

Math 4452: Math Modeling Assignment 2 Due: Feb 12 2002

- (30) 1. **Visualizing Lagrange Multipliers** You are given the function

$$f(x, y, z) = x^2 + y^3 - z^4$$

subject to the constraint

$$g(x, y, z) = x^2 + y^2 + z^2 = 1.$$

Find the maximum and minimum values, and the points which produce them, using the method of Lagrange Multipliers.

Construct diagrams representing this situation in terms of *level surfaces*. A level surface is the same concept as a level curve (or contour plot), only in three dimensions. You may find the *Mathematica* command `ContourPlot3D` helpful.

Describe your diagrams, including how the coordinates (x, y, z) of the maximum and minimum can be determined from the diagrams, and what the extraneous points (the points not relating to a max or a min) you found when you performed the Lagrange multiplier method mean.

- (40) 2. **Modeling with Lagrange Multipliers** Problem 2.5.10 from the text.
- (30) 3. **Modeling with Numerical Methods** Problem 3.5.7 from the text. You can use random numbers and `FindRoot` or `FindMinimum` in *Mathematica* instead of Newton's method. This should give you a good comparison of analytical and numerical methods.