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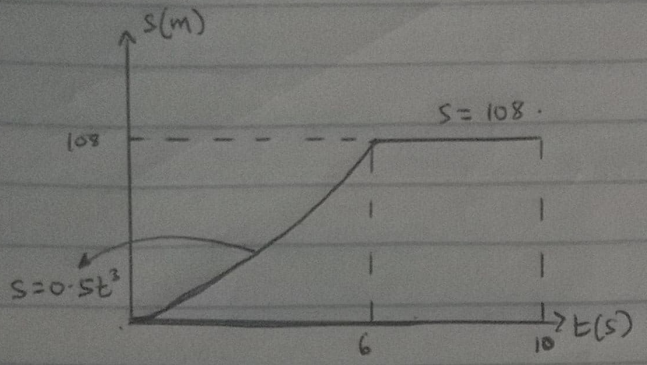
Mat. No: 19/ENG05/068

Dept: Mechatronics engineering.

(1.)



Between $t = 0s$ and $t = 6s$

$s = 0.5t^3$.

$v = \frac{ds}{dt} = \frac{d(0.5t^3)}{dt} = 0.5 \times 3t^2 = 1.5t^2\ ms^{-1}$.

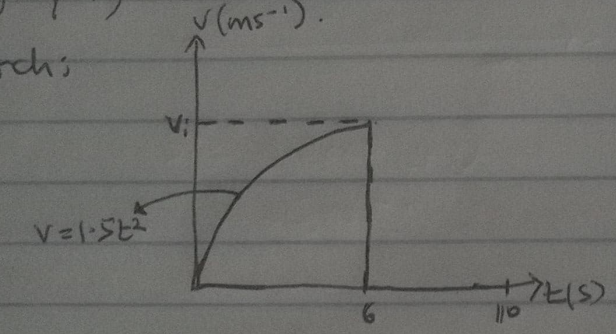
Between $t = 6s$ and $t = 10s$;

$s = 108m$

$v = \frac{ds}{dt} = \frac{0}{2} = 0ms^{-1}$.

For v-t graph;

Sketch;

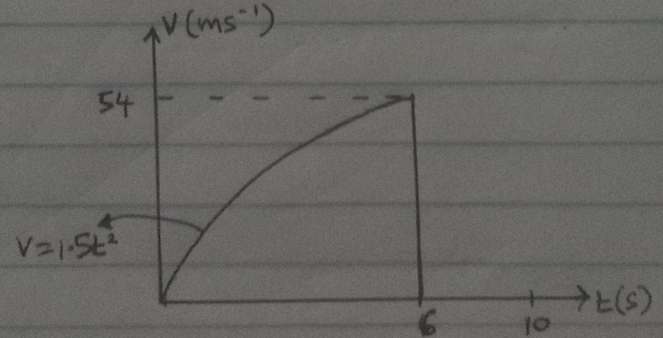


To solve for v_i;

$v_i = 1.5(6)^2 = 1.5 \times 36$

$= 54ms^{-1}$.

v-t graph:



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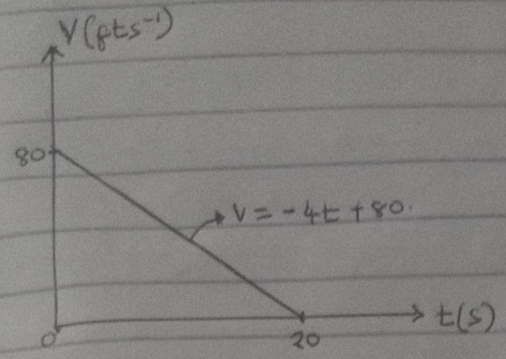


$s = \int v \cdot dt$

$= \int (-4t + 80) \cdot dt = -2t^2 + 80t + C$

When $t = 0$, $s = 0$

$\therefore 0 = -2(0)^2 + 80(0) + C$

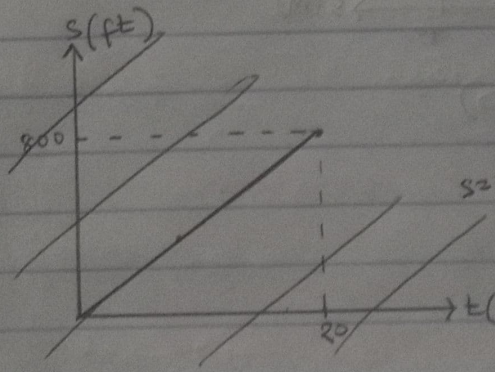
$C = 0$

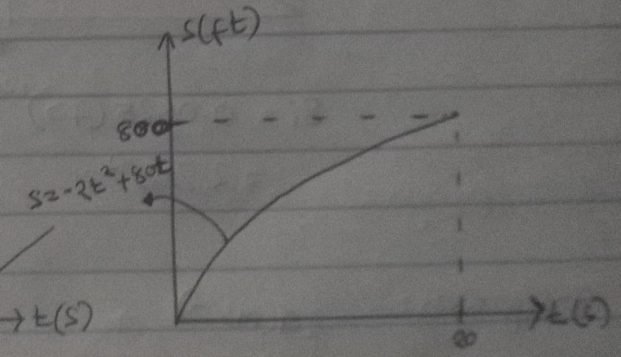
$\therefore s = -2t^2 + 80t$

At $t = 20s$; $s = -2(20)^2 + 80(20) = 800ft.$

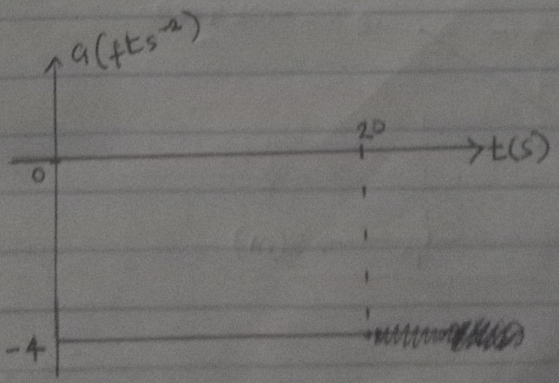
$a = dv/dt = \frac{d(-4t + 80)}{dt} = -4fts^{-2}.$

s-t graph:





a-t graph:



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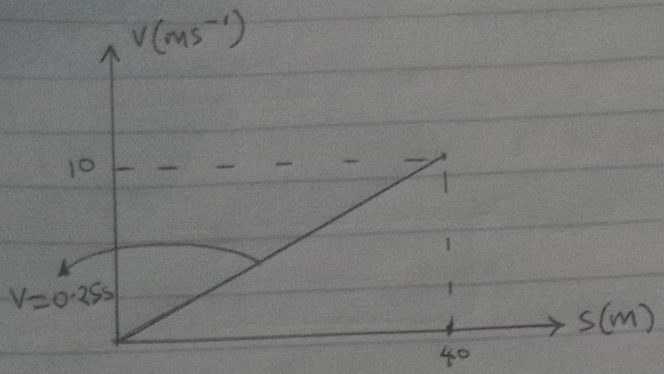


$a = v \cdot dv/ds$

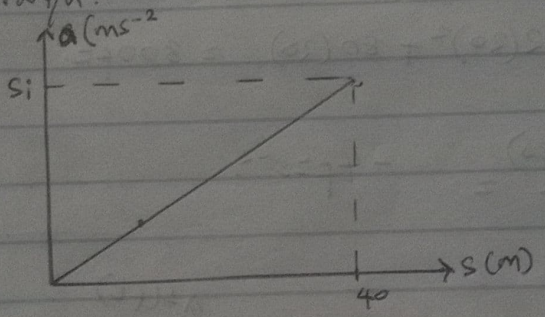
$dv/ds = \frac{d(0.25s)}{ds} = 0.25$

$a = 0.25s\,(0.25)$

$= 0.0625s.$

a-s graph:

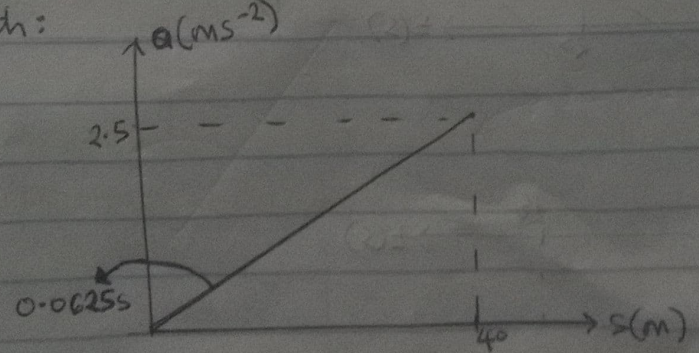
Sketch;



$Si = 0.0625(40)$

$= 2.5ms^{-2}.$

a-s graph:



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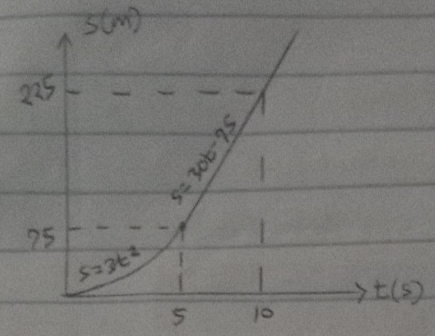


Between $t=0s$ and $t=5s$

$s = 3t^2$

$v = ds/dt = \frac{d(3t^2)}{dt} = 6t\ ms^{-1}$. At $t=5$; $v = 6(5) = 30ms^{-1}$.

$a = dv/dt = \frac{d(6t)}{dt} = 6ms^{-2}$

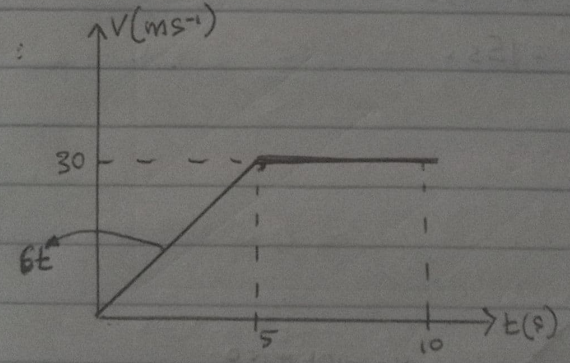
Between $t=5s$ and $t=10s$

$s = 30t - 75$

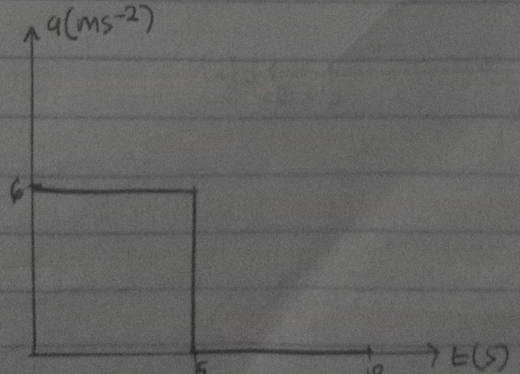
$v = ds/dt = \frac{d(30t-75)}{dt} = 30ms^{-1}$.

$a = dv/dt = \frac{d(30)}{dt} = 0$.

v-t graph:



a-t graph:



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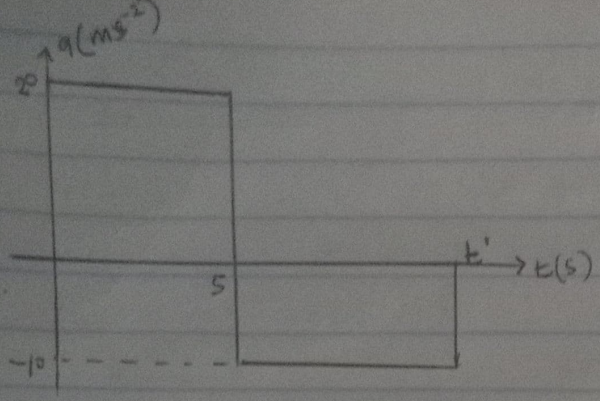


Between $t=0$ and $t=5$;

$a = 20$

$v = \int a\,dt$

$v = 20t + c$

$v = 0$, when $t = 0$

$\therefore 0 = 20(0) + c$; $c = 0$

$v = 20t$

At $t=5$; $v = 20(5) = 100\ ms^{-1}$

Between $t=5$ and $t=t'$

$a = -10$

$v = \int -10\,dt$

$v = -10t + c$

At $t=5$, $v = 100$

$100 = -10(5) + c$

$c = 100 + 50$

$c = 150$

$\therefore v = -10t + 150$

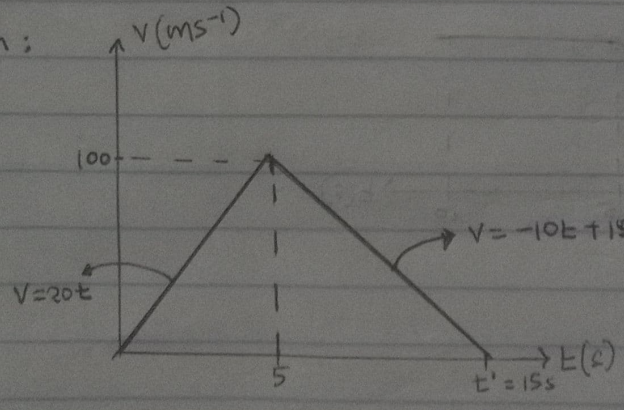
To find t'; $v = 0$ when $t = t'$

$0 = -10t' + 150$

$-10t' = -150$

$t' = 15s$.

v-t graph:



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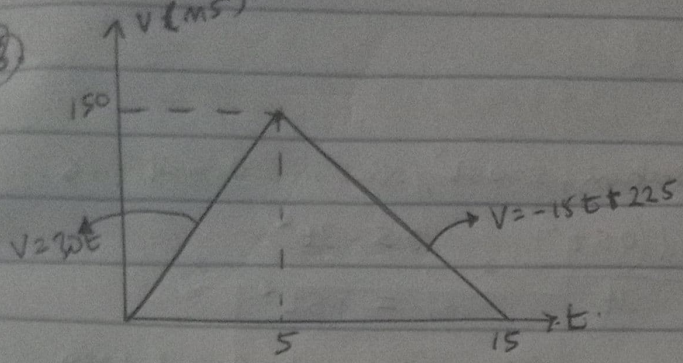

Between t=0s and t=5s;

$V = 30t$

$s = \int v\,dt = \int 30t\,dt = 15t^2 + c$

At $t=0$, $s=0$; $0 = 15(0)^2 + c$; $c=0$

$\therefore s = 15t^2$.

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

Between $t=5s$ and $t=15s$.

$V = -15t + 225$

$s = \int v\,dt = \int -15t + 225 = \frac{-15t^2}{2} + 225t + c$.

Recall ~~that~~ at $t=5$; $s = 375m$

$375 = \frac{-15(5)^2}{2} + 225(5) + c$

$c = -562.5$

$s = \frac{-15t^2}{2} + 225t - 562.5$.

~~For s-t gra~~ For total distance travelled;

$s = \frac{-15(15)^2}{2} + 225(15) - 562.5$

$= 1125m$.

s-t graph;