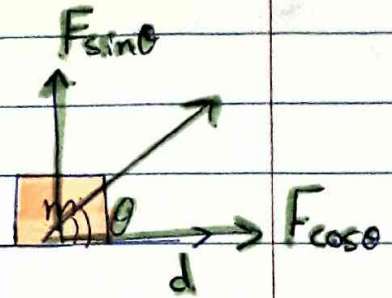


Kinetic Energy & work

* $\text{work} = \vec{F} \cdot \vec{d}$

scalar "Dot product"

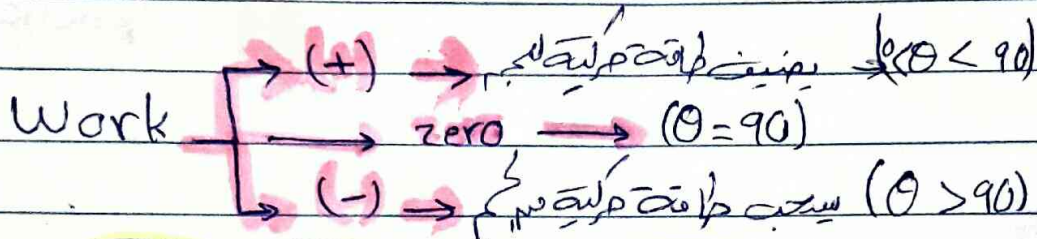


$W = Fd \cos \theta$

$W = F \cos \theta \cdot d$

$W = N \cdot m = \text{Jou}$

العمل = القوة × المسافة



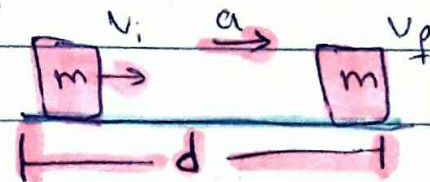
* $\text{Kinetic Energy} = \frac{1}{2} m v^2$

K.E = Jou

work - Energy Theorem :

$V_f^2 = V_i^2 + 2a \Delta x$

$\frac{m}{2} (V_f^2 - V_i^2) = 2ad$



$\frac{m}{2} V_f^2 - \frac{m}{2} V_i^2 = \frac{1}{2} m a d$

$K_f - K_i = F \cdot d$

$W = \Delta K$

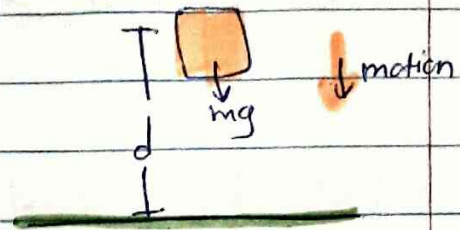
* work done by gravity:

1 mass moves downward ①

$$W_g = \vec{F} \cdot \vec{d}$$

$$= mgd \cos \theta \quad \theta = 0^\circ$$

$$= \underline{mgd}$$

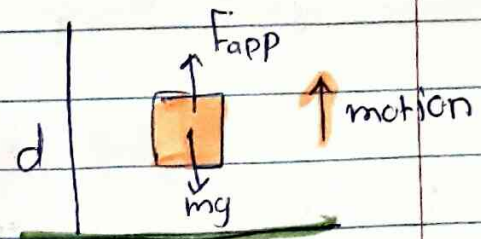


2 mass moves upward ②

$$W_g = \vec{F} \cdot \vec{d}$$

$$= mgd \cos \theta \quad \theta = 180^\circ$$

$$= \underline{-mgd}$$



* Variable Force:

$$W = \int_{x_i}^{x_f} \vec{F} \cdot d\vec{r} = \int_{x_i}^{x_f} F \cos \theta dr = \int_{x_i}^{x_f} F_x dx + \int_{y_i}^{y_f} F_y dy + \int_{z_i}^{z_f} F_z dz$$

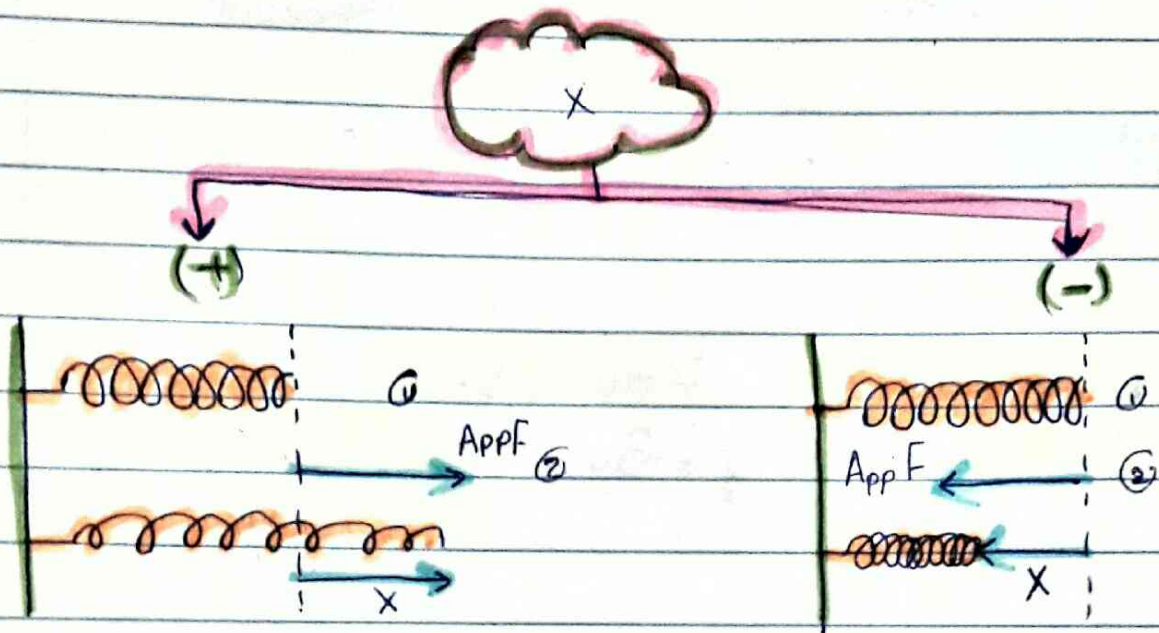
Remark: the Area under the curve F_x Vs x is Work

* work Done by a spring force.

"Variable force"

* $F_s = -Rx$ (Hook's law)

elastic constant



$$W_s = \int_{x_i}^{x_f} F_x dx = \int_{x_i}^{x_f} -Rx dx$$

$$= -R \int_{x_i}^{x_f} x dx$$

$$\rightarrow W_s = -\frac{R}{2} (x_f^2 - x_i^2) \quad \text{if } x_i = 0$$

$$\rightarrow W_s = -\frac{R}{2} x_f^2$$

