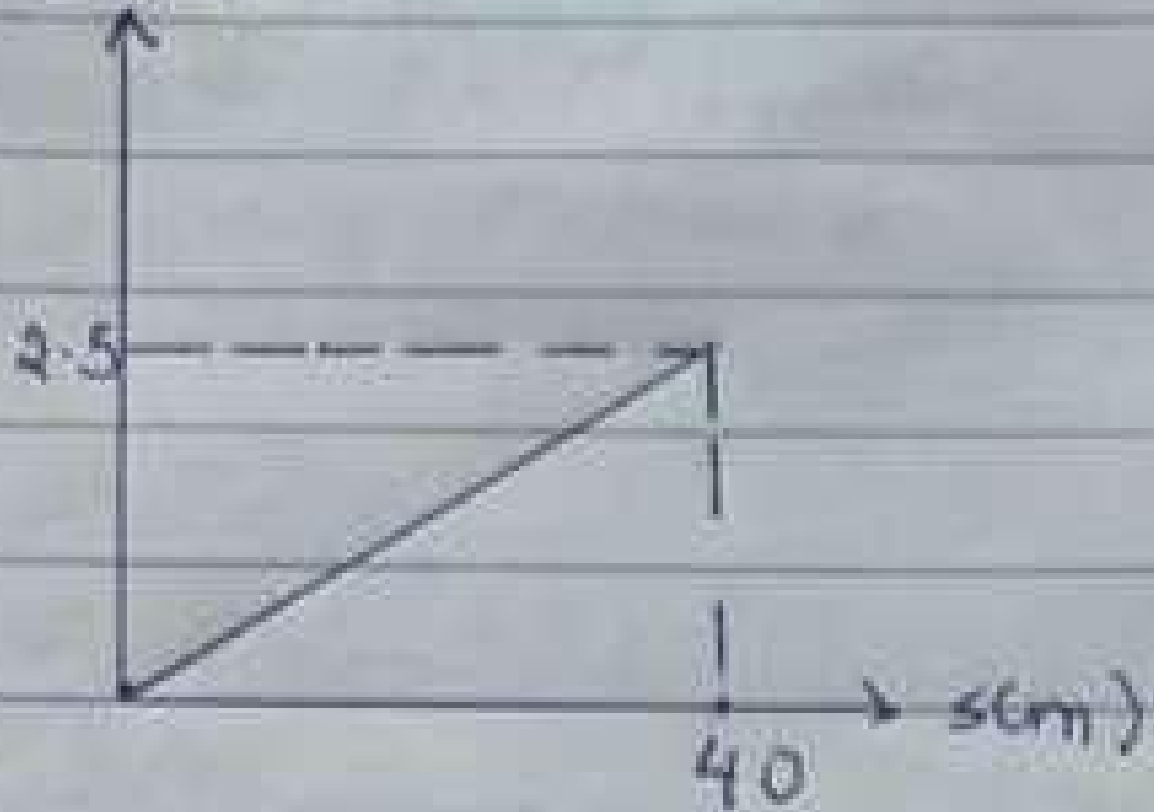
$$\frac{dv}{ds} = 0.25$$

$$\therefore a = 0.25s \times 0.25$$

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

a-s graph

a (m/s²)



4 Fig 12-13

$$a. v = \int a dt$$

$$v = \int 20 dt$$

$$v = 20t$$

$$\text{at } t = 5s$$

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

$$5s < t \leq t$$

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

$$v - 100 = -10t \Big|_5^{t'}$$

$$v - 100 = -10t' + 10(5)$$

$$v - 100 = -10t' + 50$$

$$\text{at } t', v = 0$$

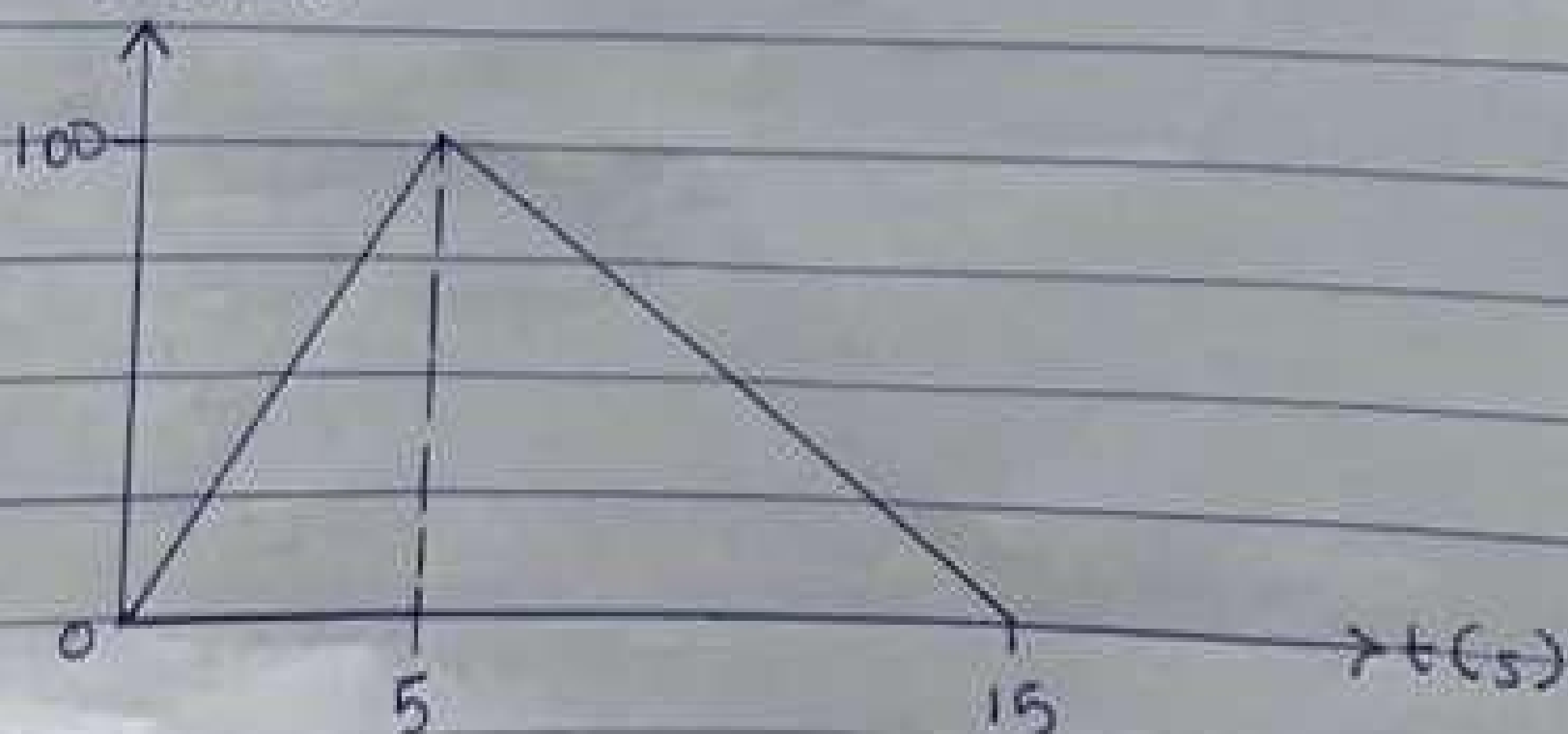
$$0 - 100 = -10t' + 50$$

$$10t' = 150$$

$$t' = 15s$$

v-t graph

v (m/s)



5 Fig 12-14

$$0 \leq t \leq 5s$$

$$v = 30t$$

$$\int_0^5 ds = \int_0^5 30t dt$$

$$s = 15t^2 \Big|_0^5$$

$$s = 15(5)^2 - 15(0)^2$$

$$s = 15 \times 25 - 0$$

$$s = 375m$$

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

$$v = -15t + 225$$

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

$$s - 375 = \frac{-15t^2}{2} + 225t \Big|_5^{15}$$

$$s - 375 = \left[\frac{-15(15^2)}{2} + 3375 \right] - \left[\frac{-15 \times 25}{2} + 1125 \right]$$

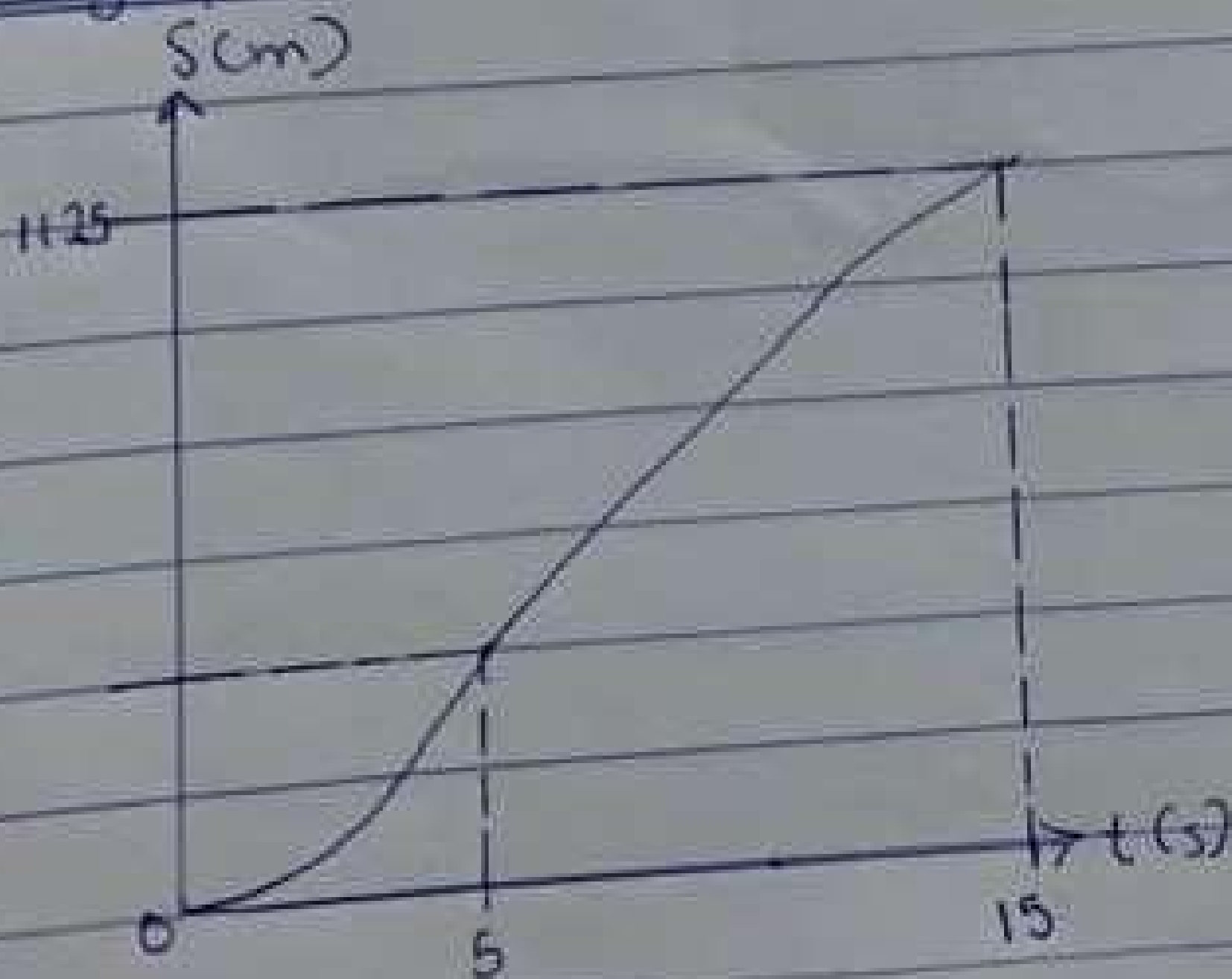
$$s - 375 = (-1687.5 + 3375) - (-187.5 + 1125)$$

$$s - 375 = 1687.5 - 937.5$$

$$s - 375 = 750$$

$$s = 1125m$$

s-t graph



G F12-12.

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

at $t = 5s$

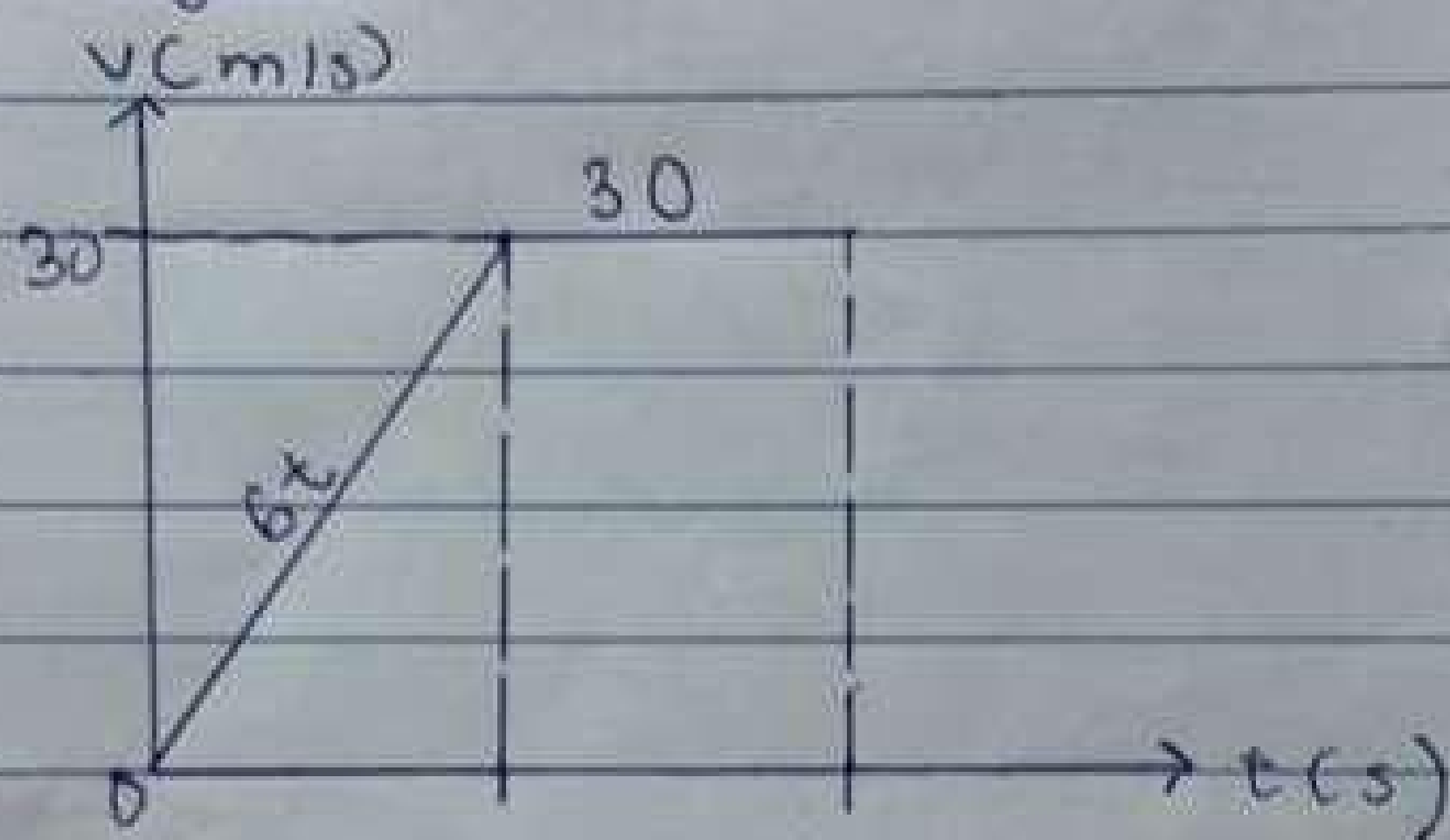
$v = 6t$

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

at $t = 10s$

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

v-t graph



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

at $t = 5s$

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

at $t = 10s$

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

a-t graph

