

Kien-Olali Kings
W1ENG051027
Mechatronics
Mechanics

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

$$a = \frac{dv}{dt} = 3(0.5)t^2 - 8$$
$$= 1.5t^2 - 8$$

$$a = \frac{dv}{dt} \Big|_{t=2} = 1.5(2)^2 - 8$$
$$= -2 \text{ m/s}^2$$

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

$$s = \int v dt$$

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

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

$$\int v dt \Big|_{t=4} = 2(4)^2 - (4)^3$$

$$= 2(16) - 64$$

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

$$3) v = (20 - 0.5s^2) \text{ m/s}$$

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

$$\frac{dv}{dt} = \frac{dv}{ds} \cdot \frac{ds}{dt} \quad \text{and} \quad \frac{ds}{dt} = 0.1$$

$$\frac{ds}{dt} = (20 - 0.5s^2) \quad \text{and} \quad a = (-0.1s)(20 - 0.5s^2)$$

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

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

4) v

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

$$v = \int a dt$$

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

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

$$s = \int v dt$$

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

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

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

(a) $t=0$

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

$$K = -2$$

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 $t=4$

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

$$= 28.7 \text{ m}$$