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 181ENGG021098  
 Computer Engineering  
 Mechanics (ENGG 234)

① For Figure 12.3(1)

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

$$s = \int v dt$$

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

$$= 2t^2 - t^3$$

When  $t = 4 \text{ sec}$

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

$$= 32 - 64$$

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

② For Figure 12.4(2)

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

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

$$\frac{dv}{dt} = 3(0.5)t^2 - 8$$

$$= 1.5t^2 - 8$$

$$a = \frac{dv}{dt} \Big|_{t=2} = 2$$

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

$$= 6 - 8 = -2 \text{ m/s}^2$$

③ For Figure 12.7

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

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

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

$$s = \int v dt = \int \left( \frac{4t^3}{3} - 2t + C \right) dt$$

$$= \frac{4t^4}{12} - \frac{2t^2}{2} + Ct$$

$$P = \frac{1}{3}t^4 - t^2 + Ct + k$$

When  $t = 0, P = 2$

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

$$k = -2$$

When  $t = 2, P = 20, k = -2$

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

$$-20 = -0.7 + 2C$$

$$C = -9.7$$

$$P = \frac{1}{3}t^4 - t^2 - 9.7t - 2$$

When  $t = 4$

$$P = \frac{1}{3}(4)^4 - 4^2 - (9.7 \times 4) - 2$$

$$P = 28.7 \text{ mm}$$

④ For Figure 12.8

$$v = (20 - 0.5s) \text{ m/s}$$

$$dt = \frac{ds}{v} \text{ and } dt = \frac{dv}{a}$$

$$a = \frac{dv}{dt}, \frac{dv}{ds} = \frac{dv}{ds} \cdot \frac{ds}{dt}$$

$$\frac{dv}{ds} = 0.15, \frac{ds}{dt} = (20 - 0.5s^2)$$

$$a = (-0.15)(20 - 0.5s^2)$$

When  $s = 15$

$$a = \left[ (-0.15 \times 15)(20 - 0.5(15)^2) \right]$$

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