$v = \frac{ds}{dt} = \left(\frac{4t^3}{3} - 2t + C_1\right) m/s$

$\frac{ds}{dt} = \frac{4}{3}t^3 - 2t + C_1)$

$\int ds = \int \left(\frac{4}{3}t^3 - 2t + C_1\right) dt$

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

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

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

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

$-2 = \frac{1}{3}(0)^4 - (0)^2 + C_1(0) + C_2$

$\therefore C_2 = -2$ //

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

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

$-20 = \frac{1}{3}(2)^4 - (2)^2 + C_1(2) - 2$

$-20 = {}^{16}/_3 - 4 + 2C_1 - 2$

$-20 = -{}^2/_3 + 2C_1$

$2C_1 = -20 + {}^2/_3$

$2C_1 = -19.33$

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

$= -9.67$ //

$\therefore C_1 = -9.67$

$C_2 = -2$

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

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

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

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

$$S = \frac{256}{3} - 16 - 38.6688 - 2$$

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

$$S = 28.67m$$

∴ The position of the particle is 28.67m

(f) $v = (20 - 0.05s^2)$

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

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

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

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

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

At $S = 15m$

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

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

$$a = (8.75)(-1.5)$$

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

$$a = -13.13 m/s^2$$

∴ The acceleration of the particle at $s = 15m$ is due $-13.13 m/s^2$ which implies that the particle is decelerating.

OYEBADE RAPHAEL OLUWAFEMI 15/ENG04/029

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

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

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

$\int ds = \int_0^4 (4t - 3t^2)\,dt$

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

$\int = [2t^2 - t^3]_0^4$

$\therefore s = [2t^2 - t^3]_0^4 - [2t^2 + 3]^0$

$s = 2(4)^2 - (4)^3 - [0]$

$s = 32 - 64$

$s = -32m \quad \therefore s = 32m$

∴ This means that the position of the particle is to the left of the origin

② $v = (0.5t^3 - 8t)\,m/s$, $t = 2s$, $a = ?$

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

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

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

at $t = 2s$

$= 1.5(2)^2 - 8$

$= (1.5 \times 4) - 8$

$= -2m/s^2$

∴ The particle is decelerating

③ $a = (4t^2 - 2)$

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

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

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

$v = \left(\frac{4t^3}{3} - 2t + C\right) m/s$