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DEPARTMENT: AERONAUTICAL ENGINEERING

COURSE: ENG234

TITLE: KINEMATICS OF A PARTICLE

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3)

ASSIGNMENT

1) $V = (4t - 3t^2)\ m/s$

let V ⇒ velocity
S ⇒ distance
a ⇒ acceleration

$S = \int V\,dt$

$S = \int 4t - 3t^2\,dt$

$S = \frac{4t^2}{2} - \frac{3t^3}{3} + c$

$S = 2t^2 - t^3 + C$

at $S = 0$, $t = 0$

$\therefore 0 = 2(0)^2 - (0)^3 + C$

$\therefore C = 0$

$\Rightarrow S = 2t^2 - t^3$

At $t = 4s$

$S = 2(4)^2 - (4)^3$

$S = -32m$ //

2) $V = 0.5t^3 - 8t$

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

$a = \frac{d}{dt}(0.5t^3 - 8t)$

$a = 1.5t - 8$

at $t = 2s$

$a = (1.5 \times 2) - 8$

$a = -5\ m/s^2$ //

3.) $a = (4t^2 - 2)\ m/s^2$

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

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

$v = \int 4t^2 - 2\,dt$

$v = \frac{4t^3}{3} - 2t + C$

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

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

$s = \int \frac{4t^3}{3} - 2t + C\,dt$

$s = \frac{4t^4}{3 \times 4} - \frac{2t^2}{2} + Ct + D$

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

Where C and D are constants

at $t = 0$, $s = -2m$

$\therefore -2 = \frac{0^4}{3} - 0^2 + C \times 0 + D$

$D = -2$

at $t = 2s$, $s = -20m$

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

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

$2C = -14 - \frac{16}{3}$

$C = -7 - \frac{8}{3}$

$c = -\frac{29}{3}$

$\therefore s = \frac{t^4}{8} - t^2 - \frac{29t}{3} - 2$

at $t = 4s$

$s = \frac{4^4}{8} - 4^2 - \frac{29 \times 4}{3} - 2$

$s = \frac{256}{3} - \frac{116}{3} - 18$

$s = \frac{140}{3} - 18$

$s = \frac{140 - 54}{3}$

$s = \frac{86}{3}$

$s = 28.67m$ //

A) $V = 20 - 0.05s^2$

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

multiplying both sides by ds

$ads = dv \times \frac{ds}{dt}$

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

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

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

$\frac{dv}{ds} = \frac{d}{ds}(20 - 0.05s^2)$

$\frac{dv}{ds} = -0.1s$

$\therefore a = (20 - 0.05s^2)(-0.1s)$

At $S = 15m$

$a = (20 - 0.05 \times 15^2)(-0.1 \times 15)$

$a = -\frac{105}{8}$

$a = 13.125 m/s^2$ //