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Chemical Engineering

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

$$V = \frac{ds}{dt}$$

$$ds = v dt$$

$$\int ds = \int v dt$$

$$\int ds = \frac{4t^2}{2} - \frac{3t^3}{3}$$

$$\int ds = 2t^2 - t^3$$

When $t = 4 \text{ s}$

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

$$= 2 \times 16 - 64$$

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

$\Rightarrow 32 \text{ m}$ to the left of the origin

2. $a = 4t^2 - 2$

$$v = \int a dt$$

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

$$s = \int v dt$$

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

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

when $t = 2$ $s = 20$

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

$$\frac{56}{3} = \frac{C^2}{2}$$

$$c = 6.11$$

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

$$s = \frac{t^4}{3} - t^2 + \frac{56}{3} \quad t = 4s$$

$$s = \frac{4^4}{3} - 4^2 + \frac{56}{3}$$

$$s = \frac{256}{3} - 16 + \frac{56}{3}$$

$$= \frac{256 - 48 + 56}{3} \Rightarrow 88m$$

$$3. \quad v = (0.5t^3 - 8t) \text{ m/s}$$

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

$$a = 1.5t^2 - 8$$

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

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

$$= 6 - 8$$

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

$$4. \quad v = (20 - 0.05s^2) \text{ m/s}$$

$$\text{at } s = 15$$

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

$$= 20 - 11.25$$

$$= 8.75 \text{ ms}^{-1}$$

$$\therefore v^2 = u^2 + 2as$$

$$\Rightarrow 8.75^2 = 0^2 + (2a \times 15)$$

$$30a = 76.5625$$

$$a = \frac{76.5625}{30}$$

$$a = 2.55 \text{ ms}^{-2}$$