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.

\[
\begin{align*}
f_x(a, b) &> 0 \\
f_y(a, b) &< 0 \\
f_{xx}(a, b) &< 0 \\
f_{xy}(a, b) &> 0 \\
f_{yy}(a, b) &> 0.
\end{align*}
\]