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. You may keep this exam sheet. Each entire problem is worth 30 points, while 10 points are free.

1. Write down two functions the union of whose graphs consists of the level surface $x^2 + y^2 + z^2 - 1 = 0$.

2. Explain why each of the following functions does or does not have a limit at $(x, y) = (0, 0)$. Make sure your explanation is careful and complete. Also, if the function has a limit, state what it is.
   
   (a) $f(x, y) = \frac{x^3 - y^3}{x - y}$
   
   (b) $f(x, y) = \frac{x^2 + y^2}{x^2 - y^2}$

3. Suppose a car travelling northeast encounters a wind from the north that applies 250 pounds of force to the car.
   
   (a) Draw a diagram of the wind and the car’s motion, labelling all relevant quantities.
   
   (b) How much work does the car’s engine do to counteract the wind, if the car travels 200 miles? Use vectors to answer this question Hint: Work, using the British system, is usually given in foot-pounds. One mile is 5280 feet.

4. Use a cross product to find an equation of the plane through $(1, 2, 3)$, $(0, 1, 0)$ and $(0, 0, 1)$. Put the equation into standard form.