



$$\begin{aligned} \oint_{\partial D} (\vec{F} \cdot \vec{n}) dl &= \oint_{\partial D} \vec{F} \cdot (\vec{n} dl) = \oint_{\partial D} (X, Y) \cdot (dy, -dx) = \oint_{\partial D} -Y dx + X dy \\ &= \iint_D \left( \frac{\partial X}{\partial x} + \frac{\partial Y}{\partial y} \right) dx dy = \iint_D (\vec{\nabla} \cdot \vec{F}) dx dy \end{aligned}$$