$\therefore \quad C_1 = 9.67$

$C_2 = -2$

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

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

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)

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

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

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

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

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

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

At $s = 15m$

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

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

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

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

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

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

3.

$a = (4t^2 - 2)$

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

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

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

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

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

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

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

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

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

At $t = 0_s$, $S = -2m$.

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

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

$\therefore\ C_2 = -2$

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

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

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

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

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

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

$2C_1 = -19.33$

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

Assignment

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

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

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

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

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

$S = [2t^2 - t^3]_0^4$

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

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

$S = 32 - 64$

$S = -32m$ $\therefore S = 32m$ left of the origin

$\therefore$ 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 $t = 2s$

$= 1.5(2)^2 - 8$

$= (1.5 \times 4) - 8$

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

$\therefore$ This implies that the particle is decelerating