OMENOKU PERPETUAL ISHIOMA
18/ENG06/1060
MECHANICAL ENGINEERING

1. $V = (4t - 3t^2)\,m/s$ at $t = 0$, $s = 0$; $t = 4$

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

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

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

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

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

$S = 32 - 64$

$S = -32m$

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

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

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

$a = \frac{d}{dt}(0.5t^2 - 8t)$

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

at $t = 2s$

$1.5(2)^2 - 8$

$= -2m/s^2$

∴ This implies that the particle decelerates.

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

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

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

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

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

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

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

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

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

At $t = 0$ $\quad s = -2m$

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

$-2 = C_2$

$\therefore C_2 = -2$

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

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

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

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

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

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

$$C_1 = -9.67$$

$$C_2 = -2$$

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

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

At $t = 4s$; $s = ?$

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

$$s = 256/3 - 16 - 38.6668 - 2$$

$$s = 28.667\,m$$

∴ The position of the particle is $28.667\,m$

4. $V = (20 - 0.05s^2)$

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

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

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

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

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

At $s = 15m$

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

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

$a = (8.75)(-1.5)$

$a = -13.125 m/s^2$

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