18/ENG09/002.

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MATRIC NO - 18/ENG09/002.

① $V = (4t - 3t^2)\ m/s$ $\quad t=0,\ S=0,\ t=4$

$V = \frac{ds}{dt} = (4t - 3t^2)$

$\therefore \frac{ds}{dt} = (4t - 3t^2)$

$\int ds = \int^4 (4t - 3t^2)\, dt$

$S = \left[\frac{4t^2}{2} - \frac{3t^3}{3}\right]_0^4$

$S = [2t^2 - t^3]^4 - [2t^2 - t^3]^0$

$S = 2[4]^2 - [4]^3 \quad - [0]$

$S = 32 - 64$

$S = -32m \quad \therefore S = 32m,$

This implies that the position of the particle is to the left of the Origin.

② $V = [0.5t^3 - 8t]\ m/s \quad t = 2s, \quad a = ?$

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

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

$a = (1.5t^2 - 8)\ m/s^2$

at $t = 2s$

$= 1.5(2)^2 - 8$

$= (1.5 \times 4) - 8$

$= -2\ m/s^2.$

This implies that the Particle is decelerating.

(3) $a = [4t^2 - 2]$

$a = \frac{dv}{dt} = (4t^2 - 2)$

$\frac{dv}{dt} = [4t^2 - 2]$

$\int dv = \int [4t^2 - 2]\, dt$

$v = \left[\frac{4t^3}{3} - 2t + C_1\right]$ m/s

$\frac{ds}{dt} = \left[\frac{4t^3}{3} - 2t + C_1\right]$

$\int ds = \int [\frac{4}{3}t^3 - 2t + C_1]\, dt$

$s = \left[\frac{4t}{3\times 4} - \frac{2t^2}{2} + C_1 t + C_2\right]$ m/s

$s = \frac{1}{3}t^4 - t^2 + C_1 t + C_2$ m

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

$s = \frac{1}{3}t - t^2 + C_1 t + C_2$

$-2 = \frac{1}{3}(0) - (0)^2 + C_1[0] + C_2$ m

$\therefore C_2 = -2$ m.

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

$s = \frac{1}{3}t^4 - t^2 + C_1 t - 2$

$-20 = \frac{1}{3}[2]^4 - [2]^2 + C_1[2] - 2$

$-20 = \frac{16}{3} - 4 + 2C_1 - 2$

$-20 = -\frac{2}{3} + 2C_1$

$2C_1 = -20 + \frac{2}{3}$

$2C_1 = -19.33$

$C_1 = \frac{-19.33}{2} = -9.67$.

$\therefore C_1 = -9.67$

$C_2 = -2$

$\therefore S = \frac{1}{3}t^4 - t^2 + C_1 t + C_2$

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

At $t = 4s$, $S = ?$

$S = \frac{1}{3}\{4\}^4 - \{4\}^2 - 9.67\{4\} - 2$

$S = \frac{256}{3} - 16 - 38.6668 - 2$

$S = \frac{256}{3} - 56.6668$

$S = 28.667m$

$\therefore$ The position of the Particle is 28.67m.

④ $V = [20 - 0.055^2]$

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

$= \frac{dv}{ds} \times V \quad \therefore a = V\frac{dv}{ds}$

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

$\therefore a = (20 - 0.055^2)(-0.15)$

At $S = 15m$

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

$a = (20 - 11.25)(-1.5)$

$a = (8.75)(-1.5)$

$a = -13.125 m/s^2$

$a = -13.13 m/s^2$

$\therefore$ The acceleration of the Particle at $S = 15m$ is due $-13.125 m/s^2$ which implies that the Particle is decelerating.