ENERGY SUMMARY

$$W_{\text{done by F}} = \vec{F} \bullet \vec{d}$$
$$= |\vec{F}||\vec{d}|\cos\phi \quad \text{in polar notation}$$
$$= F_x d_x + F_y d_y + F_z d_z \quad \text{in u.v. notation}$$

$$W_{\text{net}} = \Delta KE \qquad \text{(called the "work/energy theorem")}$$
$$= \left(KE_2 - KE_1\right)$$
$$= \left(\frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2\right)$$

$$W_{\text{done by conservative force}} = -\Delta U$$
$$= -\left(U_2 - U_1\right)$$

conservation of energy:

$$\sum KE_{\text{at point in time 1}} + \sum U_{\text{at point in time 1}} + \sum W_{\text{extraneous between time 1 and time 2}}$$
$$= \sum KE_{\text{at point in time 2}} + \sum U_{\text{at point in time 2}}$$

OR

$$E_1 + \sum W_{\text{extraneous}} = E_2$$

$$U_{\text{gravity near earth's surface}} = mgy$$

where $\vec{F}_g = -(mg)\hat{j}$ and "$y = 0$" is your choice

$$U_{\text{spring}} = \frac{1}{2}kx^2$$

where $\vec{F}_{sp} = -kx\hat{i}$ and "$x = 0$" at equilibrium