

$$\oint_C \vec{F} \cdot d\vec{r} = \iint_D \left( \frac{\partial F_2}{\partial x} - \frac{\partial F_1}{\partial y} \right) dA$$

Green's Theorem.

$$\vec{F} = \langle F_1, F_2 \rangle = F_1 \hat{i} + F_2 \hat{j}$$

$$\oint_C \vec{F} \cdot d\vec{r} \approx \left( \frac{F_2(x+\Delta x) - F_2(x,y)}{\Delta x} \right) \Delta x - \left( \frac{F_1(x,y+\Delta y) - F_1(x,y)}{\Delta y} \right) \Delta y \Delta x$$

$C$  is the tiny rectangle with area  $\Delta x \Delta y$

