



$$\begin{aligned}
 \oint_{\partial \Sigma_+} \vec{F} \cdot d\vec{l} &= \oint_{\partial \Sigma_+} (X, Y, Z) \cdot (dx, dy, dz) = \oint_{\partial \Sigma_+} X dx + Y dy + Z dz \\
 &= \iint_{\Sigma_+} (\vec{\nabla} \times \vec{F}) \cdot d\vec{S} = \iint_{\Sigma_+} \begin{vmatrix} dy \wedge dz & dz \wedge dx & dx \wedge dy \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ X & Y & Z \end{vmatrix}
 \end{aligned}$$