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181ENG061004

Mechanical Engineering

ENG 234

Mechanics

Assignment

$$1) \quad v = (4t - 3t^2) \text{ m/s} \quad t=0, s=0, t=4$$

$$v = \frac{ds}{dt} = (4t - 3t^2)$$

$$\therefore \frac{ds}{dt} = 4t - 3t^2$$

$$\int ds = \int_0^4 (4t - 3t^2)$$

$$s = \left. \frac{4t^2}{2} - \frac{3t^3}{3} \right|_0^4$$

$$s = 2t^2 - t^3 \Big|_0^4$$

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

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

$$\textcircled{2} v = (0.5t^3 - 8t) \text{ m/s} \quad t = 2 \text{ s} \quad \textcircled{1}$$

$$v = f(t)$$

$$v = 0.5t^3 - 8t$$

$$a = \frac{dv}{dt} = 1.5t^2 - 8$$

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

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

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

$$8) \quad a = (4t^2 - 2) \\ a = \frac{dv}{dt} = (4t^2 - 2)$$

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

$$\int dv = \int (4t^2 - 2) dt \\ v = \frac{4t^3}{3} - 2t + C_1 \quad \text{m/s}$$

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

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

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

$$s = \frac{1}{3}t^4 - t^2 + C_1 t + C_2 //$$

$$\text{At } t = 0, \quad s = -2 \text{ m}$$

$$s = \frac{1}{3}t^4 - t^2 + C_1 t + C_2$$

$$-2 = \frac{1}{3}(0)^4 - (0)^2 + C_1(0) + C_2$$

$$C_2 = -2 //$$

$$\text{At } t=2, \quad s = -20 \text{ m}$$

$$s = \frac{1}{3}t^4 - t^2 + C_1t - 2$$

$$-20 = \frac{1}{3}(2)^4 - (2)^2 + C_1(2) - 2$$

$$-20 = \frac{16}{3} - 4 + 2C_1 - 2$$

$$-20 = -\frac{2}{3} + 2C_1$$

$$2C_1 = -20 + \frac{2}{3}$$

$$\frac{2C_1}{2} = \frac{-19.33}{2}$$

$$C_1 = -9.67$$

$$s = \frac{1}{3}t^4 - t^2 + C_1t + C_2$$

$$\text{At } t=4,$$

$$s = \frac{1}{3}t^4 - t^2 - 9.67t + 2$$

$$s = \frac{1}{3}(4)^4 - (4)^2 - 9.67(4) + 2$$

$$s = 28.667 \text{ m}$$

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

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

$$a = v \frac{dv}{ds}$$

$$\frac{dv}{ds} = -0.15$$

$$a = (20 - 0.05s^2) (-0.15)$$

$$\text{At } s = 15\text{m}$$

$$a = (20 - 0.055(15)^2) (-0.15)$$

$$a = (20 - 11.25) (-1.5)$$

$$a = (8.75) (-1.5)$$

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