3.1 Find the flux of $F = (x, y, 1)$ through the surface parameterized by $s : D \to \mathbb{R}^3$, $s(u, v) = (e^u, e^v, uv)$, oriented upwards, where

$$D = \{(u, v) \in \mathbb{R}^2 : 0 \leq v \leq 1, 0 \leq u + v \leq 1\}.$$

3.2 Find the flux of the curl of $F = (e^{x^2+y^2+z^2}, (x^2 - 1) \sin(y), y + z)$ through the surface given by $y^2 + z^2 = 1$, $-1 \leq x \leq 1$, oriented outwards. [Hint: You will need to compute two integrals].

3.3 Evaluate $\int_C \ln(x^2 + 1)dx + xzd\gamma - e^\gamma dz$, where $C$ is the boundary of the surface $y^3 = x^2 + z^2$, $0 \leq y \leq 1$. [Hint: Think about which surface to integrate over].

3.4 Section 9.14, ex 8.

3.5 (Final exam, Fall 2011) Let $S$ be the square with vertices

$$\begin{align*}
(1, 0, 0), & \quad (0, 1, 0), & \quad (0, 1, \sqrt{2}), & \quad (1, 0, \sqrt{2}),
\end{align*}$$

and let $C$ be the boundary of $S$, traversed in this order of vertices.

Let $W$ be the vector field $W = zi + xj + yk$.

Find the value of the integral $I = \int_C W \cdot d\mathbf{r} = \int_C zdx + xdy + ydz$.

3.6 (Final exam, Fall 2010) Compute

$$\int\int_S \text{curl} F \cdot \mathbf{n} \, dS$$

where

$$F = xzi + (zy - 2y)j + y^2zk$$

and $S$ is the cone $z^2 = x^2 + y^2$ with $0 \leq z \leq 2$ and $\mathbf{n}$ the outward (i.e. downward pointing) normal.

3.7 Section 9.8, ex 22.

3.8 Evaluate $\int_C(y + \sin(x))dx + (2x - \cos(y))dy$, where $C$ is the circle $(x - 1)^2 + (y - 3)^2 = 4$, positively oriented.