$$\int$$

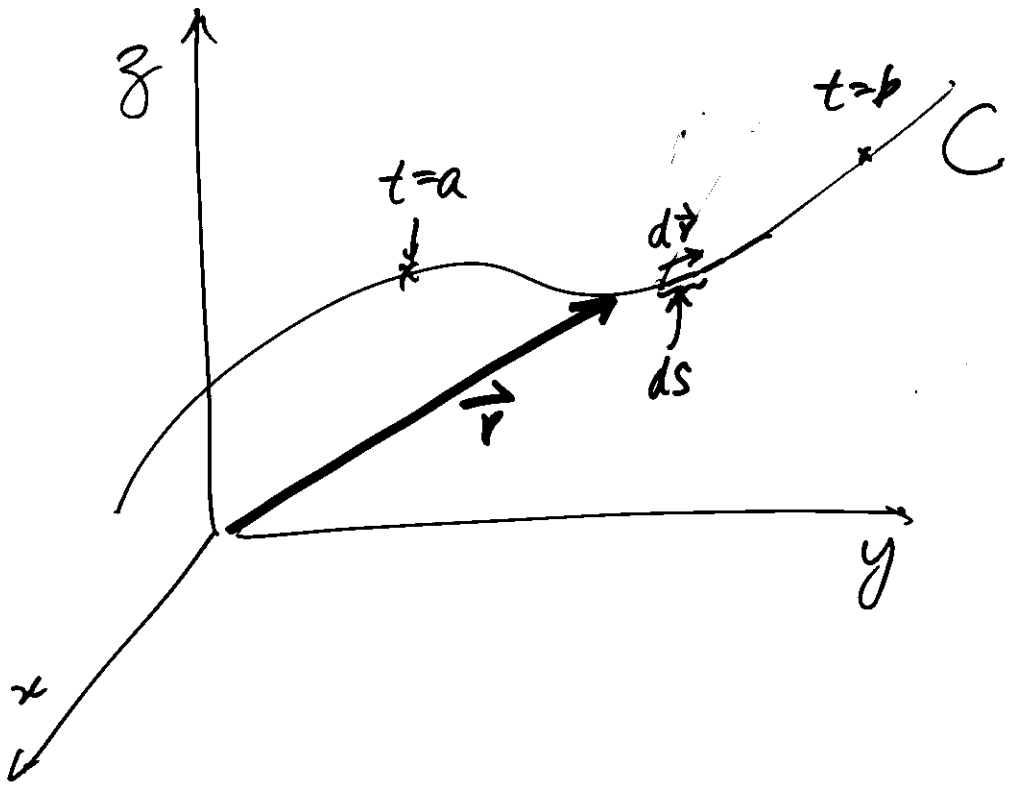
$$P(x,y)\,dx + Q(x,y)\,dy = \phi$$

$$\frac{\partial f}{\partial x} = P(x,y)$$

$$\frac{\partial f}{\partial y} = Q(x,y)$$

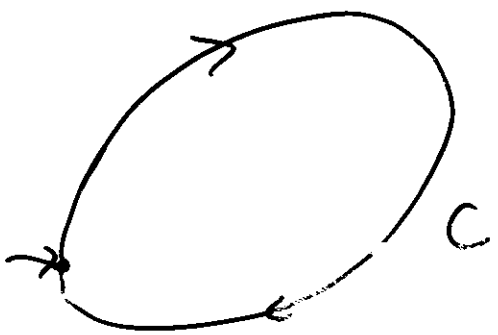
$$\left[\frac{\partial P}{\partial y} = \frac{\partial Q}{\partial x}\right]$$

Exactness test



$$\text{grad}(F) = \nabla F$$

$$= \frac{\partial F}{\partial x}\vec{i} + \frac{\partial F}{\partial y}\vec{j} + \frac{\partial F}{\partial z}\vec{k}$$



$$\oint_C$$

$$\frac{\partial F_2}{\partial x} = \frac{\partial F_1}{\partial y}$$

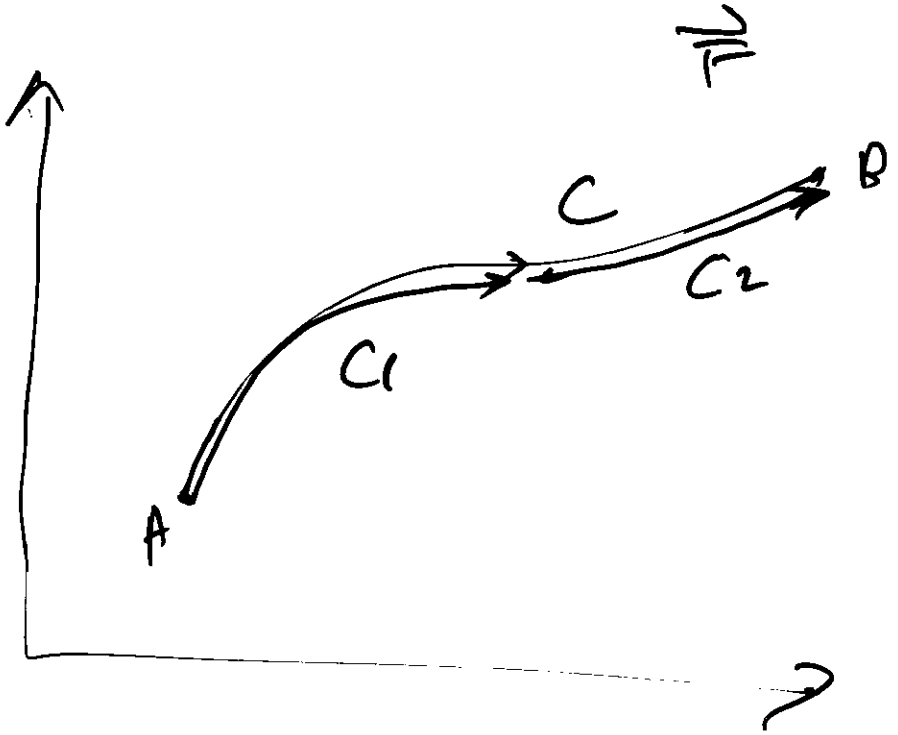
$$F_2 = \frac{\partial f}{\partial y} \qquad F_1 = \frac{\partial f}{\partial x}$$

$$\Downarrow \qquad \Downarrow$$

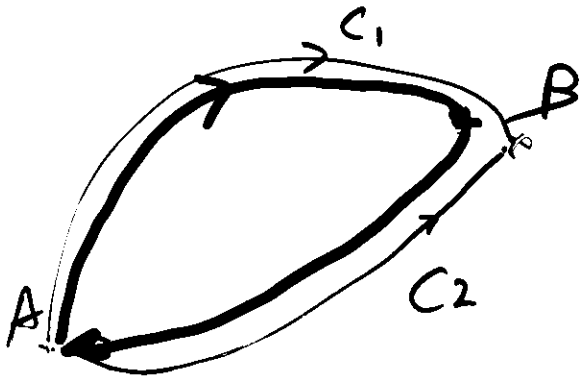
$$\frac{\partial F_2}{\partial x} \qquad \frac{\partial F_1}{\partial y}$$

$$\| \qquad \|$$

$$\frac{\partial f}{\partial y \partial x} = \frac{\partial^2 f}{\partial x \partial y}$$



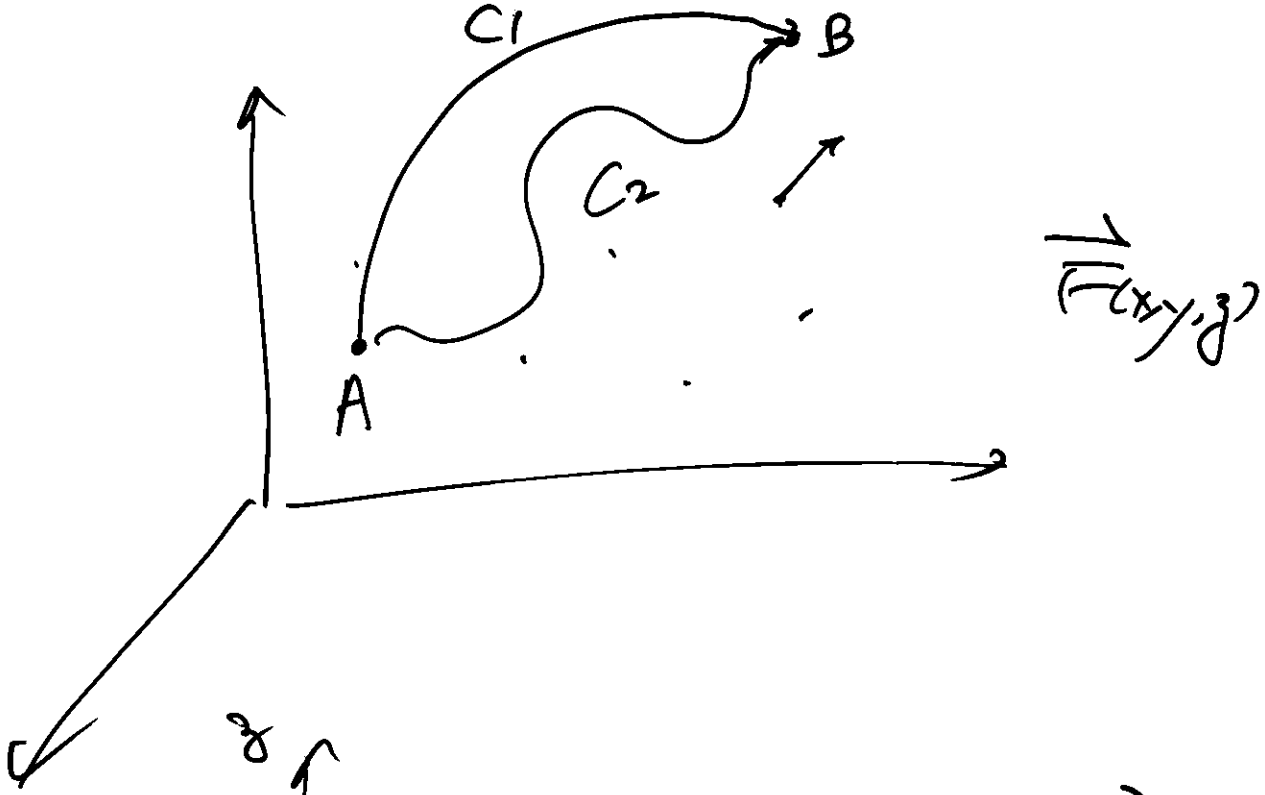
$$\int_C \vec{F} \cdot d\vec{r} = \int_{C_1} \vec{F} \cdot d\vec{r}$$

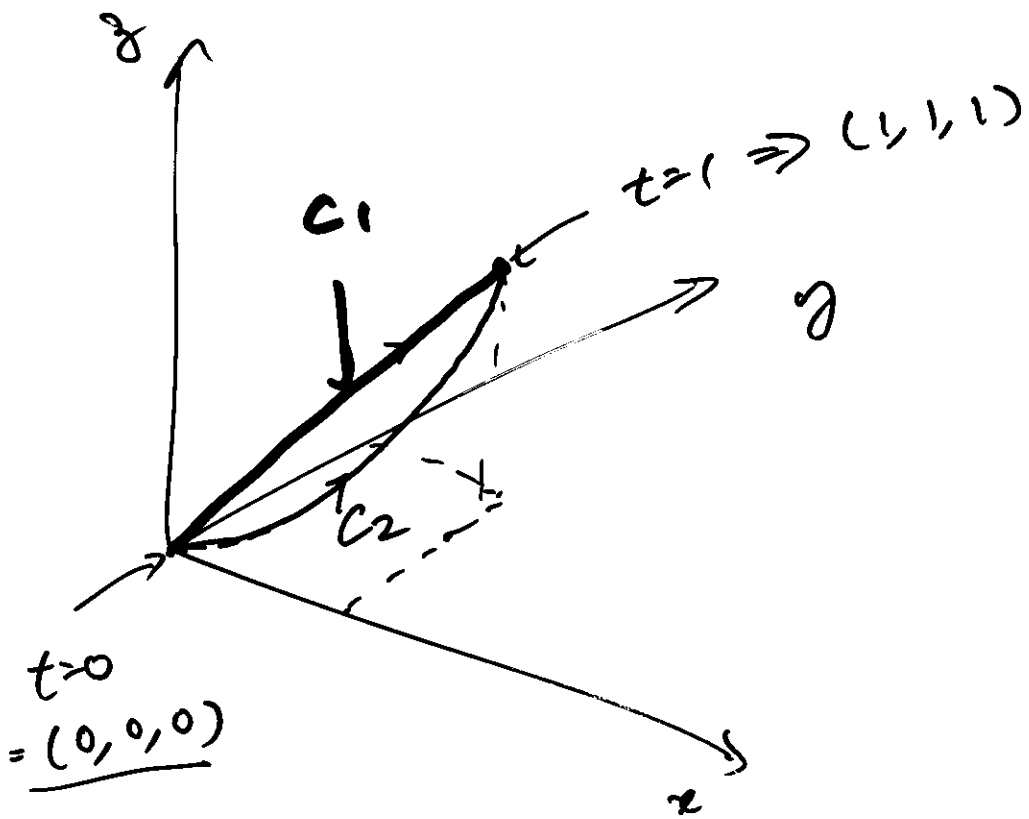


$$\int_{C_2}^{\top} \vec{F} \cdot d\vec{r}$$

$$\int_C = \oint = \int_{C_1} + (-1) \int_{C_2}$$

$$\int_{C_1} = \int_{C_2}$$


C1
B
C2
A
$\vec{F}(x,y,z)$


z
C1
t=1 ⇒ (1,1,1)
y
C2
t=0
= (0,0,0)
x