

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. Consider the function

$$f(x, y) = \sqrt{y - x} \ln(x - y^2).$$

Find the domain of  $f(x, y)$ . Then write it in **formal notation** and graph it on the  $xy$ -plane.

2. Show that the limit

$$\lim_{(x,y) \rightarrow (0,0)} \frac{xy^4}{x^2 + y^8}$$

does not exist. Please provide **all details**.

3. Calculate the partial derivatives of the following functions:

(a)  $\frac{\partial f}{\partial x}$  if  $f(x, y) = \sqrt{9 - x^2 - y^2}$ .

(b)  $\frac{\partial g}{\partial y}$  if  $g(x, y) = e^{\sqrt{x^2 + y^2}}$ .

(c)  $\frac{\partial h}{\partial z}$  if  $h(x, y, z) = \frac{x}{y + z}$ .