$\because K = \frac{1}{2} mv^2$

Differentiating with respect to x

$$\frac{dk}{dx} = \frac{1}{2} m \frac{dv^2}{dx} \qquad \left[\frac{dv^2}{dx} = \frac{dv^2}{dv} \cdot \frac{dv}{dx}\right]$$

$$\frac{dk}{dx} = \frac{1}{2} m.2v.\frac{dv^2}{dx}$$

$$\frac{dk}{dx} = m.\frac{dx}{dt}.\frac{dv}{dx}$$

$$\frac{dk}{dx} = m.\frac{dv}{dt}$$

$$\frac{dk}{dx} = ma$$

$$\frac{dk}{dx} = F$$

$$dk = F.dx$$

or $K = \frac{1}{2} m. dv^2/dt$ $\left[\frac{dv^2}{dx} = \frac{dv^2}{dv} \cdot \frac{dv}{dx}\right]$

$$\frac{dk}{dt} = \frac{1}{2} m.2v.\frac{dv}{dt} \qquad \left[= 2v.\frac{dv}{dt}\right]$$

$$\frac{dk}{dt} = m.v\frac{dv}{dt}$$

$$\frac{dk}{dt} = m.v\frac{dv}{dt} a$$

$$\frac{dk}{dt} = F.\frac{dv}{dt}$$

$$dk = f.dx$$

Integrating the above equation from initial to final position we get

$$\int_{ki}^{k_f} dk = \int_{xi}^{x_f} F.dx$$

$$[K]_{ki}^{k_f} = W_{Total}$$

Or $K_f - K_i = W_{Total}$ ....(10)