Math 2263
Check-up 2
14.1 - 14.6

There are three questions, all referring to the function

\[ f(x, y) = \cos(x + y) \sin(x - y). \]

1. Find an equation for the plane that is tangent to the graph of \( f \) when \( (x, y) = \left( \frac{\pi}{4}, \frac{\pi}{2} \right) \).

2. Find the directional derivative of \( f \) at the point \( (x, y) = \left( \frac{\pi}{2}, \pi \right) \) in the direction of the vector \( (2, 3) \).
3. Now suppose additionally that \( x \) and \( y \) are functions of \( s \) and \( t \):

\[
x(s, t) = \pi st
\]

and

\[
y(s, t) = \pi(s + t)
\]

and that \( s \) and \( t \) are functions of \( u \) and \( v \):

\[
s(u, v) = u^2 v
\]

and

\[
t(u, v) = uv^2.
\]

Use the chain rule to find the value of \( \frac{\partial f}{\partial u} \) at \((u, v) = (2, 1)\).