

Show all work. 5 points each.

1. Find the natural domain of  $f(x, y) = \ln \sqrt{x^2 - y}$  and determine if it is open, closed or neither.

2. Use the chain rule to find  $\left[ \mathbf{D}(\mathbf{g} \circ f) \begin{pmatrix} a \\ b \\ c \end{pmatrix} \right]$  with  $f \begin{pmatrix} a \\ b \\ c \end{pmatrix} = x^2 + y^2 + 2z^2$  and  $\mathbf{g}(t) = \begin{pmatrix} t \\ t^2 \\ t^3 \end{pmatrix}$