1. Consider the function \( f(x, y) = x^2y + e^{x-y} \) for parts (a), (b), (c) and (d).

(a) Compute \( f_x, f_y, f_{xy} \) and \( f_{yx} \).

(b) Compute the equation of the tangent plane to the graph of \( z = f(x, y) \) at \((2, 2, 9)\).

(c) Use the previous part to approximate \( f(2.1, 1.9) \).
(d) Find a point \((a, b, c)\) in the graph of \(z = f(x, y)\) such that its tangent plane has the equation \(3x - z = 1\). Hint: there is a solution such that \(a = 1\).

2. (a) You maneuver a spaceship in a three dimensional space. At time \(t\) the position of the spaceship is given by the vector \(\langle x(t), y(t), z(t) \rangle\). A proton star at the origin emits radiation in such a way that the perceived radiation at a point in space is given by the equation \(R(x, y, z) = e^{-(x^2 + y^2 + z^2)}\).
Assume that at time \(t = 0\) the position of the spaceship is \(\langle x(0), y(0), z(0) \rangle = \langle 1, 1, 1 \rangle\) and that its velocity is \(\langle x'(0), y'(0), z'(0) \rangle = \langle 1, 2, -4 \rangle\). Determine the rate of change of the perceived radiation by the spaceship at time \(t = 0\).

(b) (Bonus marks) Construct an example of a function \(f(x, y)\) such that every level curve is a single line of the form \(c = 2x + y\) for some \(c \in \mathbb{R}\) but whose graph is NOT a plane.
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