Agbor Ruth Micah
18/ENG04/006
Electrical Engineering
ENG 234.

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

$t = 0,\ S = 0,\ t = 4$

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

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

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

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

$$S = 2t^2 - t^3 \Big]_0^4$$

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

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

$$S = 32 - 64$$

$$S = -32m$$

$$\therefore S = 32m$$

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 $t = 2s$

$= 1.5(2)^2 - 8$

$= (1.5 \times 4) - 8$

$= -2m/s^2$

∴ This implies that the particle is decelerating.

∴ $C_1 = -4.67$

$C_2 = -2$

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

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

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

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

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

$\therefore C_2 = -2$

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

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

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

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

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

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

$2C_1 = -19.33$

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

$= -9.67$

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

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 28.69m

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

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

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

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

$V = (\frac{4t^3}{3} - 2t + c_1) m/s$

$\therefore \cancel{V} = \frac{ds}{dt} = (\frac{4}{3}t^3 - 2t + c_1)$

$\int ds = \int (\frac{4}{3}t^3 - 2t + c_1)dt$

$S = \frac{4t^4}{3 \times 4} - \frac{2t^2}{2} + c_1 t + c_2) m$

CONS

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

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

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

$$\therefore a = \frac{vdv}{ds}$$

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

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

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 $S = 18m$ is due $-13.125 m/s^2$ which implies that the particle is decelerating.

Doshima Weds Ayodeji

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