

## Level Surfaces and Quadric Surfaces- HW Problems

1. Prove that the following surfaces are smooth surfaces:

a.  $\frac{x^2}{p^2} + \frac{y^2}{q^2} + \frac{z^2}{r^2} = 1$ ; (ellipsoid)

b.  $z = \frac{x^2}{p^2} - \frac{y^2}{q^2}$ ; (hyperbolic paraboloid)

c.  $\frac{x^2}{p^2} + \frac{y^2}{q^2} = 1$  (elliptic cylinder)

d.  $\{(x, y, z) \in \mathbb{R}^3 \mid x^2 + y^2 + z^4 = 1\}$

2. Identify the following quadric surfaces by putting the equations in standard form:

a.  $x^2 - y^2 - 2x - z + 1 = 0$

b.  $\vec{\Phi}(u, v) = (u \sin(2v), u, u \cos(2v))$

c.  $\vec{\Phi}(u, v) = (2 \sin(u), v, 2 \cos(u))$

d.  $\vec{\Phi}(u, v) = (\sinh^2 u, (\sinh(u)) \sinh(v), (\sinh(u)) \cosh(v))$ .