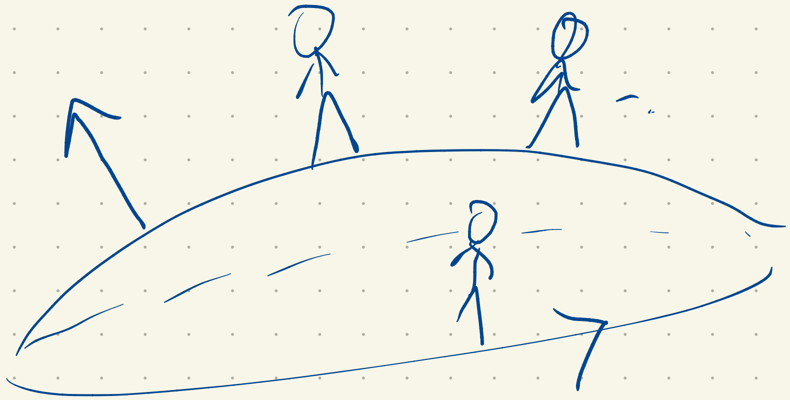
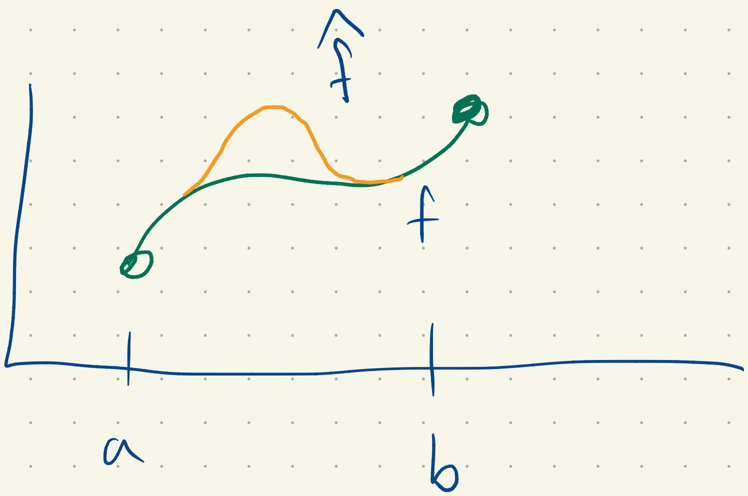


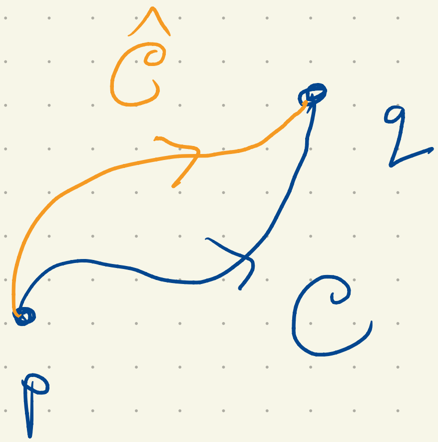
$$\iint_S \vec{\nabla} \times \vec{Z} \cdot \vec{n} \, dS = \int_C \vec{Z} \cdot d\vec{r}$$



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

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

$$= f(b) - f(a)$$

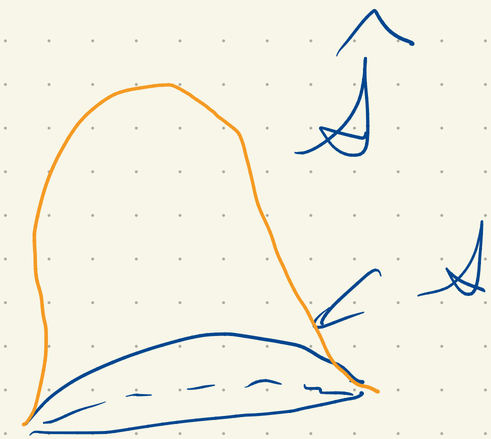


$$\int_C \vec{\nabla} f \cdot d\vec{r} = f(q) - f(p)$$

FTLI

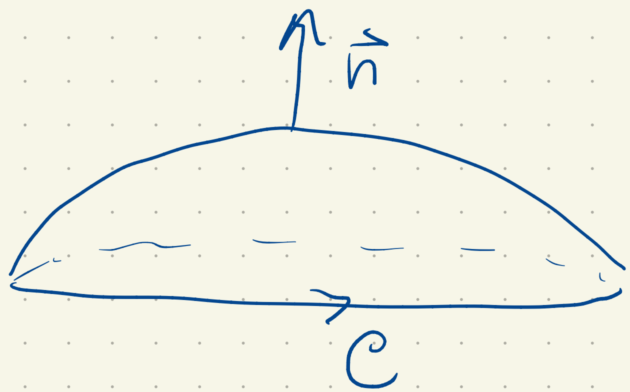
$$\int_C \vec{\nabla} f \cdot d\vec{r} \quad \text{vs} \quad \int_{\hat{C}} \vec{\nabla} f \cdot d\vec{r}$$

$$=$$



$$\iint_S (\vec{\nabla} \times \vec{Z}) \cdot \vec{n}\, dS = \int_C \vec{Z} \cdot d\vec{r}$$

$$\iint_S (\vec{\nabla} \times \vec{Z}) \cdot \vec{n}\, dS \quad \text{vs} \quad \iint_{\hat{S}} (\vec{\nabla} \times \vec{Z}) \cdot \vec{n}\, dS$$



$z = \sqrt{3}$

$x^2+y^2+z^2=4$

$z = \pm\sqrt{4-x^2-y^2}$

$z \geq \sqrt{3}$

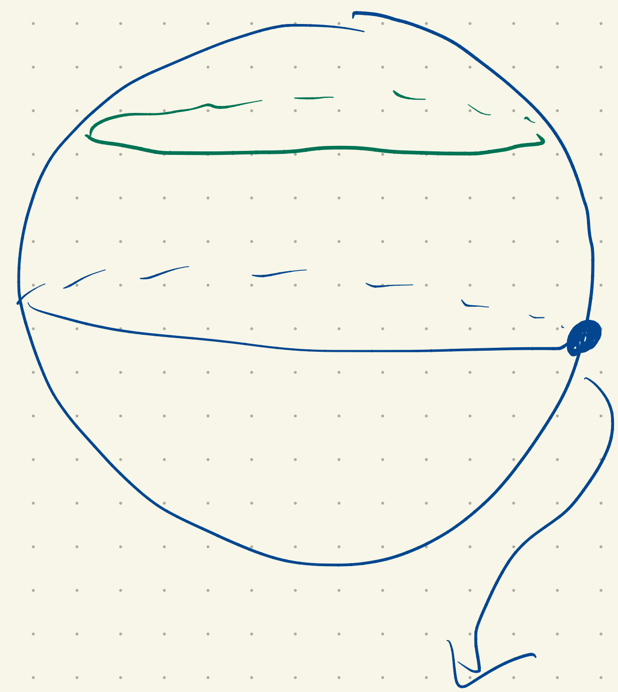
$x^2+y^2 \leq 1$

$\vec{F} = \langle xz,\ yz+x,\ xy \rangle$

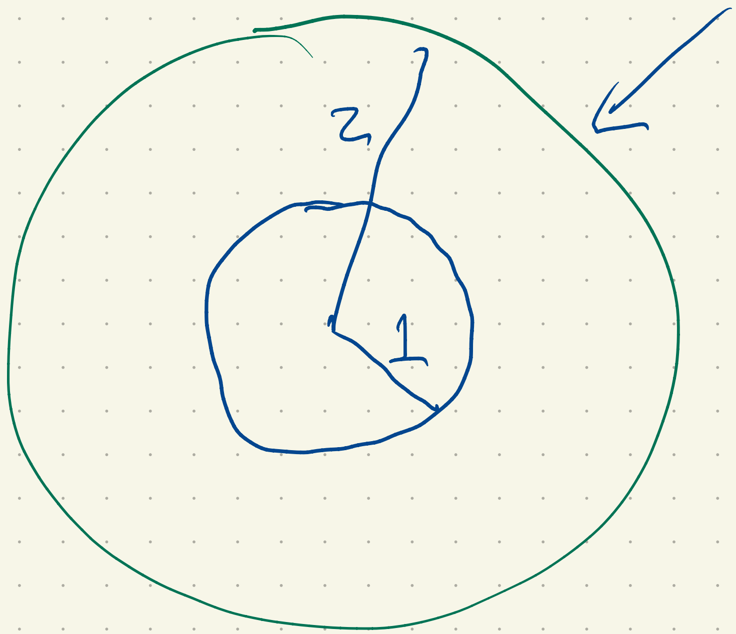
$$\iint_S (\vec{\nabla}\times\vec{F})\cdot\vec{n}\, dS = \int_C \vec{F}\cdot d\vec{r}$$

$$\pi \qquad\qquad \pi$$

$$\vec{r}(u,v) = \langle u, v, \sqrt{4-u^2-v^2} \rangle$$



$(2,0,0)$



$u^2+v^2 \le 1$

$\vec{r}_u$

$\vec{r}_v$

$$\vec{r}_u \times \vec{r}_v = \left\langle \frac{u}{\sqrt{4-u^2-v^2}}, \frac{v}{\sqrt{4-u^2-v^2}}, 1 \right\rangle$$

points perp. to surface

$$\vec{\nabla} \times \vec{F} = \langle x-y, x-y, 1 \rangle$$

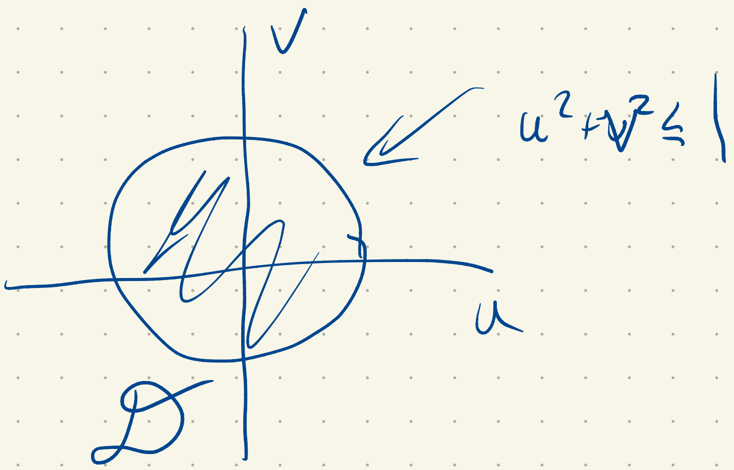
$$(\vec{\nabla} \times \vec{F})(\vec{r}(u,v)) = \langle u-v, u-v, 1 \rangle$$

$$\iint_S (\vec{\nabla} \times \vec{F}) \cdot \underline{\vec{n}}\, dS = \iint_D (\vec{\nabla} \times \vec{F})(\vec{r}(u,v)) \cdot (\vec{r}_u \times \vec{r}_v)\, du\, dv$$

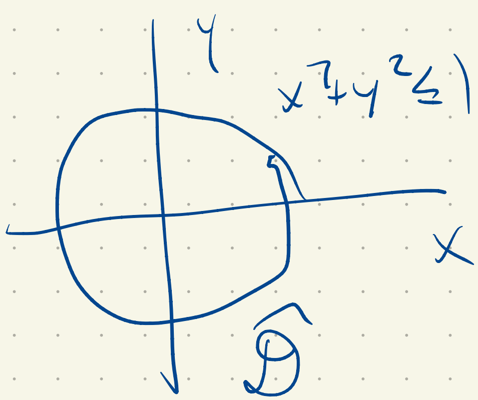
↑ region of u's v's that describes your $\mathcal{D}$

$u^2+v^2 \le 1$

$= \pi$

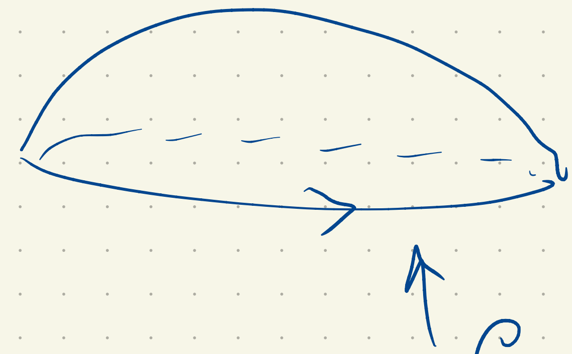


$$\iint_{\mathcal{D}} u^2 \, dA(u,v)$$



$$\iint_{\hat{\mathcal{D}}} x \, dA(x,y)$$

$$\int_C \vec{F}\cdot d\vec{r}$$



C

$x^2+y^2=1$

$z=\sqrt{3}$

$$\vec{\sigma}(t) = \langle \cos(t), \sin(t), \sqrt{3} \rangle$$

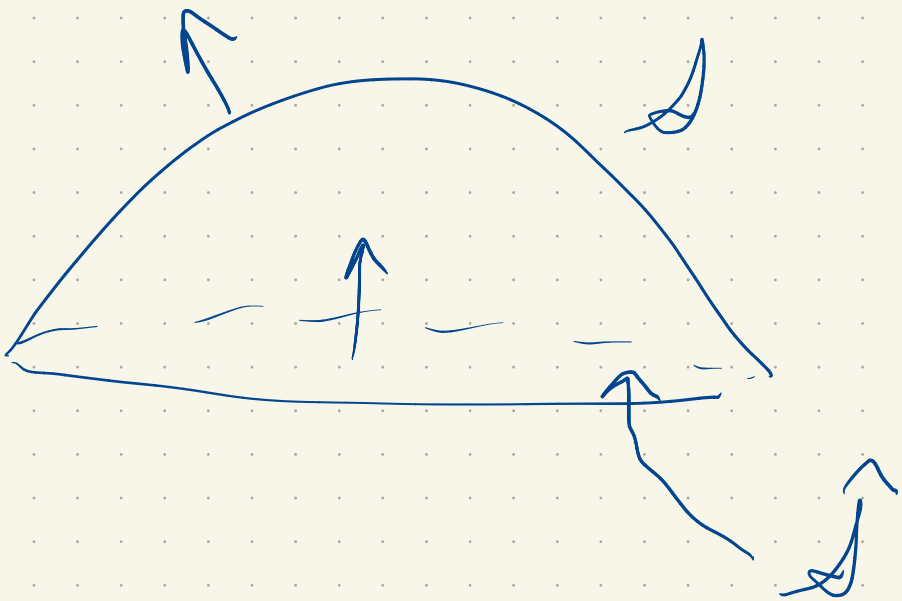
$$0 \le t \le 2\pi$$

$$\vec{F} = \langle xz, yz+x, xy \rangle$$

$$\vec{F}(\vec{\sigma}(t)) = \langle \sqrt{3}\cos(t), \sqrt{3}\sin(t)+\cos(t), \cos(t)\sin(t) \rangle$$

$$\vec{\sigma}'(t) = \langle -\sin t, \cos(t), 0 \rangle$$

$$\int_C \vec{F}\cdot d\vec{r} = \int_0^{2\pi} \underline{\vec{F}(\vec{\sigma}(t))}\cdot \vec{\sigma}'(t)\,dt = \pi$$



$$\iint_{S} (\vec{\nabla} \times \vec{F}) \cdot \vec{n} \, dS = \pi$$

$$\iint_{\hat{S}} (\vec{\nabla} \times F) \cdot \vec{n} \, dS = \pi$$

$$\vec{r}(u,v) = \langle u, y, \sqrt{3} \rangle$$

$$\vec{\nabla} \times \vec{F} = \langle x-y, x-y, 1 \rangle$$

$$\vec{r}_u = \langle 1, 0, 0 \rangle$$

$$\vec{\nabla} \times \vec{F}(\vec{r}(u,v)) = \langle u-v, u-v, 1 \rangle$$

$$\vec{r}_v = \langle 0, 1, 0 \rangle$$

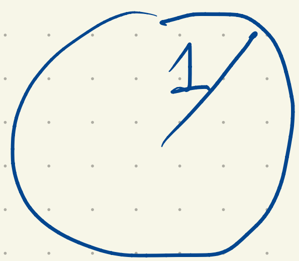
$$\vec{\nabla} \times \vec{F}(\vec{r}(u,v)) \cdot (\vec{r}_u \times \vec{r}_v) = 1$$

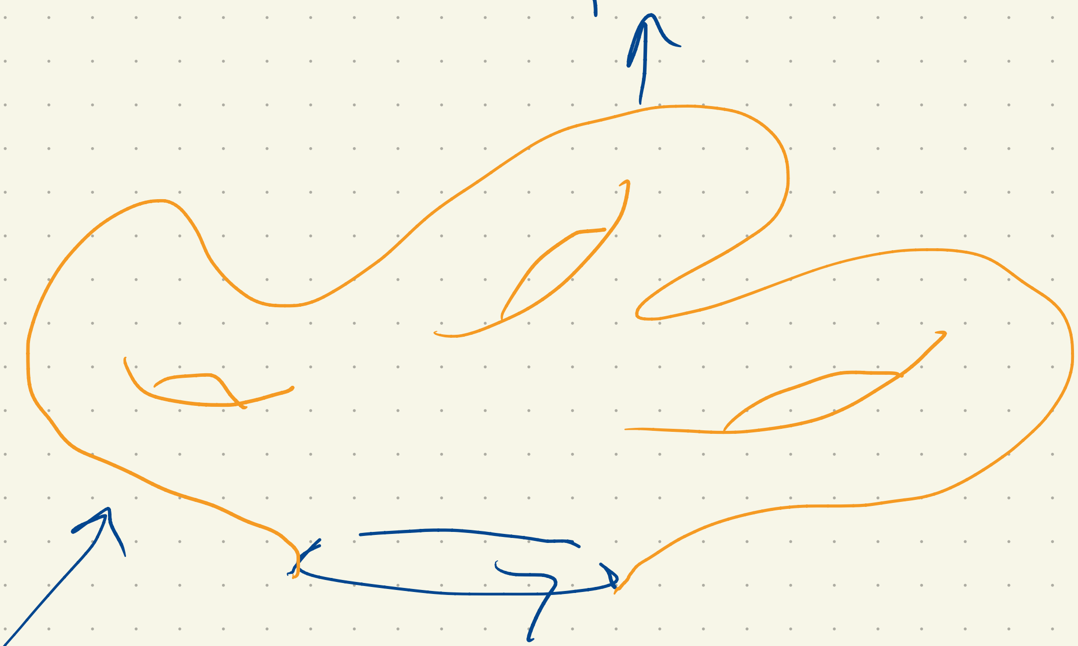
$$\vec{r}_u \times \vec{r}_v = \langle 0, 0, 1 \rangle$$

$$u^2 + v^2 \leq 1$$

$$\iint_{\hat{S}} (\vec{\nabla} \times \vec{F}) \cdot \vec{n}\, dS = \iint_{D} 1 \, du\, dv = \pi$$

$u^2 + v^2 \leq 1$





$\hat{S}$

$$\iint_{\hat{S}} (\vec{\nabla} \times \vec{F}) \cdot \vec{n}\, dS = \pi$$

$$\parallel$$

$$\int_C \vec{F} \cdot d\vec{r}$$