1. Compute both div $\boldsymbol{F}$ and curl $\boldsymbol{F}$ in the case that $\boldsymbol{F} = \langle e^{xy}, \sin y, y \ln z \rangle$.

2. Let C denote the line from $(1, 1)$ to $(2, 3)$. Compute the line integrals

$$\int_C (x + y)\, ds, \qquad \int_C x\, dy.$$

3. Find the work done by the force field $\boldsymbol{F} = \langle -x, y \rangle$ while moving an object from $(1, 0)$ to $(0, 1)$ along the part of the unit circle that lies in the first quadrant.

4. Show that $\boldsymbol{F} = \langle 4x^3 - 4xy, 3y^2 - 2x^2 \rangle$ is conservative and find a potential function ϕ. Use this potential function to compute the line integral

$$\int_{(1,1)}^{(2,2)} \boldsymbol{F} \cdot d\boldsymbol{r}.$$