

Choose a vector field $\vec{F}$ from the first column below. Choose a small loop C (that is, a simple, closed, positively-oriented curve) which does **not** go around the origin.

- Is $\oint \vec{F} \cdot d\hat{r}$ positive, negative, or zero?
- Will a paddlewheel spin if placed inside your loop, and, if so, which way?
- Do you think $\nabla \times \vec{F}$ is zero or nonzero inside your loop?
Explain.
- Compute $\nabla \times \vec{F}$. Did you guess right? *Explain.*
- Is $\oint \vec{F} \cdot \hat{n} ds$ positive, negative, or zero? ($\hat{n}$ is the *outward* pointing normal vector to C .)
- Is the net flow outwards across your loop positive, negative, or zero?
- Do you think $\nabla \cdot \vec{F}$ is zero or nonzero inside your loop? *Explain.*
- Compute $\nabla \cdot \vec{F}$. Did you guess right? *Explain.*
- Repeat the above steps for vector fields $\vec{G}$ and $\vec{H}$ chosen from the second and third columns.

