1. Find $\frac{\partial^3 f}{\partial x^2 \partial y}$ of

$$f(x, y) = \sin(xy)$$

Solution:

$$f(x, y) = \sin(xy)$$
$$\frac{\partial f}{\partial y} f(x, y) = x \cos(xy)$$
$$\frac{\partial^2 f}{\partial x \partial y} f(x, y) = -xy \sin(xy) + \cos(xy)$$
$$\frac{\partial^3 f}{\partial^2 x \partial y} f(x, y) = -xy^2 \cos(xy) - 2y \sin(xy)$$

2. Find the linearization of $f(x, y) = x^3 y + x^2 y^2 + xy^3$ at the point $(1, 2, 14)$.

Solution:

$$L(x, y) = f_x(1, 2)(x - 1) + f_y(1, 2)(y - 2) + z_0$$
$$= 22(x - 1) + 17(y - 2) + 14$$
$$= 22x + 17y - 42$$