Stokes Theorem

$$\int_{\partial S} \vec{F} \bullet d\vec{r} = \iint\limits_{S} \nabla \times \vec{F} \bullet d\vec{S}$$

$$\int_{\partial S} \vec{F} \cdot \vec{T} \, ds = \iint\limits_{S} (\nabla \times \vec{F}) \bullet \vec{n} \, dS$$

$$\Downarrow$$

$$\int_{\partial S} \vec{F} \cdot d\vec{r} = \iint\limits_{S} (\nabla \times \vec{F}) \bullet d\vec{S}$$

Parametrize ∂S by $\vec{r}(t) = \langle x(t), y(t), z(t) \rangle$, $a \leqslant t \leqslant b$.

Parametrize S by $\vec{R}(u,v) = \langle x(u,v), y(u,v), z(u,v) \rangle$, $z(u,v) \in D$.

#1

$\vec{F} = \langle z^2, -3xy, x^3y^3 \rangle$

$S : z = 5 - x^2 - y^2$ above$z = 1$

Find $\iint\limits_S \nabla \times \vec{F} \bullet d\vec{S}$.

More details.

#5

$\vec{F} = \langle y + \sin(z), z^2 \cos(y), x^3 \rangle$.

$C : \langle \cos(t), \sin(t), \sin(2t) \rangle$ for $0 \leqslant t \leqslant 2\pi$.

Find $\displaystyle\int_C \vec{F} \bullet d \langle r \rangle$.