Ex 4·3

Q2 $v = \frac{ds}{dt} = t^2 - 4t + 3$

(i) acc $= \frac{d^2s}{dt^2} = 2t - 4.$

at $t = 5$ $\quad 2(5) - 4$

$= 6 \text{ m/sec}^2$

(ii) $s = \int (t^2 - 4t + 3)\,dt$

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

$= \frac{t^3}{3} - 2t^2 + 3t + C$

at $t = 3$ $\quad s = 4$

$4 = \frac{(3)^3}{3} - 2(3)^2 + 3(3) + C$

$4 = 9 - 18 + 9 + C$

$4 = C$

$\therefore s = \frac{t^3}{3} - 2t^2 + 3t + 4.$

(iii) displacement (s) when $t = 1$

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

$= \frac{16}{3} = 5\frac{1}{3} \text{ m}.$

s v a

Q4 $a = (2t-3)$ cm/se

(i) $v = \int (2t-3)\,dt$

$= \frac{2t^2}{2} - 3t + C$

$= t^2 - 3t + C$

speed (v) = 3 m/sec at $t = 0$.

$\Rightarrow 3 = (0)^2 - 3(0) + C \quad \Rightarrow C = 3$.

$\therefore v = t^2 - 3t + 3$

$s = \int (t^2 - 3t + 3)\,dt$

$= \frac{t^3}{3} - \frac{3t^2}{2} + 3t + C$

$s = 2$ at $t = 0$.

$\Rightarrow 2 = \frac{(0)^3}{3} - \frac{3(0)^2}{2} + 3(0) + C \quad \Rightarrow C = 2$

$\therefore s = t^3/3 - 3t^2/2 + 3t + 2$.

(ii) v when $t = 2$

$v = (2)^2 - 3(2) + 3$

$v = 4 - 6 + 3 = 1$ m/sec

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

$= 8/3 - 12/2 + 6 + 2 = \frac{14}{3} = 4\frac{2}{3}$ m.

S V A

Q5 Initial $v = 25\ m/s$ $A = -10\ m/sec^2$

(i) $v = \int Accel$

$= \int -10\,dt.$

$= -10t + C.$

$v = 25$ at $t = 0$

$25 = -10(0) + C$

$C = 25$

$\therefore v = -10t + 25$

(ii) $height(s) = \int v$

$= \int (-10t + 25)\,dt$

$= \frac{-10t^2}{2} + 25t + C$

$= -5t^2 + 25t + C$

height $= 0$ at $t = 0$

$0 = -5(0)^2 + 25(0) + C \Rightarrow C = 0.$

$\therefore s = -5t^2 + 25t.$

(iii) Max height $\Rightarrow \frac{ds}{dt} = 0. \Rightarrow v = 0.$

$-10t + 25 = 0$

$25 = 10t$

$2.5 = t.$

(iv) height at $t = 2.5.$

$-5(2.5)^2 + 25(2.5) = \frac{125}{4} = 31\frac{1}{4}\ m.$

(x)

time to return to height = 0.

$$-5t^2 + 25t = 0$$

$$-5t(t-5) = 0$$

$$\Rightarrow -5t = 0 \qquad t - 5 = 0$$

$$t = 0 \qquad t = 5.$$

$\Rightarrow$ It takes 5 sec.

Q6 $\frac{dN}{dt} = 4e^t + 10$

(i) $N = \int (4e^t + 10)\,dt$

$= 4e^t + 10t + C.$

(i) $N = 10$ at $t = 0$.

$10 = 4e^0 + 10(0) + C$

$10 = 4 + C$

$6 = C$

$\therefore N = 4e^t + 10t + 6.$

at $t = 5$

$N = 4e^5 + 10(5) + 6$

$= 649.65$

≈ 650 to nearest whole N°

Sonia

Q8 $\frac{dh}{dt} = 2t - 3$ (v)

height $= \int (2t - 3)\,dt$

$= \frac{2t^2}{2} - 3t + C$

$= t^2 - 3t + C$

$h = 4$ at $t = 0$ (start)

$4 = (0)^2 - 3(0) + C \Rightarrow C = 4$

$\therefore h = t^2 - 3t + 4.$

(ii) height = 36 cm $\Rightarrow$ 32 cm to fill.

$32 = t^2 - 3t + 4$

$t^2 - 3t - 28 = 0$

$(t - 7)(t + 4) = 0$

$t = 7$ $t = -4$ not valid.

$\Rightarrow t = 7$ sec