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

where $t = 0 \text{ sec}$, $t = 4 \text{ sec}$, $s = ?$

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

$$\int_0^s ds = \int_0^4 [4t - 3t^2] dt$$

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

$$s = [2t^2 - t^3]_0^4$$

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

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

2) $V = [0.5t^3 - 8t] \text{ m/s}$

$$a = \frac{dV}{dt} = \frac{d}{dt} [0.5t^3 - 8t]$$

$$a = (0.5t^3 - 8t)$$

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

when $t = 2 \text{ s}$

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

$$a = -2 \text{ m/s}$$

$$3) \quad a = (4t^2 - 2) \text{ m/s}$$

$$\text{when } t = 0, \quad s = 2 \text{ m}$$

$$\text{when } t = 2 \text{ s}, \quad s = 20 \text{ m}$$

$$\text{when } t = 4 \text{ s}, \quad s = ?$$

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

$$v = \int a dt$$

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

$$v = \frac{4t^3}{3} - 2t + C \dots (1)$$

$$s = \int v dt$$

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

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

$$\text{when } t = 0, \quad s = 2$$

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

$$C_2 = -2$$

$$\text{when } t = 2, \quad s = -20 \text{ and } C_2 = -2$$

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

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

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

$$-19.33 = 2C_1$$

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

$$= -9.67$$

Putting $C_1 = 9.67$ and $C_2 = -2$ in eqn (2)

$$s_{at 4} = \frac{1}{3} (4)^4 - 4^2 + (-9.67 \times 4) + (-2)$$

$$s = 85.33 - 16 + (-38.64) - 2$$

$$s = 28.69 \text{ m}$$

4) $ds = v dt$

$$dt = \frac{ds}{v} \dots (1)$$

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

$$dt = \frac{dv}{a} \dots (2)$$

equating 1 and 2

$$\frac{ds}{v} = \frac{dv}{a}$$

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

~~velocity~~

$$dv = (20 - 0.05s^2) ds$$

$$dv = -0.15 ds$$

$$a = \frac{[20 - 0.05s^2] \cdot [-0.15] ds}{ds}$$

$$a = -28 + 0.05s^3$$

$$a \text{ (at } s = 15) = -28 + 0.05(15)^3$$

$$a = -13.125 \text{ m/s}^2$$