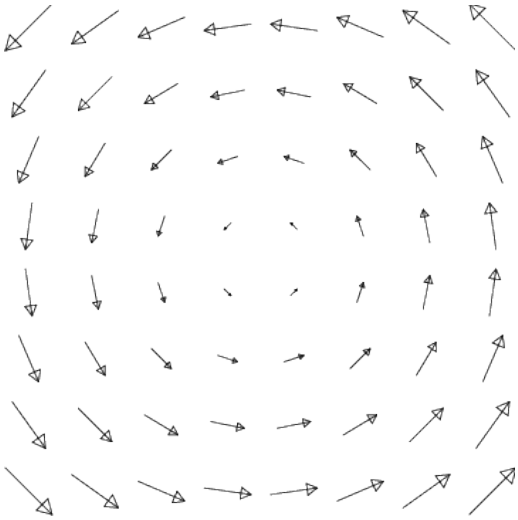
Choose a vector field $\vec{\boldsymbol{F}}$ from the first column below. Choose a small loop C (that is, a simple, closed, positively-oriented curve) which does **not** go around the origin.

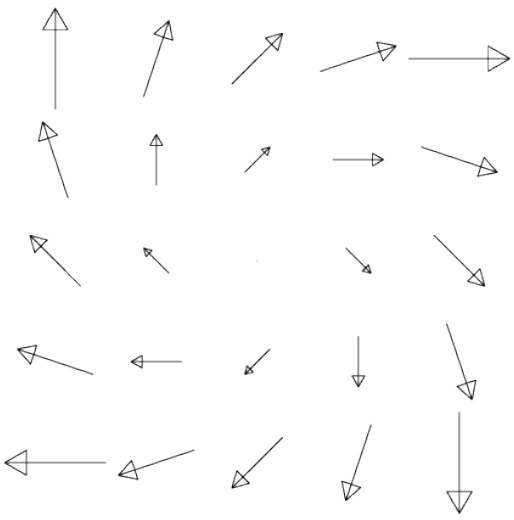
- Is $\oint \vec{\boldsymbol{F}} \cdot d\hat{\boldsymbol{r}}$ positive, negative, or zero?

- Will a paddlewheel spin if placed inside your loop, and, if so, which way?

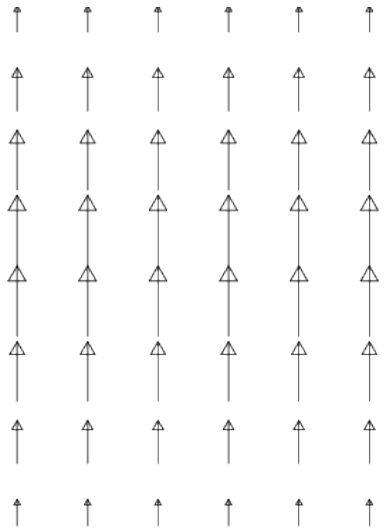
- Do you think $\nabla \times \vec{\boldsymbol{F}}$ is zero or nonzero inside your loop?
  Explain.
- Compute $\nabla \times \vec{\boldsymbol{F}}$. Did you guess right? *Explain.*
- Is $\oint \vec{\boldsymbol{F}} \cdot \hat{\boldsymbol{n}}\, ds$ positive, negative, or zero? ($\hat{\boldsymbol{n}}$ is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



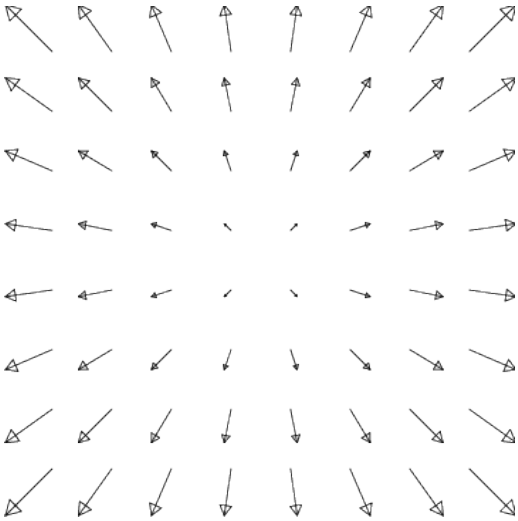
$-y\,\hat{\boldsymbol{x}} + x\,\hat{\boldsymbol{y}}$



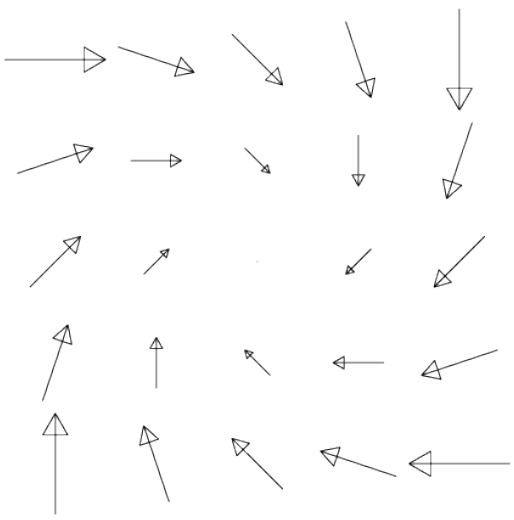
$(x+y)\,\hat{\boldsymbol{x}} + (y-x)\,\hat{\boldsymbol{y}}$



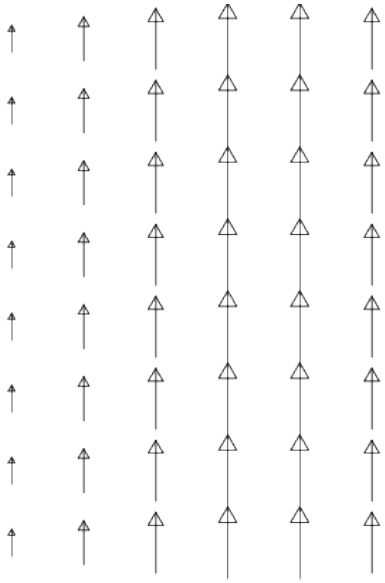
$e^{-y^2}\,\hat{\boldsymbol{y}}$



$x\,\hat{\boldsymbol{x}} + y\,\hat{\boldsymbol{y}}$



$(y-x)\,\hat{\boldsymbol{x}} - (x+y)\,\hat{\boldsymbol{y}}$



$e^{-x^2}\,\hat{\boldsymbol{y}}$