Problem #1. Evaluate
\[ \iint_{R} \frac{yx}{y^2 + 2} \, dy \, dx \]
where \( R = [0, 2] \times [-1, 1] \).

Problem #2. Integrate \( f(x, y, z) = ze^{x^2+y^2} \) over the cylinder \( S \) defined by \( x^2 + y^2 \leq 4 \) and \( 2 \leq z \leq 3 \).

Problem #3. Find the volume of the region \( V \) given by \( z \leq 6 - x^2 - y^2 \) and \( z \geq \sqrt{x^2 + y^2} \).

Problem #4. Evaluate
\[ \int_{\tau} x\cos(z) \, ds \]
where \( \tau(t) = (t, t^2, 0) \) and \( t \in [0, 1] \).

Problem #5. Evaluate
\[ \int_{C} y^2 \, dx + 2xy \, dy \]
where \( C \) is the unit circle oriented counterclockwise.

Problem #6. Find a parametrization \( \Phi : D \to \mathbb{R}^3 \) of the surface \( S \subset \mathbb{R}^3 \) defined by:
\[ x^2 + y^2/2 + z^2/3 = 1, \]
for some region \( D \subset \mathbb{R}^2 \).

Problem #7. Evaluate
\[ \iint_{S} z \, dA \]
over the surface \( S \) defined by \( x^2 + y^2 \leq 1 \) and \( z = x^2 + y^2 \).

Problem #8. Evaluate
\[ \iint_{S} 2xdx - 2ydy + z^2 \, dz \]
where \( S = x^2 + y^2 = 4 \) and \( 0 \leq z \leq 1 \) is oriented outwards.
Problem #9. Use Green’s theorem to evaluate:
\[ \int_C x \, dx + y \, dy \]
where \( C \) is the boundary of the square \([-1, 1] \times [-1, 1]\) oriented counterclockwise.

Problem #10. Evaluate
\[ \iint_S \nabla \times \mathbf{F} \cdot d\mathbf{A} \]
using Stokes’ theorem, where \( \mathbf{F}(x, y, z) = (y, -x, zx^3 y^2) \) and \( S \) is the surface defined by the equations: \( x^2 + y^2 + z^2 = 1 \), \( z \leq 0 \), and oriented upwards.

Problem #11. Let \( V \subset \mathbb{R}^3 \) be the region \( x^2 + y^2 \leq z \leq 1 \). Evaluate
\[ \iint_{\partial V} (y, z, xz) \cdot d\mathbf{A} \]
using Gauss’s theorem.