Math 126 Homework hints

Note: As I’m sure you’ve all seen in section, I make mistakes too! I can’t guarantee that everything here will be right 100% of the time. If you think there’s an error in something, please e-mail me and I’ll try to get a correction up. Same goes for any clarification or further questions; if I’ve made something even more confusing, please e-mail or come to office hours to clear it up!

14.7

Problem 4: Find the local maximum and minimum values and saddle point(s) of the function. If you have three-dimensional graphing software, graph the function with a domain and viewpoint that reveal all the important aspects of the function. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

\[ f(x, y) = 2e^x \cos y \]

When you hear local maximum, local minimum, or saddle point, your mind should immediately go to finding critical points. Once we have all of the critical points, look at the second derivatives to classify what kind each one is. How do we find critical points? First compute the partial derivatives in the standard way, treating the variable with respect to which we are not taking a derivative as a constant. That is:

\[ f_x(x, y) = 2e^x \cos y, \text{ since the derivative of } e^x \text{ is itself and we treat } 2 \cos y \text{ as a constant.} \]

\[ f_y(x, y) = -2e^x \sin y, \text{ since the derivative of } \cos y \text{ is } -\sin y \text{ and we treat } 2e^x \text{ as a constant.} \]

Critical points occur when both \( f_x \) and \( f_y \) are zero. When will this occur? Since \( e^x \) is never zero, it will depend entirely on the \( y \) values. But \( \cos y \) is zero if and only if \( y \) is of the form \( \pi/2 + \pi k \) for some integer \( k \), and \( \sin y \) is zero if and only if \( y \) is of the form \( \pi k \) for some integer \( k \). Can there every be a \( y \)-value that satisfies both of these conditions? What does this tell us about critical points (and therefore the local max/min’s and saddle points)?