Mathematics 221 Fall Project 4

Due October 1

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Name

Directions: Be sure to follow the guidelines for writing up projects as specified in the course information sheet (passed out on the first day of class). Whenever appropriate, use in-line citations, including page numbers and people consulted when you present information obtained from discussion, a text, notes, or technology. **Only write on one side of each page.**
"*Personally, I'm always ready to learn, although I do not always like being taught.*" – Winston Churchill

Project Description

Do both of the following.

1. Show that the function $z = xe^y + ye^x$ is a solution of the partial differential equation

$$\frac{\partial^3 z}{\partial x^3} + \frac{\partial^3 z}{\partial y^3} = x\frac{\partial^3 z}{\partial x \partial y^2} + y\frac{\partial^3 z}{\partial^2 x \partial y}.$$

2. If f and all of its partial derivatives are continuous and satisfy the inequalities below, describe the shape of the surface that is the graph of $z = f(x, y)$ near $(a, b, f(a, b))$ as completely as you can.

$$\begin{aligned} f_x(a,b) &> 0 \\ f_y(a,b) &< 0 \\ f_{xx}(a,b) &< 0 \\ f_{xy}(a,b) &> 0 \\ f_{yy}(a,b) &> 0. \end{aligned}$$