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18/ENG09/044
CIVIL ENGINEERING

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

$v = ds/dt = (4t - 3t^2)$

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

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

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

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

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

$= 32 - 64$

$S = -32m$

Displacement is negative meaning the particle is 32m on the negative x direction away from the origin

2 $v = (0.5t^3 - 8t)$, $t = 2s$. $a = ?$

$a = dv/dt$

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

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

$\left.\frac{dt}{t=2s}\right.$

$1.5(2)^2 - 8 = 1.5(2)^2 - 4 = -2\ m/s^2$

The particle is decelerating

QUESTION 3

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

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

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

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

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

$ds/dt = 4/3\, t^3 - 2t + C_1$

$\int ds = \int (4/3\, t^3 - 2t + C)\, dt$

$$S = \frac{4t^4}{12} - \frac{2t^2}{2} + C_1 t + C_2$$

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

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

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

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

$$C_2 = -2.$$

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

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

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

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

$$C_1 = -10 + \frac{1}{3} = -9.67$$

$C_1 = -9.67$, $C_2 = -2$

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

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

At $t = 4s$, $S = ?$

$$S = \frac{1}{3}(4)^4 - (4)^2 - 9.667(4) - 2$$

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

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

$$S = 28.667m$$

displacement of particle is

28.67m

Question 4

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

$a = dv/dt = dv/ds \times ds/dt$

$dv/ds \times v$

$a = \frac{v\,dv}{ds}$; $\frac{dv}{ds} = -0.1s$

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

at $s = 15$

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

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

$a = (8.75)(-1.5)$

$a = -13.125 m/s^2$

The particle decelerates at a rate of ~~$-13 m/s$~~ $-13.125 m/s^2$