1. Find all partial derivatives for each of the following functions:

(a) \( f(x, y) = x^2 y^3 + \frac{y}{x} \)

(b) \( g(s, t) = \frac{s^2}{s^2 + t^2} \)

(c) \( h(u, v) = \ln(1 + u^2 + v^2) \)

(d) \( f(x, y) = e^{x-y} \)

(e) \( V(r, h) = \frac{1}{3} \pi r^2 h \)

(f) \( f(x, y, z) = \sin(x + y) \sin(y) - \cos(z^2) \)
2. Find the indicated higher order partial derivatives:

(a) For \( f(x, y) = x^2 + 2y^2 + xy \), find \( f_{xx}(x, y) \), \( f_{xy}(x, y) \) and \( f_{yy}(x, y) \).

(b) For \( z = \ln \left(\frac{x+1}{y}\right) \), find \( \frac{\partial^2 z}{\partial x^2} \), \( \frac{\partial^2 z}{\partial x \partial y} \), and \( \frac{\partial^2 z}{\partial y^2} \).

3. Verify that the function \( u(x, y) = e^x \cos y \) satisfies the “Laplace equation” \( u_{xx}(x, y) + u_{yy}(x, y) = 0 \) for all \( x \) and \( y \).