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 Course: ENGINEERING MECHANICS (EMG 234)  
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① For figure 12.3(c)

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

$$S = \int v dt$$

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

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

$$\text{When } t = 4 \text{ sec}$$

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

$$= 32 - 64$$

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

② For figure 12.4(2)

$$V = (8.5t^2 - 8t) \text{ m/s}$$

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

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

$$= 1.5t^2 - 8$$

$$A = \frac{dv}{dt} / t = 2$$

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

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

③ For figure 12.7

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

$$v = \int A dt = \int 4t^2 - 2$$

$$= 4t^3/3 - 2t + C$$

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

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

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

$$\text{When } t=0, P=2$$

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

$$k = -2$$

$$\text{When } t=2, P=20, k=-2$$

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

$$-20 = 0.7 + 2C$$

$$C = -9.7$$

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

$$\text{When } t=4$$

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

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

④ For figure 12.8

$$V = (20 - 0.55t) \text{ m/s}$$

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

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

$$\frac{dv}{ds} = 0.15, \frac{ds}{ds} = (20 - 0.55s)$$

$$A = (-0.15)(20 - 0.55s)$$

$$\text{When } S=15$$

$$A = [(-0.15)(15)(20 - 0.55(15))]$$

$$= -18.125 \text{ m/s}^2$$