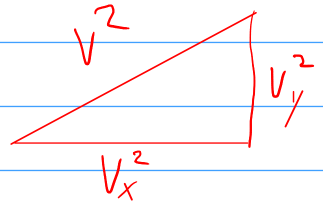
$$v_f^2 - v_0^2 = 2a\Delta x$$

$$\underbrace{\tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_0^2}_{\text{change in KE}} = \underbrace{ma}_{\text{net force}}\Delta x \longrightarrow \Delta KE = \underbrace{F\Delta x}_{\text{work done}}$$

$$\tfrac{1}{2}mv_{x_f}^2 - \tfrac{1}{2}mv_{x_0}^2 = ma_x\Delta x$$

$$+\quad \tfrac{1}{2}mv_{y_f}^2 - \tfrac{1}{2}mv_{y_0}^2 = ma_y\Delta y$$



$$\left(\tfrac{1}{2}mv_{x_f}^2 + \tfrac{1}{2}mv_{y_f}^2\right) - \left(\tfrac{1}{2}mv_{x_0}^2 + \tfrac{1}{2}mv_{y_0}^2\right) = F_x\Delta x + F_y\Delta y$$

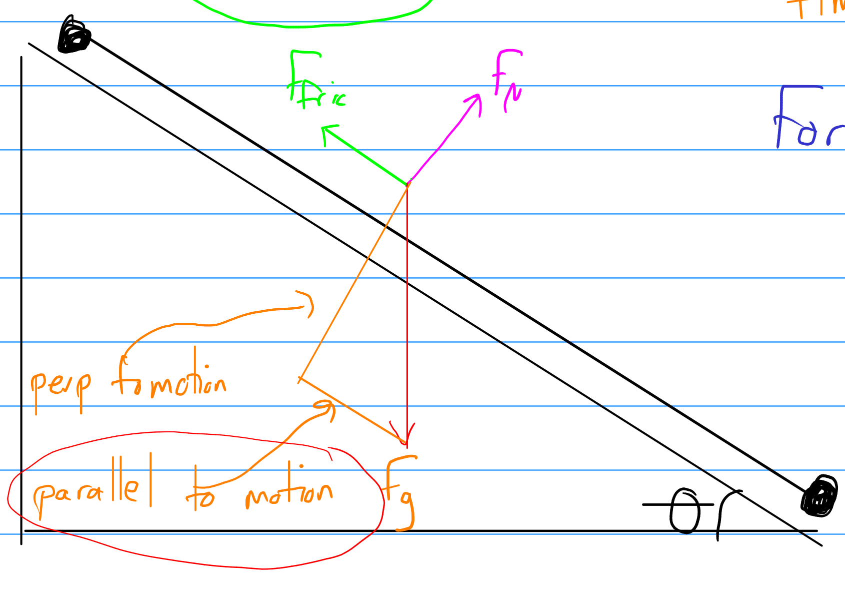
$$\underbrace{\tfrac{1}{2}mv_f^2 \qquad - \tfrac{1}{2}mv_0^2}_{\text{change in KE}} = \underbrace{\vec{F}\cdot\Delta\vec{s}}_{\text{work done by all forces}}$$

in 2D

$\vec{F}\cdot\Delta\vec{s}$ means:

$F\cdot(\Delta s)_{\parallel} \longrightarrow$ force times displacement parallel to force

or $F_{\parallel}\cdot(\Delta s) \longrightarrow$ force in direction of displacement times the displacement



Forces:

- F_N does no work since it is $\perp$ to Δs.
- F_{fric} does negative work.
- F_g does positive work (this!)

$W_{normal} = 0$

$$W_{all} = \Delta KE \Rightarrow \underbrace{W_{grav}}_{\vec{F}\cdot\Delta\vec{s}} + \underbrace{W_{fric}} + \underbrace{\cancel{W_{normal}}} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_0^2$$