Problem 1 *(75)Let S be a compact surface with no boundary. Suppose that p is the point on S where the maximum of x value occurs. What can we say about the sign of the Gauss curvature is at p? (No proof needed)*

Problem 2 *(125)Let $(u,v) \mapsto R \subset S^2$ be a parameterization of a piece of the sphere containing the north pole. Argue that there it is impossible to have $E = 1$, $G = v^2$ and $F = 0$.*

Problem 3 *(100)Consider the surface arising as the graph of $z = \sqrt{1-x^2}$ for $|x| < 1$. Try to find a parameterization of this surface so that $E = 1 = G$ and $F = 0$.*

Problem 4 *(100)Find a parameterization of any part of the plane $\{z = 0\}$ so that $F < 0$ at some points and $F > 0$ at other points.*

Problem 5 *(150)Consider the graph of the function $z = 2 + \sin(x)$ rotated around the x-axis. Give a point on S with negative Gauss curvature. Give a point on S with positive Gauss curvature. Give an example of a geodesic in S.*

Problem 6 *(150)Consider the the surface $z = xy$, parameterized by (u, v, uv). Find the Christoffel symbols. The curve (t, t, t^2) is parameterized in (u,v) coordinates by $\alpha(t) = (t,t)$. Using Christoffel symbols, compute the covariant derivative of $\alpha'(t)$ with respect to the surface S. Is $\alpha(t)$ a parameterized geodesic? Is the curve traced out by α a geodesic?*

Problem 7 *(100)Give an example of a line of curvature that is not a geodesic.*

Problem 8 *(125)Consider the surface defined by*

$$z = \cosh x$$

rotated around the x axis, for some positive valued function f Find the geodesic curvature k_g of the curve defined by $x = T$ as a function of T.