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Comp. Eng.

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

$$s = \int v \cdot dt$$

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

$$s = 2t^2 - t^3 + C$$

$$s = 2(4)^2 - 4^3 + 0$$

$$s = 32 - 64 + 0$$

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

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

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

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

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

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

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

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

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

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

$$dv = a \cdot dt$$

$$dv = (4t^2 - 2) \cdot dt$$

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

$$v = \frac{ds}{dt}$$

$$ds = v \cdot dt$$

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

$$s = \frac{4t^4}{12} - \frac{2t^2}{2} + C_1 t + C_2$$

$$\text{At } t = 0$$

$$2 = \frac{4(0)^4}{12} - (0)^2 + C_1(0) + C_2 = -2$$

12

$$At + t = 2s \quad s = 20m$$

$$-20 - \frac{4(2)^4}{12} - \frac{2 \times 2^2}{2} + 2 \times C_1 = 2$$

$$-18 = 5.33 - 4 + 2C_1$$

$$\frac{-18 - 5.33 + 4}{2} = C_1$$

$$C_1 = -9.665$$

$$S = \frac{4t^4}{12} - \frac{2 \times t^2}{2} + 2(-9.665)$$

$$S = \frac{4(2)^4}{12} - \frac{2 \times 2^2}{2} + 2(-9.665)$$

$$S = 85.33 - 10 - 19.324$$

$$S = 50.006m$$

$$4) \quad v = 20 - 0.05s^2$$

$$a = v \cdot \left(\frac{dv}{ds} \right)$$

$$\frac{dv}{ds} = -0.1s$$

$$a = (20 - 0.05s^2) \cdot (-0.1)s$$

$$a = -2s - 0.005s^3$$

$$a = s = 15m$$

$$a = -2(15) + 0.005(15)^3$$

$$a = -30 + 16.875$$

$$a = 13.125m^2$$