Recall FTC
- single & multivariable
  (for n=3 case, the surface integrals on p.3 Friday are missing their "dA"'s.)

* derive n = 2 div. thm (page 5 Friday).
  \[ \oint_C \mathbf{F} \cdot d\mathbf{r} = \iint_D \text{div}\mathbf{F} \, dA \]
  Test it for \( \mathbf{F} = (x, y) \), \( \mathbf{G} = (-y, x) \)

Notice — this theorem tells you what "divergence" is measuring!

\[ F = (x, y) \]

\[ G = (-y, x) \]
* derive $n=2$ Green's Thm (page 5 Fme).

Test it for $\vec{F} = \langle x, y \rangle$

$\vec{G} = \langle -y, x \rangle$

\[
\int \int_R Q_x - P_y \, dA = \oint_{\partial R} P \, dx + Q \, dy = \int_{\partial R} \overrightarrow{F} \cdot d\overrightarrow{s}
\]

Notice - this theorem tells you what scalar curl is measuring!
- Why the cross-partial condition $Q_x = P_y$ (in a rectangular domain) implies $\langle P, Q \rangle = \nabla f$ (page 6, Fnl.)

$n = 3$ div thm.

\[
\iiint_{\mathcal{R}} \text{div} \, \mathbf{F} \, dV = \iiint_{\partial \mathcal{R}} \mathbf{F} \cdot \mathbf{n} \, dA
\]

(see page 4, Fnl.)

Test it for $\mathbf{F} = <x, y, z>$

$\mathcal{R} =$ unit ball centered at origin.

$F = <x, y, z>$