

Okenabirhie Oghenemeru Nita  
Biomedical Engineering  
18/ENG1081015  
ENG 234 Assignment (Mechanics)

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

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

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

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

$$s = \left( \frac{4t^2}{2} - \frac{3t^3}{3} \right)_0^4$$

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

$$s = 32 - 64$$

$$s = -32 \text{ m}$$

$\therefore s = 32 \text{ m}$  left of the origin

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

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

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

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

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

$$\text{at } t = 2 \text{ s}$$

$$= 1.5(2)^2 - 8$$

$$= (1.5 \times 4) - 8$$

$$= -2 \text{ m/s}^2$$

$\therefore$  This implies that the particle is decelerating

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

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

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

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

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

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

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

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

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

$$\text{At } t = 0, \quad s = -2 \text{ m}$$

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

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

$$\therefore C_2 = -2$$

$$\text{At } t = 2, \quad s = -20 \text{ m}$$

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

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

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

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

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

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

$$2C_1 = -19.33$$

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

$$\therefore C_1 = -9.67$$

$$C_2 = -2$$

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

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

$$\text{At } t = 4\text{s} \quad s = ?$$

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

$$s = \frac{256}{3} - 16 - 38.668 - 2$$

$$s = \frac{256}{3} - 56.668$$

$$s = 28.667\text{m}$$

$\therefore$  The Position of the Particle is 28.67m

$$\text{H)} \quad v = (20 - 0.05s^2)$$

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

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

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

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

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

$$\text{At } s = 15\text{m}$$

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

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

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

$$a = -13.125\text{m/s}^2$$

$$a = -13.13\text{m/s}^2$$

$\therefore$  The acceleration of the Particle at  $s = 15\text{m}$  is  $-13.125\text{m/s}^2$  which implies that the Particle is decelerating