1. Find all critical points of $f(x, y) = xy + \frac{2}{x} + \frac{4}{y}$. Do NOT classify them.

2. Suppose that $(0, -2)$ is a critical point of an everywhere differentiable function $f(x, y)$ with

$$f(0, -2) = -2, \quad f_{xx}(0, -2) = -1, \quad f_{xy}(0, -2) = 2, \quad f_{yy}(0, -2) = -5.$$ 

Determine whether $(0, -2)$ is a local maximum, local minimum, or saddle point of $f$. Explain your answer.
3. Let \( f(x, y) = x - y \). The constraint \( g(x, y) = 3 \) is sketched in the image below. On the image, indicate the point where \( f \) will have a global maximum subject to the constraint \( g(x, y) = 3 \). Briefly justify your choice.