Standard 4: Work along a curved path w/ a given force field

$$W = \int_C \vec{F} \cdot d\vec{s}$$

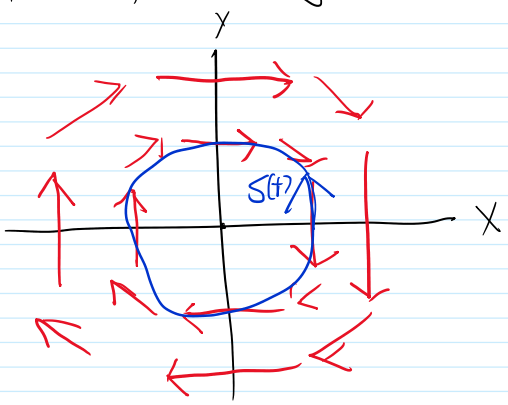
$$\vec{F} = y\hat{i} - x\hat{j}$$

$$x(t) = \cos(t)$$

$$y(t) = \sin(t)$$

$$\vec{s}(t) = \cos(t)\hat{i} + \sin(t)\hat{j}$$

$$d\vec{s} = -\sin(t)\,dt\,\hat{i} + \cos(t)\,dt\,\hat{j}$$



$$\vec{F}(t) = \sin(t)\hat{i} - \cos(t)\hat{j}$$

$$\vec{F} \cdot d\vec{s} = \left(\sin(t)\hat{i} - \cos(t)\hat{j}\right) \cdot \left(-\sin(t)\,dt\,\hat{i} + \cos(t)\,dt\,\hat{j}\right)$$

$$= \sin^2(t)\,dt - \cos^2(t)\,dt$$

$$W = \int_0^{2\pi} \sin^2(t)\,dt - \int_0^{2\pi} \cos^2(t)\,dt$$

$$= \frac{1}{2}\left(t - \frac{1}{2}\sin(2t)\right)\Big|_0^{2\pi} - \frac{1}{2}\left(t + \frac{1}{2}\sin(2t)\right)\Big|_0^{2\pi}$$

$$= \frac{1}{2}\left(2\pi - \frac{1}{2}\sin(4\pi) - 0 + \frac{1}{2}\sin(0)\right) - \frac{1}{2}\left(2\pi + \frac{1}{2}\sin(4\pi) - 0 - \frac{1}{2}\sin(0)\right)$$

$$= \pi - \pi = 0$$