First Examination
Tuesday, February 4, 2003

Instructions: This exam should be done on your own paper. Your name should be on each sheet and on the back of the last sheet; the answers should appear written carefully and in order. If in doubt, show intermediate steps: Full credit may not be given, even for correct answers, unless work is arranged clearly and explained. This exam is closed book. You may leave after handing in your exam paper, but be sure to check your answers carefully. Each entire problem is worth 30 points, while 10 points are free.

1. Consider the function \( f(x, y) = x^2 - y^2 \).
   
   (a) Draw cross sections of this function for \( x = -1, \) \( x = 0, \) and \( x = 1 \).
   
   (b) Draw cross sections of this function for \( y = -1, \) \( y = 0, \) and \( y = 1 \).
   
   (c) Using these cross-sections, sketch a rough graph of the function. Describe the shape of the graph.

![Figure 1: The figure for problem 2](image)

2. Which of the following functions does the surface in Figure 1 represent? Explain fully why you chose the function you did.
   
   a) \( f(x, y) = x^2 + y^2 \)  
   b) \( f(x, y) = x^2 \sin(y) \)  
   c) \( f(x, y) = x + y \)  
   d) \( f(x, y) = e^x - e^y \)  
   e) \( f(x, y) = x^2 + \sin(y) \)  
   f) \( f(x, y) = x^2 \cos(y) \)

3. Draw contours \( f(x, y) = c \) at levels \( c = 0, \) \( c = 1, \) and \( c = 2, \) for the function

   \[ f(x, y) = x^2 + y^2 / 4. \]

   Describe the shape of the function surface.