

**Math 335-002 \* Spring 2015 \* Homework #3**

Due date: Thursday, February 12, 2015

Please show all work in detail to receive full credit

1. Consider the surface  $x^2 - y^2 + z^2 = 4$ 
  - a) Sketch the surface “traces” (cross-sections)  $x=0$ ,  $x=\pm 1$ ,  $x=\pm 2$
  - b) Sketch the surface “traces” (cross-sections)  $y=0$ ,  $y=\pm 1$ ,  $y=\pm 2$
  - c) Sketch the surface “traces” (cross-sections)  $z=0$ ,  $z=\pm 1$ ,  $z=\pm 2$
  - d) Put together results of (a-c) to sketch this surface in 3D (it doesn't have to be artistically neat, jut make a rough sketch)
  
2. Consider the function (“scalar field”)  $F(x, y) = -\ln(x^2 + y^2)$ 
  - a) Find its domain and range
  - b) Find the following partial derivatives:  $F_x$ ,  $F_y$ ,  $F_{xx}$ ,  $F_{yy}$ ,  $F_{xy}$
  - c) Is this function smooth over its entire domain of definition?
  - d) Sketch the surface  $z = F(x, y)$  (hint: it's easier than it may seem).
  
3. Find the following limits, if they exist; if the limit does not exist, indicate why:
  - a)  $\lim_{(x,y) \rightarrow (0,1)} \frac{xy}{x^4 + y^4}$  note that this is the limit at (0,1), not the origin
  - b)  $\lim_{(x,y) \rightarrow (0,0)} \frac{x^4 - x^2 y^2}{x^2 + x^2 y^2}$
  - c)  $\lim_{(x,y) \rightarrow (0,0)} \frac{1 - \cos(xy)}{(xy)^2}$
  - d)  $\lim_{(x,y) \rightarrow (0,0)} \frac{xy}{x^2 + y^2}$

