1. Compute \( \int_c [(y-x)i + x^4y^3j] \cdot ds \) where \( c(t) = (t^2, t^3) \) for \(-1 \leq t \leq 1\).

2. Let \( F = xi + yj - zk \) and \( c(t) = (t, 3t^2, 2t^3) \). Compute \( \int_c F \cdot dS \) for \(-1 \leq t \leq 1\).

3. Let \( F = yi - xj \) and \( c(t) = (\cos t, \sin t) \). Compute \( \int_c F \cdot dS \) for \( 0 \leq t \leq 2\pi \).

4. Let \( F = yi - x^2j \). Compute \( \int_c F \cdot dS \) where \( c \) is the boundary of the square with vertices \((0,0), (0,2), (2,0), \) and \((2,2)\). USE A LINE INTEGRAL!
5. Let \( F = yi - x^2j \). Verify Green’s theorem over the square with vertices \((0, 0), (0, 2), (2, 0),\) and \((2, 2)\).

6. Use Green’s theorem to find the area between the circle \( x^2 + y^2 = 9 \) and the ellipse \( \frac{x^2}{4} + \frac{y^2}{9} = 4 \).

7. Let \( F = (x^2y + x)i + (y^3 - xy^2)j = M(x, y)i + N(x, y)j \). Verify Green’s theorem by computing both

\[
\oint_{\partial D} M \, dx + N \, dy \quad \text{and} \quad \iint_{D} (N_x - M_y) \, dA
\]

where \( D \) is the region bounded by \( y = \sqrt{x} \) and \( x = 4 \).
In-Class Examples

1. Compute $\int_c (xi + yj) \cdot ds$ where $c(t) = (2t + 1, t + 2)$ for $0 \leq t \leq 1$.

2. Let $F = xyi + y^2j$ and let $D$ be the region bounded by the line $y = x$ and the parabola $y = x^2$. Verify Green’s theorem here. (Textbook p. 429)

3. Let $D$ be the rectangle with vertices $(0, 0), (0, 1), (2, 0)$ and $(2, 1)$ and $F = 2yi + 2xyj$. Verify Green’s Theorem here.

4. Let $a$ be a positive constant. Use Green’s theorem to calculate the area under one arch of the cycloid

$$x = a(t - \sin t) \quad y = a(1 - \cos t)$$