Submit full answers to the Required Problems. Remember to use complete sentences and proper grammar when writing a solution. Include sketches wherever appropriate.

**Required Problems**

G&P section 1.1: 4, 12, 18

For 12 on *stereographic projection*, you should derive the following formulas. If \((x, y, z)\) is a point on the sphere, show that

\[
\pi(x, y, z) = \left( \frac{x}{1 - z}, \frac{y}{1 - z} \right).
\]

Show that the inverse map \(\pi^{-1}\) applied to a point \((u, v)\) in the plane satisfies

\[
\pi^{-1}(u, v) = \left( \frac{2u}{u^2 + v^2 + 1}, \frac{2v}{u^2 + v^2 + 1}, \frac{u^2 + v^2 - 1}{u^2 + v^2 + 1} \right).
\]

*n.b.*, there are typos in problems 4 and 18. In 4, the ball \(B_a = \{ x : |x| < a \}\). In 18, the function \(g(x) = f(x - a)f(b - x)\).

**Additional Problems** – you may submit these for feedback; if you do, please indicate on the top of your first page. We will discuss these in the problem session.

G&P section 1.1: 3, 8, 9, 11