1. Let $F(x, y) = \nabla(e^{xy} + x^5 \sin(y^4 \cdot \pi))$. Let $c(t) = (t^3, 1 - t^2), t \in [0, 1]$. Find $\int_{c(t)} F \, ds$.

2. Let $F(x, y) = (xy, x + y)$. Let $c(t) = (t, 0), t \in [0, 2]$ and $d(t) = (t, 1 - (t - 1)^2), t \in [0, 2]$. Compute the line integrals $\int_c F \cdot ds$ and $\int_d F \cdot ds$. Compare the results and explain why $F$ is not $\nabla f$ for some function $f$.

3. Let $C$ be the triangle given by $A = (0, 0), B = (0, 1), C = (1, 1)$. View $C$ as a directed simple curve with counterclockwise orientation. Compute $\int_C F \cdot ds$ with $F(x, y) = \nabla f(x, y)$ where $f(x, y) = e^{\sqrt{xy}} \sin(x \cos(y))$.

4. p. 449, problems 14, 16.

5. Find a parametrization of the part of the sphere of radius 3 which lies to the left of the $xz$–plane. (The choice of the two variables and the choice of $\Phi$ should be fairly straightforward, but make sure you get the domain of the variables right).

6. Let $C$ be the ‘infinite’ cylinder of radius 2 around the $z$–axis. Now let $S$ be the surface given by cutting $C$ along the planes $z = 3$ and $z = x$. Find a parametrization of $S$.

7. Let $S$ be the part of the graph of $z = x^2 + y^2 - 4$ which lies below the $z$–axis. Find a parametrization for $S$.

8. Let $S$ be the triangle given by the points $P = (0, 0, 1), Q = (2, 3, 1)$ and the origin. Find a parametrization for $S$.

9. p. 459, problems 1, 2 (hint: first find the $u, v$ which give you the point)

10. p. 459, problems 5, 7

11. p. 459, problem 13 (a) – (c)

12. p. 459, problem 14 (for (b) and (c) recall methods from previous chapters),