1. (Spring 2011) Evaluate
\[ \int_C xy^3 dx + 3x^2y^2 dy \]
where \( C \) is the boundary of the region in the first quadrant enclosed by the x-axis, the line \( x = 1 \) and the curve \( y = x^3 \), traversed counter-clockwise.

2. (Fall 2010) Find the value of the line integral \( I = \int_C (x^2+y)dx + (y^2-x)dy \) where \( C \) is the triangle with vertices \((x,y) = (0,0), (3,0), (0,4)\) traversed counterclockwise.

3. (Fall 2011) Evaluate the integral
\[ \int_C \left( y + \sin\left( e^{x^2} \right) \right) \, dx - 2xdy, \]
where \( C \) is the circle \( x^2 + y^2 = 1 \) traversed counterclockwise.

4. Use Green’s theorem to evaluate the integral
\[ \oint_C (3ydx + 2xdy) \]
where \( C \) is the boundary of \( 0 \leq x \leq \pi, 0 \leq y \leq \sin x \).

5. (Fall 2013) Use Green’s theorem to evaluate the line integral \( \int_C \mathbf{F} \cdot d\mathbf{r} \) where
\[ \mathbf{F} = \left( e^{y^2} - 2y \right) \mathbf{i} + \left( 2x ye^{y^2} + \sin(y^2) \right) \mathbf{j} \]
and \( C \) goes along a straight line from \((0,0)\) to \((1,2)\) and continues along a straight line to \((3,0)\).

6. (Fall 2003) Find the surface area of that portion of the paraboloid \( z = 4 - x^2 - y^2 \) that is above the plane \( z = 1 \).

7. Find the surface area of the portion of the paraboloid \( y = x^2 + z^2 \) that is between the planes \( y = 1 \) and \( y = 4 \).

8. The rectangular coordinate equation \( z = \sqrt{x^2 + y^2} \) represents the cone \( \phi = \frac{\pi}{4} \). Find the area of the surface cut from the hemisphere \( x^2 + y^2 + z^2 = 2, z \geq 0 \) by the cone \( z = \sqrt{x^2 + y^2} \).

9. Let \( S \) be the part of the paraboloid \( z = 17 - x^2 - y^2 \) lying above the plane \( z = 1 \), oriented with normal vector pointing downward. Compute the flux of \( \nabla \times \mathbf{F} \) across \( S \), where \( \mathbf{F} \) is the vector field \( \mathbf{F} = (-yz, xz^2, xyz) \).
**Hint:** Use Stokes’ theorem.
10. Let $C$ be the curve which is the boundary of the square $1 \leq x \leq 2$, $2 \leq y \leq 3$. Use the surface integral in Stokes’ theorem to calculate the line integral of the vector field $\vec{F} = (y^2 + z^2)\hat{i} + (x^2 + y^2)\hat{j} + (x^2 + y^2)\hat{k}$ over the curve $C$ traversed counterclockwise when viewed from above.