1. (7) (a). In the figure below, \( B(8, 42, 0) \) and for all \((x, y), x \leq 8, y \geq 42\), the function value is 0 (namely the function is all zero on the left-upper corner of \( B \)). For points \( A, B, C, D, E \), classify them into local maxima, local minima and saddle points (Hint: a global maximum is definitely a local maximum).

(b). Suppose the gradient of \( f \) exists everywhere. Mark true or false for the following. No need to explain.

- If \( \nabla f(a, b) = 0 \), \((a, b)\) is either a local maximum or a local minimum.
- If \( f \) achieves the global maximum at \((a, b)\), \( f_x(a, b) = 0, f_y(a, b) = 0 \).
- If \( f \) achieves the global minimum at \((a, b)\) which is an interior point, then \( \nabla f(a, b) = 0 \).
- If \((a, b)\) is an interior local maximum and \((x(t), y(t))\) is a parametrized smooth curve so that \( x(1) = a, y(1) = b \), then \( g(t) = f(x(t), y(t)) \) has a local maximum at \( t = 1 \) and \( g'(1) = 0 \).

2. (3) Find all critical points for \( f(x, y) = xy e^{-x-y} \).