3. (8 pts.) Prove that the following limit does not exist.

\[
\lim_{{(x,y) \to (0,0)}} \frac{x^2 - y^2}{x^2 + y^2}
\]

**Path 1**  \( x = 0, y = t \)

\[
\lim_{{t \to 0}} \frac{0 - t^2}{0 + t^2} = -1
\]

**Path 2**  \( x = t, y = 0 \)

\[
\lim_{{t \to 0}} \frac{t^2 - 0}{t^2 + 0} = 1
\]

Since limits disagree, full limit DNE.