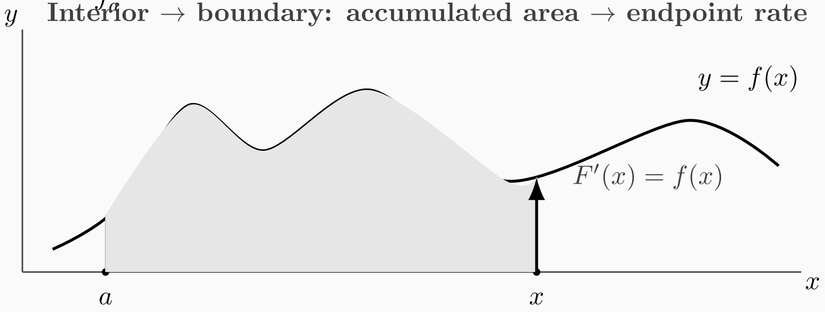
FTC I (Accumulation)

$$F(x) = \int_a^x f(t)\,dt \quad \Rightarrow \quad F'(x) = f(x)$$

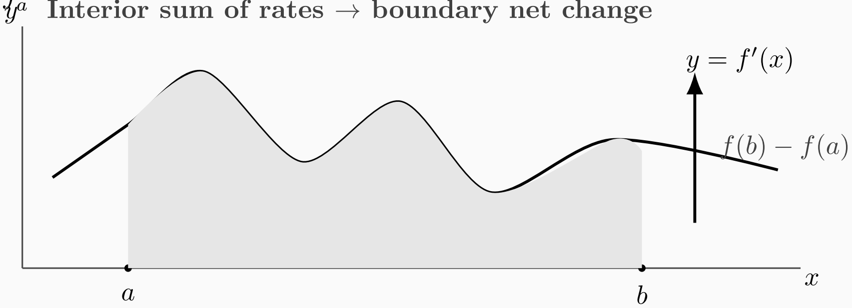
Interior → boundary: accumulated area → endpoint rate



FTC II (Evaluation)

$$\int_a^b f'(x)\,dx = f(b) - f(a)$$

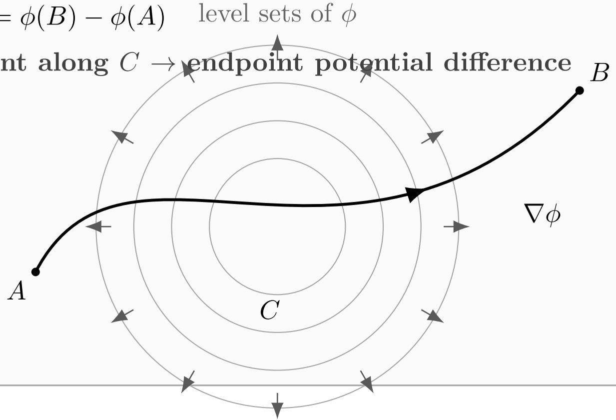
Interior sum of rates → boundary net change



Fundamental Theorem of Line Integrals

$$\int_C \nabla\phi \cdot d\mathbf{r} = \phi(B) - \phi(A)$$

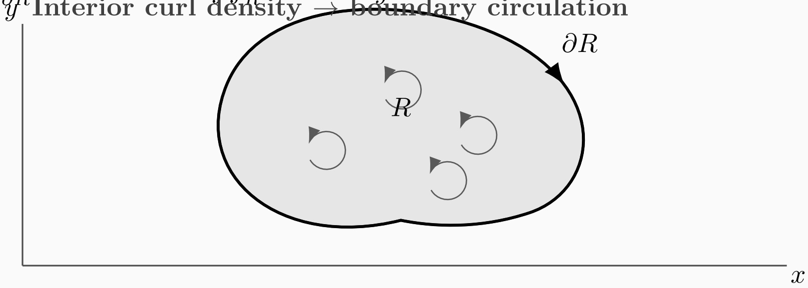
Gradient along $C \to$ endpoint potential difference



Green's Theorem (Planar)

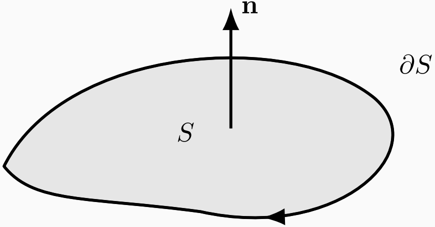
$$\oint_{\partial R} P\,dx + Q\,dy = \iint_R \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right) dA$$

Interior curl density → boundary circulation



Stokes' Theorem (Surface)

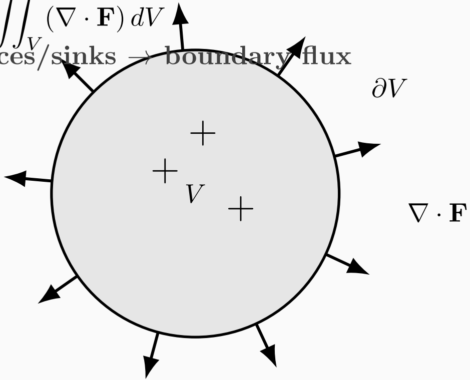
$$\oint_{\partial S} \mathbf{F} \cdot d\mathbf{r} = \iint_S (\nabla \times \mathbf{F}) \cdot \mathbf{n}\, dS$$



Divergence Theorem (Gauss)

$$\iint_{\partial V} \mathbf{F}\cdot\mathbf{n}\,dS = \iiint_V (\nabla\cdot\mathbf{F})\,dV$$

Interior sources/sinks → boundary flux



Generalized Stokes (Unified Form)

$$\int_{\partial\Omega} \omega = \int_{\Omega} d\omega$$

One theorem to rule them all: boundary integral equals integral of a derivative