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 COURSE: ENGINEERING MECHANICS  
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1) For FIGURE 12.3 <1>

$$V = \langle 4t - 3t^2 \rangle \text{ m/s}$$

$$S = \int v dt$$

$$S = \int \langle 4t - 3t^2 \rangle dt$$

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

When  $t = 4s$

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

$$= 32 - 64$$

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

2) For FIGURE 12.4 <2>

$$V = \langle 0.5t^3 - 8t \rangle \text{ m/s}$$

$$A = dv/dt$$

$$dv/dt = 3 \langle 0.5 \rangle t^2 - 8$$

$$= 1.5t^2 - 8$$

$$A = dv/dt \Big|_{t=2}$$

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

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

3) For FIGURE 12.7 <3>

$$A = \langle 4t^2 - 2 \rangle \text{ m/s}^2$$

$$V = \int A dt$$

$$V = \int 4t^2 - 2$$

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

$$S = \int V dt$$

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

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

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

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  $t=4$

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

$$P = 28.7 \text{ m/s}$$

4) For FIGURE 12.8 <4>

$$V = \langle 20 - 0.55t \rangle \text{ m/s}$$

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

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

$$\frac{dv}{ds} = -0.15, \quad \frac{ds}{dt} = (20 - 0.55t^2)$$

$$A = \langle -0.15 \rangle (20 - 0.055t^2)$$

When  $S=15$

$$A = \langle -0.1 \times 15 \rangle (20 - 0.05(15^2))$$

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