

# Line Integral Strategy

Yes (Brute force is the only option)

Scalar Line Int. w/ Arc Length?

$$\int_C f ds$$

No.  $\int_C \vec{F} \cdot d\vec{r}$

$$\int_C P dx + Q dy$$

No

Are you sure?  
(Start over...)

Is  $C$  simple + closed?

Yes

Use Green's Thm:

$$\oint_C P dx + Q dy = \iint_D \left( \frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y} \right) dA$$

No

Is  $\vec{F}$  conservative?

$$\frac{\partial Q}{\partial x} = \frac{\partial P}{\partial y}$$

Yes

Can you find  $f$ ?  
 $\vec{\nabla} f = \vec{F}$  (potential)

No

Yes

Evaluate  
 $f(\text{end}) - f(\text{start})$   
(by FTCFLI)

Can you use an easier path from start  $\rightarrow$  end?  
(by path independence)

Yes, use new path

No, use original path

Parametrize  $C$ , Evaluate in terms of parameter  
(Brute force)

"Brute force" will always work,  
but can often be avoided  
using FTCFLI or G.T.  
path independence