$ds = v\,dt$ $\quad s = \int$

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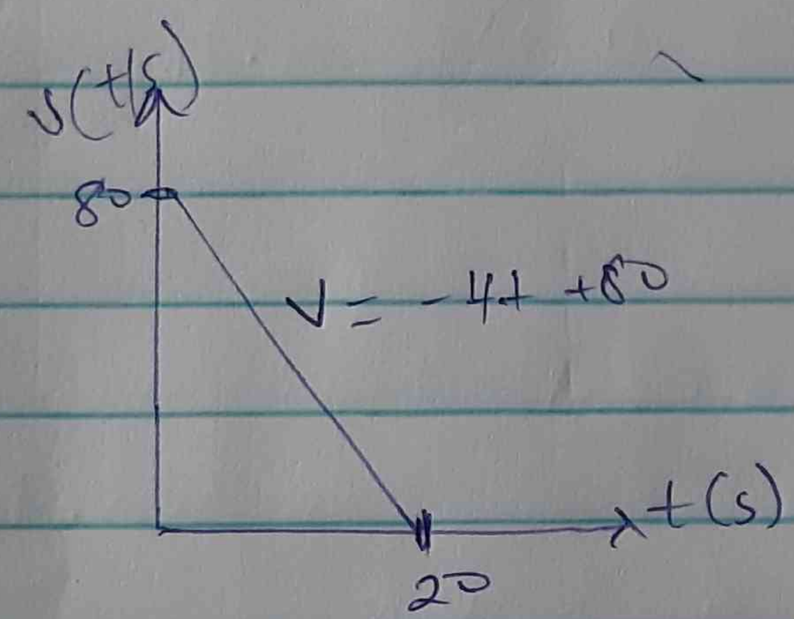
Assignment

1.) A van travels along a straight road with a velocity described by the graph. Construct the s-t and a-t graphs during the same period. Take $s = 0$ when $t = 0$



Solution

$v = -4t + 80$

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

$ds = v\,dt$

$\int ds = \int v\,dt$

$s = \int -4t + 80$

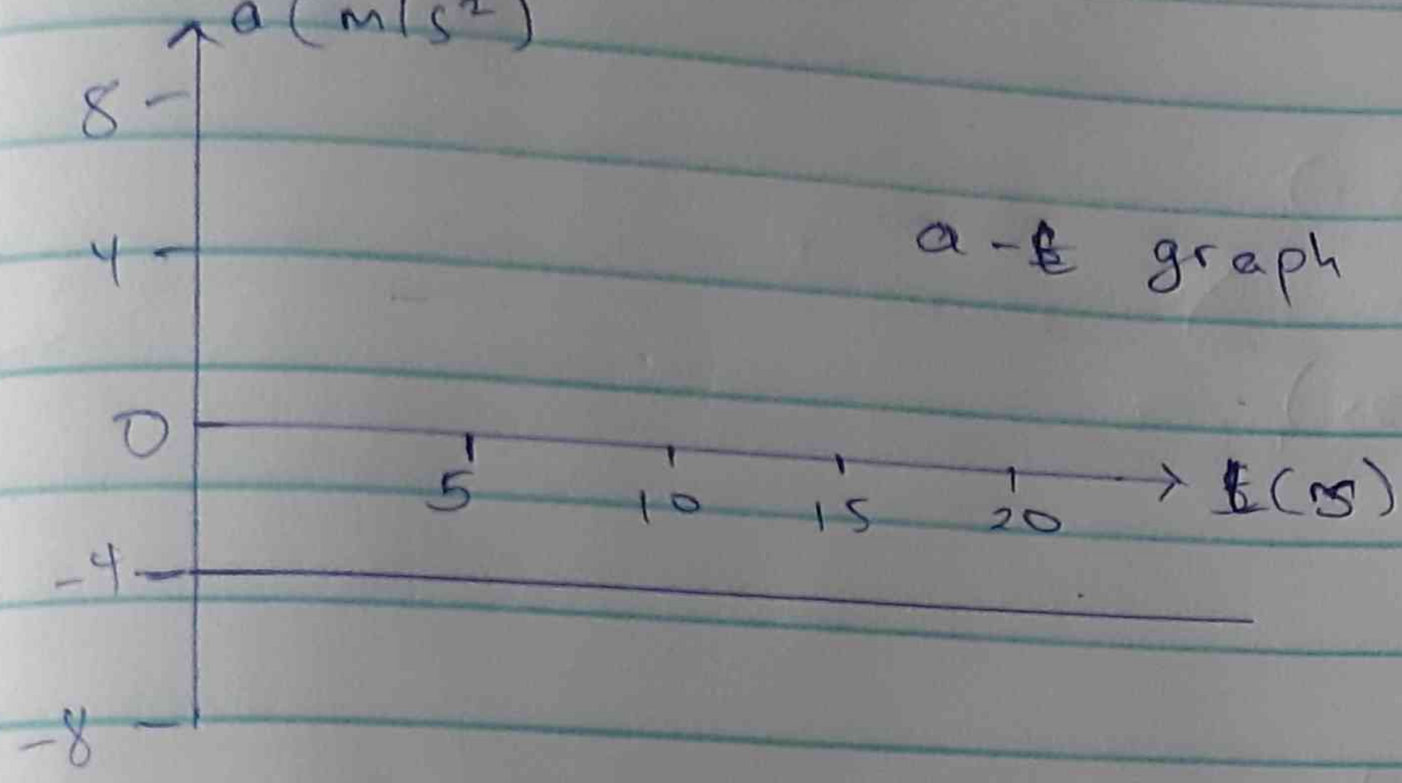
$s = -\frac{4t^2}{2} + 80t + C$ when $s = 0, t = 0$

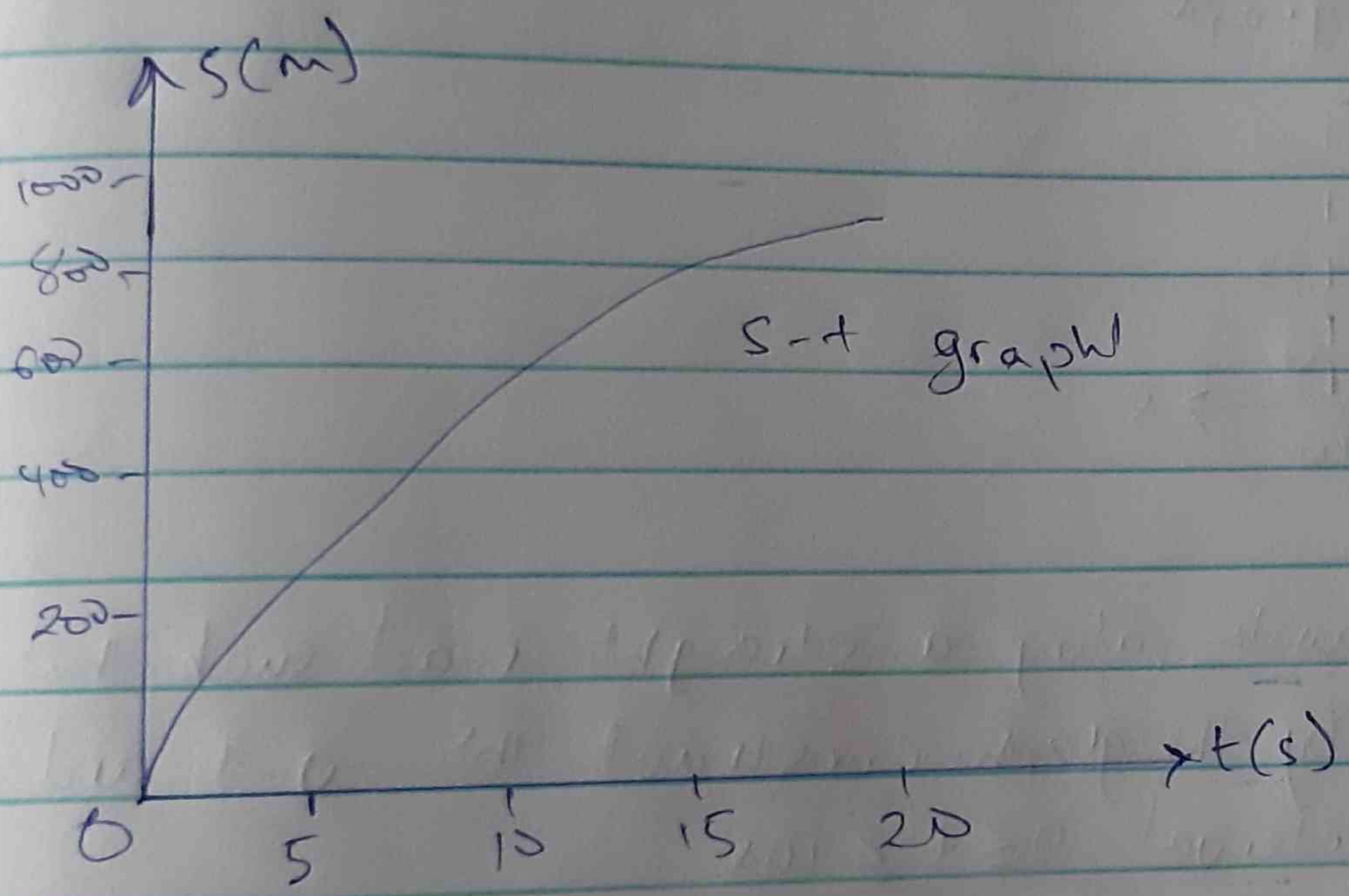
$0 = 0^2 + 0 + C \quad , C = 0$

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

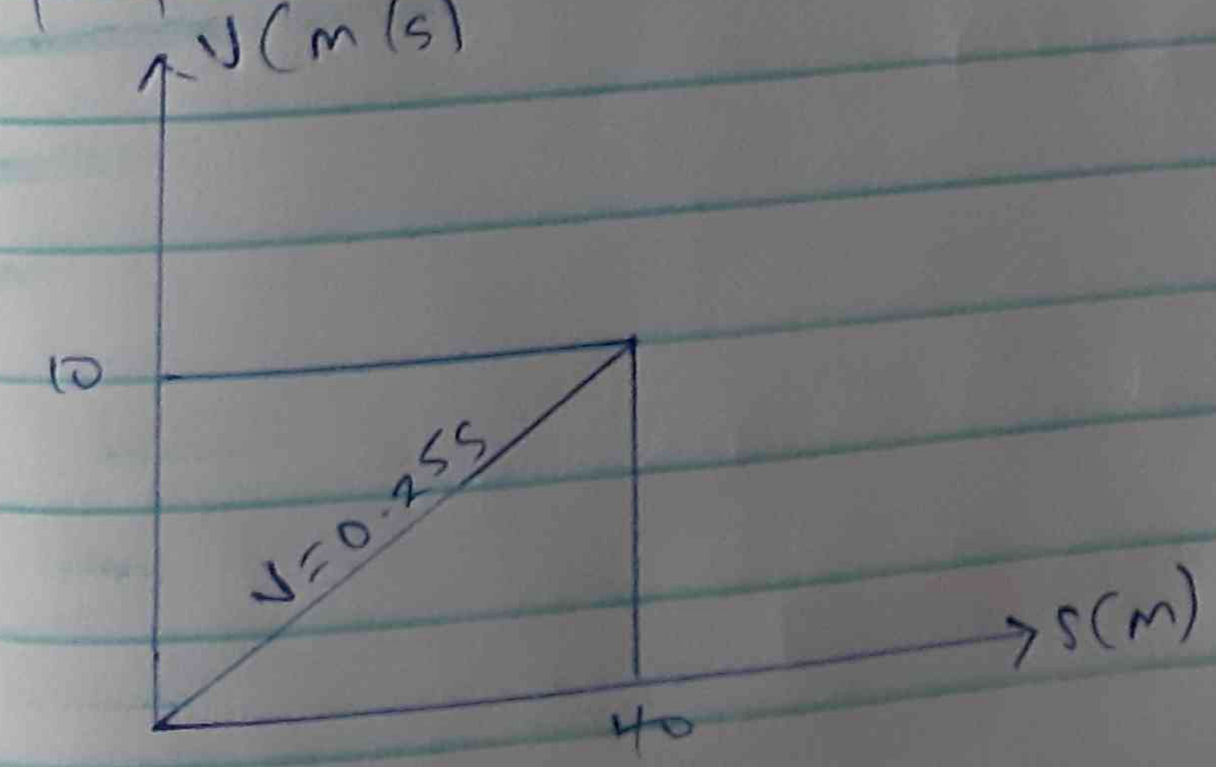
$a = \frac{dv}{dt} = -4t + 80$ ..

$a = -4$





2) A bicycle travels along a straight road where its velocity is described by the v-s graph. Construct the a-s graph for the same time interval.



Solution

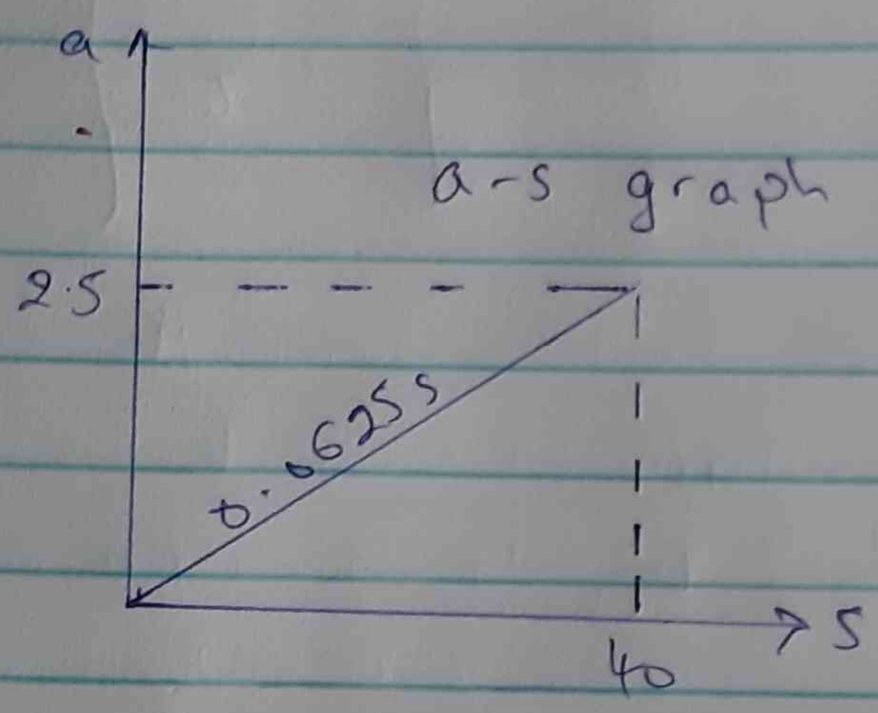
$$a\,ds = v\,dv$$

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

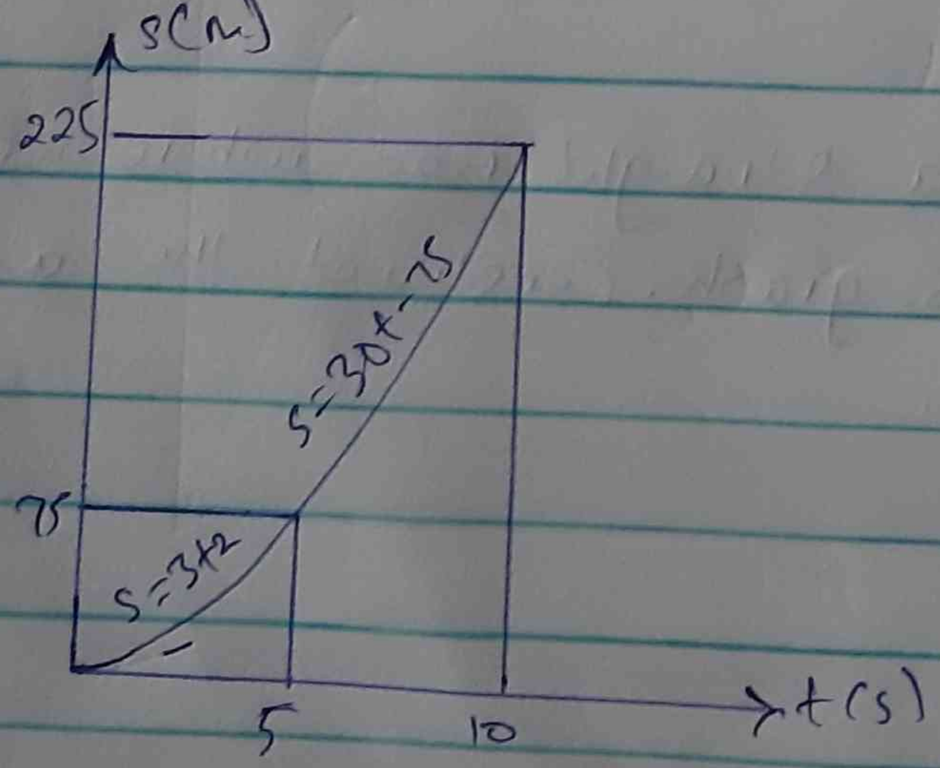
$$a = 0.25s\,\frac{d(0.25s)}{ds}$$

$$= (0.25s)(0.25)$$

$$= 0.0625$$



8) The sports car travels along a straight road such that its position is described by the graph. Construct the v-t and a-t graphs for the time interval $0 \leq t \leq 10s$



Solution

$0 \leq t \leq 5$

$s = 3t^2$

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

$v = 6t$

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

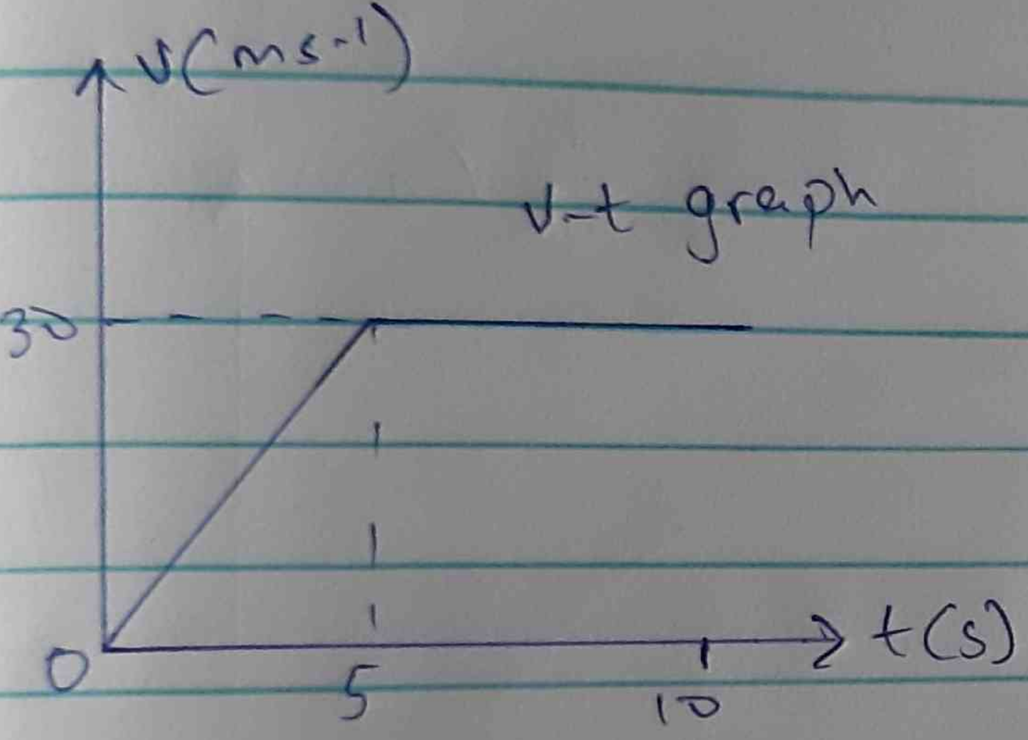
$a = 6$

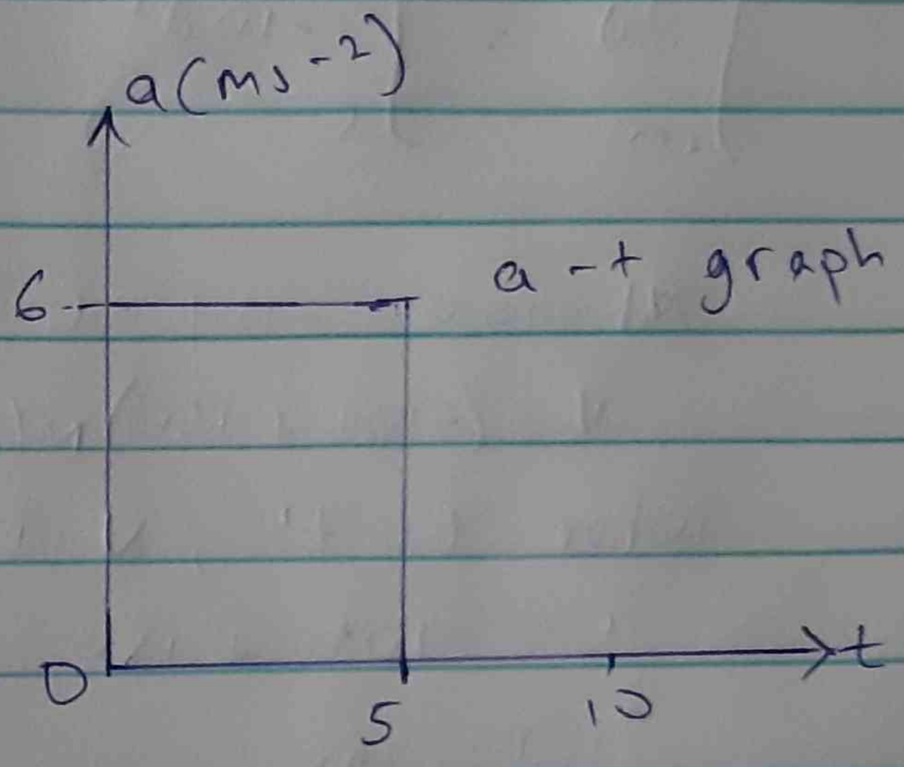
(b) $5 \leq t \leq 10$

$s = 30t - 75$

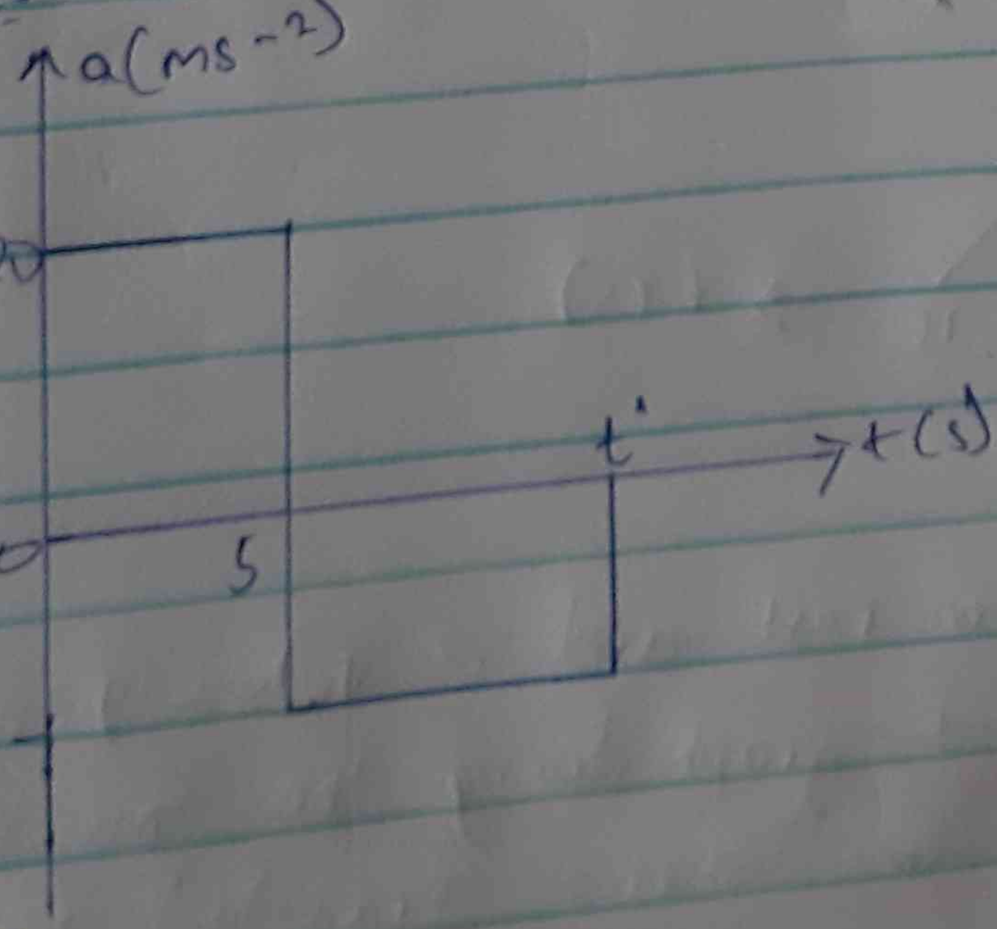
$v = 30$

$a = 0$





4) The dragster starts from rest and has an acceleration described by the graph. Construct the v-t graph for the time interval $0 \leq t \leq t'$ where t' is the time for the car to come to rest.



Solution

$0 \leq t \leq 5$

assuming $v = 0, t = 0$

$a = 20 ms^{-2}$ $\quad a = \frac{dv}{dt} \quad dv = a\,dt$

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

$v = 20t$

when $t = 5s \quad v = 20(5) = 100 ms^{-1}$

$5 \leq t \leq t' \quad a = -10 ms^{-2}$

$$\int_{100}^{v} dv = \int_5^t -10\,dt$$

$v - 100 = -10t - (-10)(5)$

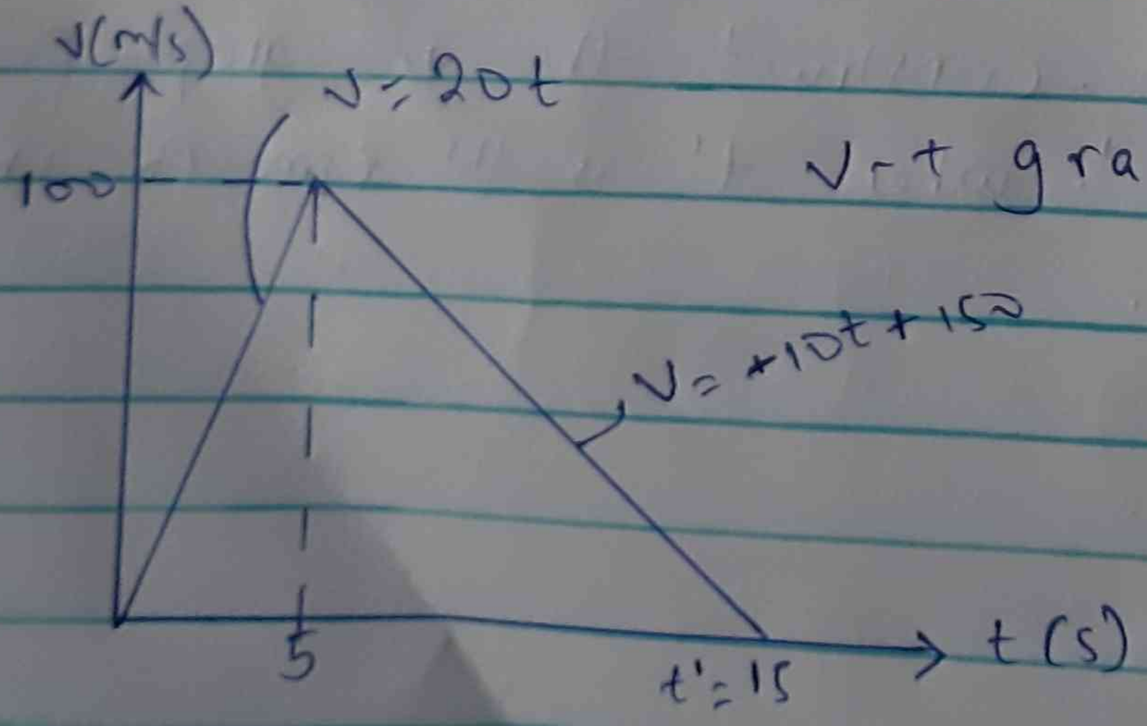
$v = (-10t + 150)\ m/s$

when $t = t'$, $v = 0$

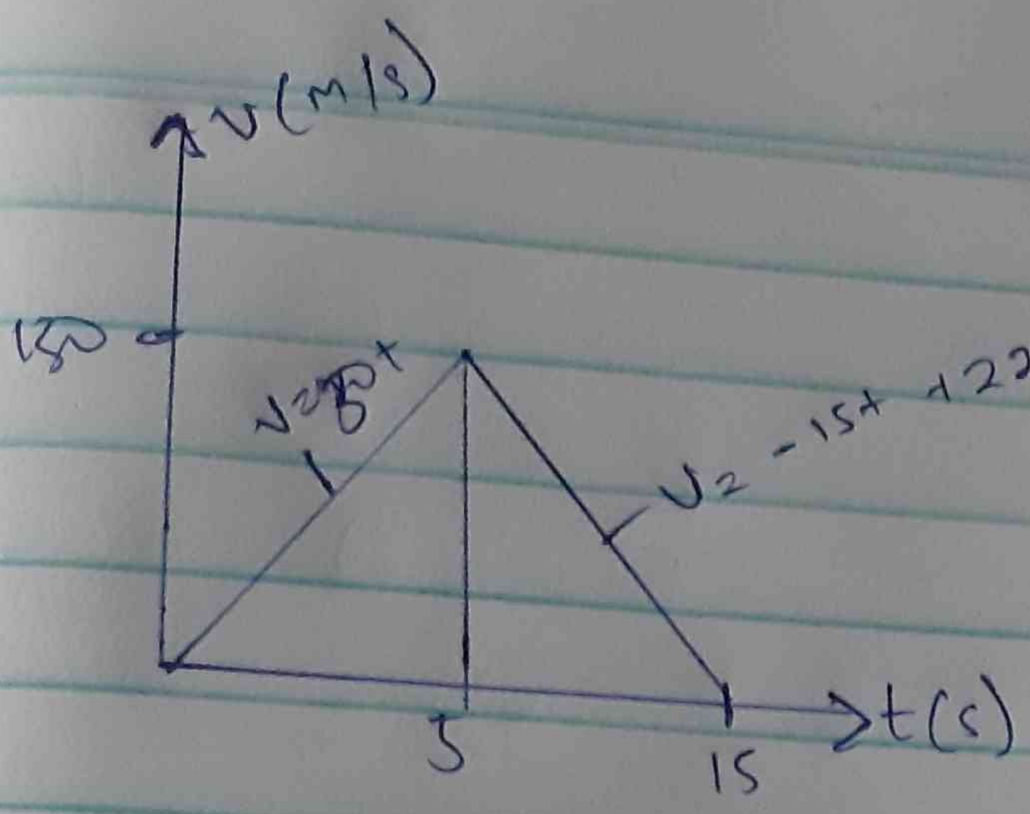
$0 = -10t + 150$

$10t = 150$

$t = \frac{150}{10} = 15s$



5) The dragster starts from rest and its velocity described by the graph. Construct the s-t graph during the time interval $0 \leq t \leq 15$ interval.



Solution

$0 \leq t \leq 15s$; $v = 30t\ ms^{-1}$

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

$ds = v\,dt$

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

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

when $t = 5s$, $s = 15(5)^2 = 375\ m$.

$5 \leq t \leq 15s$: $v = -15t + 225$

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

$s - 375 = -7.5t^2 + 225t - [-(5)^2 + 120(5)]$

$s = (-7.5t^2 + 225t - 200)m$

~~when $t = 15s$~~

~~$s = (-7.5(15)^2 + 225 - 200) =$~~

- Distance travelled,

$\Delta s = \frac{1}{2}bh = \frac{1}{2}(15)(150) = 1125\ m$