

YOUR NAME: \_\_\_\_\_

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Read each problem **very carefully** before starting to solve it. Each problem is worth 5 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. (a) Use the chain rule to compute  $\frac{\partial f}{\partial s}$  if  $f(x, y, z) = x^3 + yz^2$  and

$$x = s^2 + t, \quad y = s + t^2, \quad z = st.$$

Express your answer exclusively in terms of  $s, t$ .

- (b) Use implicit differentiation to calculate  $\frac{\partial z}{\partial y}$  if  $e^{xy} + \sin(xz) + y = 0$ .

2. Find the points  $(x, y)$ , where the function

$$f(x, y) = y^3 - 3y^2 - 12xy - x^2$$

has relative extrema or saddle points and identify the type of points.

