

①

Fig 12.3

$$v = (4t - 3t^2) \text{ m/s, at } t=0 \text{ } s=0$$

$$\text{at } t=4 \text{ } s=?$$

$$v = ds/dt$$

$$ds = v dt$$

Integrating both sides and putting

$$s=0 \text{ for } t=0 \text{ s and}$$

$$s=x \text{ for } t=4 \text{ s}$$

$$\int_0^x ds = \int_0^4 v dt$$

$$[s]_0^x = \int_0^4 (4t - 3t^2) dt$$

$$(x-0) = \left[ 4 \frac{t^2}{2} - 3 \frac{t^3}{3} \right]_0^4$$

$$x = (2t^2 - t^3)_0^4$$

$$x = [2(4)^2 - (4)^3] - 0$$

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

②

Fig 12-4

$$\text{Given: } v = 0.5t^3 - 8t$$

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

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

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

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

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

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

③

Fig 12.7

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

$$\text{at } t=0, x = -2 \text{ m}$$

$$\text{at } t=2 \text{ s, } x = -20 \text{ m}$$

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

Integrate both sides  $\int dv = \int (4t^2 - 2) dt$

$$v = \frac{4t^3}{3} - 2t + C_1$$

$$v = \frac{dx}{dt} = \frac{4t^3}{3} - 2t + C_1$$

Integrate - again,

$$\int dx = \int \left( \frac{4t^3}{3} - 2t + C_1 \right) dt + C_2$$

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

At given conditions find  $C_1$  and  $C_2$

$$C_2 = -2$$

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

$$= -20$$

$$\therefore C_1 = -29/3$$

$$\therefore \text{at } t=4$$

$$x = \frac{(4)^4}{3} - (4)^2 - \left( \frac{29}{3} \right) 4 - 2$$

$$= \boxed{28.67 \text{ m}}$$

④

Fig 12.8

$$\text{Velocity, } \frac{ds}{dt} = v = (20 - 0.05s^2) \text{ m/s}$$

$$\text{acceleration, } a = \frac{dv}{dt} = \frac{d}{dt} (20 - 0.05s^2)$$

$$a = (0 - 0.05) \times (2) (s) \frac{ds}{dt}$$

$$= -0.1 (s) (v)$$

$$\text{at } s=15 \text{ m, } v = 20 - 0.05(15)^2$$

$$= 8.75 \text{ m/s}$$

$$\text{at } s=15 \text{ m, } a = -0.1 \times 15 \times 8.75$$

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

This implies RETARDATION.

$$\boxed{m/s^2} =$$