(1) Use the limit definition of the partial derivative to find \( \frac{\partial f}{\partial x} \) if \( f(x, y) = x^2 y \).

\[
\lim_{h \to 0} \frac{f(x + h, y) - f(x, y)}{h} = \lim_{h \to 0} \frac{(x + h)^2 y - x^2 y}{h} = \lim_{h \to 0} \frac{x^2 + 2xh + h^2 - x^2}{h} = \lim_{h \to 0} \frac{2xh + h^2}{h} = \lim_{h \to 0} 2xy + y^0 = 2xy
\]

(2) Let \( g(x, y, z) = \sin(xyz) - x^2 y + yze^z x^2 \)

(a) Find \( \frac{\partial g}{\partial x} \).

\[
\frac{\partial g}{\partial x} = yz \cos(xyz) + 2xy + 2xye^z x^2
\]

(b) Find \( \frac{\partial g}{\partial y} \).

\[
\frac{\partial g}{\partial y} = xz \cos(xyz) - x^2 + x^2 z e^z
\]

(c) Find \( \frac{\partial g}{\partial z} \).

\[
\frac{\partial g}{\partial z} = xy \cos(xyz) + x^2 y e^z + x^2 y z e^z
\]

(3) Let \( f(x, y, z) = \frac{x}{y + z} \).

(a) Find \( f_z(3, 2, 1) \).

\[
f_z(3, 2, 1) = -x/(y + z)^2|_{(3, 2, 1)} = -1/3
\]

(b) Find \( \nabla f \).

\[
\nabla f = \left( \frac{-x}{x+y}, \frac{-x}{(y+z)^2}, \frac{-x}{(y+z)^2} \right)
\]

(4) Find the equation of the tangent plane of the surface \( z = e^{x^2-y^2} \) at the point \((1, -1, 1)\).

\[
z = x - y - 1
\]

(5) Use linear approximation to estimate the value of \( \sqrt{20 - (1.95)^2 - (1.08)^2} \).

(6) A particle’s position at time \( t \) is \( (te^t, 2t^5, 1/(2t + 1)) \).

(a) What is the particle’s velocity at time 0?

\[
(e^t + te^t, 10t^4, -2/(2t + 1)^2)|_{t=0} = (1, 0, -2)
\]

(b) What is the particle’s acceleration at time 0?

\[
(2e^t + te^t, 40t^3, 8/(2t + 1)^3)|_{t=0} = (2, 0, 8)
\]