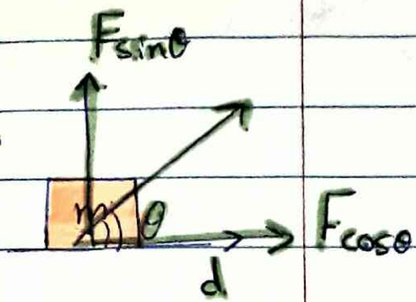
Kinetic Energy & Work

* $Work = \vec{F} \cdot \vec{d}$ scaler "Dot product"



$W = Fd\cos\theta$

$W = F\cos\theta \; d$ $\qquad W = N.m = Joil$

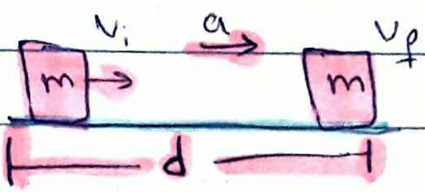
* القوة اللي تعمل على إزاحة الجسم

Work
- (+) → يضيف طاقة حركية للجسم → $(0 < \theta < 90)$
- zero → $(\theta = 90)$
- (−) → يسحب طاقة حركية من الجسم $(\theta > 90)$

* $Kinetic\ Energy = \frac{1}{2} m v^2$ $\qquad K.E = Joil$

Work – Energy Theorem :–

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



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

$\frac{m}{2}V_f^2 - \frac{m}{2}V_i^2 = \frac{2}{2}mad$

$K_f - K_i = F.d$

$W = \Delta K$

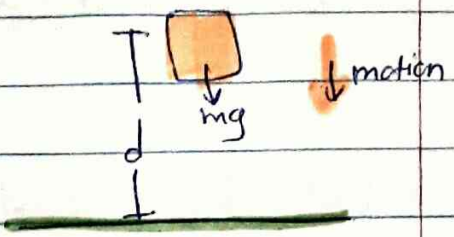
* work done by gravity:

1 mass moves downword ①

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

$= mgd\cos\theta$ ($\theta = zero$)

$+mgd$

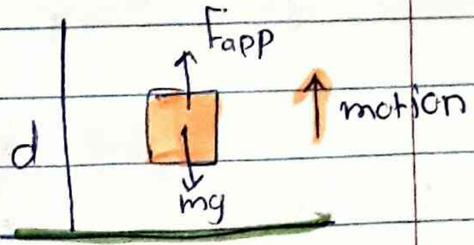


2 mass moves upward ②

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

$= mgd\cos\theta$ ($\theta = 180$)

$= -mgd$



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* Variable force:

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

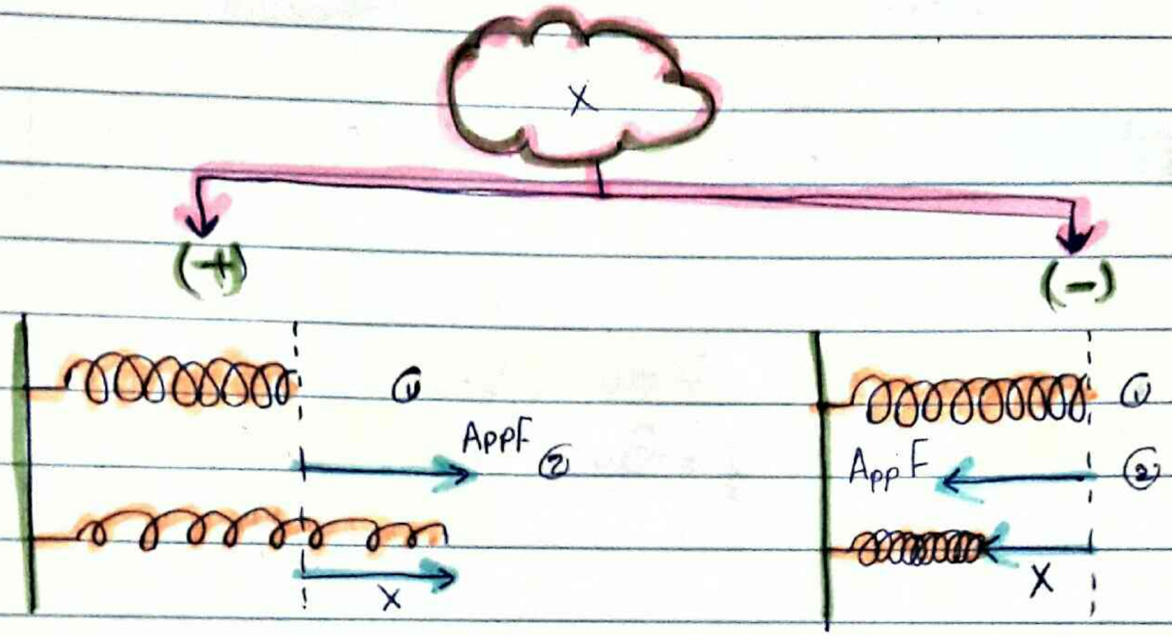
Remark: the Area under the carve F_x Vs x is "Work"

* work Done by a spring force

"Variable force"

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

k → elastic constant



$$\cdot\, W_s = \int_{x_i}^{x_f} F_x \, dx = \int_{x_i}^{x_f} -kx \, dx$$

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

$$\longrightarrow W_s = -\frac{k}{2}\left(x_f^2 - x_i^2\right) \quad \text{if } x_i = 0$$

$$\Rightarrow W_s = -\frac{k}{2} x_f^2$$