1. [6 Points] a. Use the Two Path Test to show the following limit does not exist.

\[
\lim_{(x,y) \to (0,0)} \frac{x^4 + 2xy^3 + y^4}{x^4 + y^4}.
\]

Approaching \((0,0)\) along the \(x\)-axis, we have

\[
\lim_{x \to 0} f(x,0) = \lim_{x \to 0} \frac{x^4}{x^4} = 1.
\]

Approaching \((0,0)\) along the line \(y = x\), we have

\[
\lim_{x \to 0} f(x,x) = \lim_{x \to 0} \frac{x^4 + 2x^4 + x^4}{x^4 + x^4} = \lim_{x \to 0} \frac{4x^4}{2x^4} = 2.
\]

Since the limits are different for different paths,

\[
\lim_{(x,y) \to (0,0)} f(x,y)
\]

does not exist.

b. At what points of \(\mathbb{R}^2\) is the previous function continuous?

\(f\) is continuous everywhere except the origin.
2. [4 Points] Find the first partial derivatives of the following function.

\[ w(x, y, z) = \sqrt{x + 6y \tan (yz)} \]

\[ \frac{\partial w}{\partial x} = \frac{1}{2 \sqrt{x+6y}} \tan yz \]

\[ \frac{\partial w}{\partial y} = \frac{6}{2 \sqrt{x+6y}} \tan yz + \frac{z}{\sqrt{x+6y}} \sec^2(yz) \]

\[ \frac{\partial w}{\partial z} = y \sqrt{x+6y} \sec^2(yz) \]