Olawoyin Sadeeq Babalol
18/ENG05/1048 (Mechatronics Engr.)

1. $V = (4t - 3t^2)\,ms^{-1}$

$ds = v\,dt$

$S = \int v\,dt$

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

$= (2t - t^3)\,m$

when $t = 4$

$S = 2t^2 - t^3$

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

$= 32 - 64$

$= -32$

Position is 32m from the starting point in the opposite direction.

2] $v = (0.5t^3 - 8t)\ ms^{-1}$

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

$a = (1.5t^2 - 8)\ ms^{-2}$

$t = 2$ seconds

$acc = [1.5(2^2) - 8]\ ms^{-1}$

$= (6 - 8)ms^{-2}$

$= -2\ ms^{-2}$

3]. $a = (4t^2 - 2)\ ms^{-2}$

$v = \int a\,dt$

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

$v = \left(\frac{4}{3}t^3 - 2t + k\right) ms^{-1}$

$s = \int v\,dt$

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

$s = \frac{t^4}{3} - t^2 + ct + k$

$$S = \frac{t^4}{3} - t^2 + ct + k$$

When $t = 0s$, $S = -2m$

$$-2 = \frac{(0)^4}{3} - (0)^2 + c(0) + k$$

$$\therefore k = -2$$

when $t = 2s$, $S = -20m$

$$\therefore -20 = \frac{(2)^4}{3} - (2)^2 + c(2) - 2$$

$$2c = -20 - 16/3 + 6$$

$$2c = -19.33$$

$$c = -9.67$$

$$\therefore S = \frac{t^4}{3} - t^2 - \frac{29}{3}t - 2$$

when $t = 4$

$$s = \frac{(4)^4}{3} - (4)^4 - \frac{29(4)}{3} - 2$$

$$= 28.67\text{m to the right of origin}$$

4] $v = (20 - 0.05s^2)\,ms^{-1}$

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

$$ads = vdv$$

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

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

$$\therefore a = v \times 0.1s$$

$$a = [0.15(20 - 0.05s^2)]\,ms^{-2}$$

$$= (0.005s^3 - 2s)\,ms^{-2}$$

When $s = 15m$

$$a = 0.005(15)^3 - 2(15)$$

$$a = -13.125\,ms^{-2}$$