MATH 241 Calculus III Spring 2023 Groupwork 4: Sections 13.1-13.4

You should work on and discuss this worksheet with members of your group. Your TA will assist as needed. Turn in your solutions either on this sheet or a separate sheet of paper. Be sure to include your name!

- 1. For the surface $f(x, y) = x^2 y$, sketch in one graph the level curves corresponding to c = -2, -1, 0, 1, 2. Describe in words what the surface of f looks like. [You can try to sketch it as well.]
- 2. If $f(x,y) = x^3 + x^2y^3 2y^2$, find $f_x(2,1)$ and $f_y(2,1)$. Interpret these numbers as slopes. Then compute all of the second derivatives f_{xx} , f_{yy} , f_{xy} , f_{yx} .
- 3. If $f(x,y) = \sin(2x+3y)$, calculate $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$.
- 4. Find $\partial z/\partial x$ if $x^2 + y^2 + z^2 = 3xyz$. [Note in order to find a partial *x*-derivative of *z*, we are considering z = z(x, y) here.]
- 5. Show that any function of the form z = f(x + at) + g(x at) is a solution of the *wave* equation

$$z_{tt} = a^2 z_{xx}.$$

This equation models waves such as a vibrating guitar string. Hint: Let u = x + at, v = x - at.