

Many particle

$$x(t) = t + 2t^3$$

$$v(t) = 6t^2 \Rightarrow KE(t) = \frac{1}{2}m(6t^2)^2 = \frac{1}{2}(4)(36)t^4 = 72t^4 = KE$$

$$a(t) = 12t \Rightarrow F(t) = ma(t) = 4 \cdot 12t = 48t = F$$

$$P(t) = F(t)v(t) = (48t)(6t^2) = 288t^3$$

$$W = \int_{t=0}^{t=2} P(t) dt = \int_0^2 288t^3 dt = \left. \frac{288t^4}{4} \right|_0^2 = 72 \cdot 2^4 = 72 \cdot 16 =$$

$$W = 1152 \text{ Joules}$$