MECHANICS

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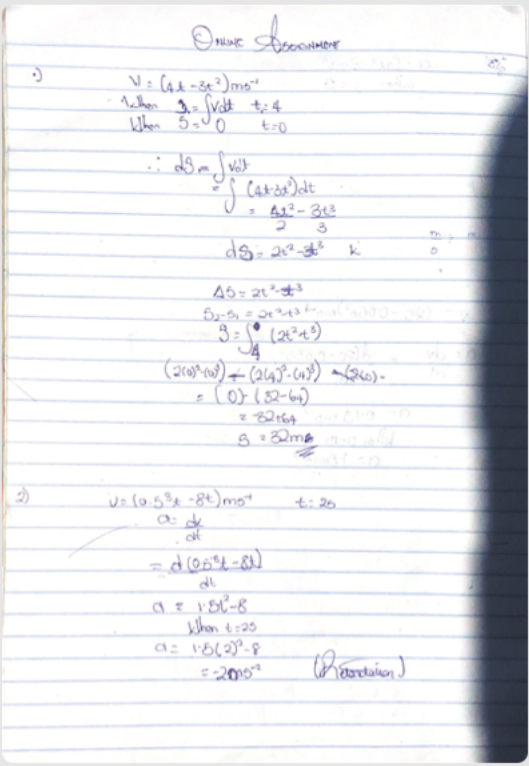

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~~5) $a = (4t^2 - 2)ms^{-2}$~~ $t =$

4) $V = (20 - 0.05s^2)\,ms^{-1}$

$\frac{dv}{ds} = -0.15$

$dv = -0.15\,ds$

~~$dv = -0.15\,ds$~~ $\Rightarrow$ ~~$ds = \frac{1}{0.15}dv$~~

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

$a = \frac{dv}{dt} \Rightarrow \frac{-0.15\,ds}{dt}$

but $\frac{ds}{dt} = v = (20 - 0.05s^2)\,ms^{-1}$

$\therefore\ a = -0.15\frac{ds}{dt}$

$= -0.15 \times (20 - 0.05s^2)$

$a = -3 + 0.0075s^3$

but $s = 15m$

$a = -2(15) + 0.005(15)^3$

$-30 + 16.875$

$= -13.125\,ms^{-2}$

5) $a = (4t^2 - 2)\,ms^{-2}$

$a = \frac{dv}{dt}$ and $a = \frac{d^2s}{dt^2}$

$\therefore\ v = \int a\,dt$

$= \int (4t^2 - 2)\,ms^{-2}$

$v = \left(\frac{4t^3}{3} - 2t + c\right) ms^{-1}$

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

$s = \int v\,dt$

$= \int \left(\frac{1}{3}t^3 - 2t + C\right) ms^{-1}$

$s = \left(\frac{1}{3}t^4 - t^2 + Ct + k\right) m$ $\quad s = \left(\frac{1}{3}t^4 - t^2 + Ct + k\right) ms^{-1}$

at $t=0$ $s=2$ (negative because it is to the left)

$s = \frac{1}{3}t^4 - t^2 + Ct + k$

$-2 = \frac{1}{3}(0)^4 - (0^2) + C(0) + k$

$\therefore k = -2$

$\therefore s = \frac{1}{3}t^4 - t^2 + Ct - 2$

At $t=2s$ $\quad s = -2m$

$-20 = \frac{1}{3}(2)^4 - (2)^2 + C(2) - 2$

$-20 + \frac{16}{3} + 4 + 2 = 2C$

~~$C = -8.88$~~ $\quad C = -19.33$

$\frac{2}{2}$

$= -9.667m$

$\therefore s = \frac{1}{3}t^4 - t^2 - 9.67t - 2$

When $t = 4$

$s = \frac{1}{3}(4)^4 - (4)^2 - 9.67(4) - 2$

$= 28.7m$