Formula Sheet:

- **Clairaut's Theorem:** Suppose f is defined on a disk D that contains the point (a, b). If the functions f_{xy} and f_{yx} are both continuous on D, then
$$f_{xy}(a, b) = f_{yx}(a, b).$$

- **Differentiability** Suppose f is defined on a disk D that contains the point (x_0, y_0). We say that f is differentiable at (x_0, y_0) if
$$f(x, y) = f(x_0, y_0) + f_x(x_0, y_0)(x - x_0) + f_y(x_0, y_0)(y - y_0) + \text{error term},$$
where
$$\lim_{(x,y)\to(x_0,y_0)} \frac{\text{error term}}{\sqrt{(x - x_0)^2 + (y - y_0)^2}} = 0,$$
or, equivalently,
$$\text{error term} = (x - x_0)h_1(x, y) + (y - y_0)h_2(x, y)$$
with
$$\lim_{(x,y)\to(x_0,y_0)} h_1(x, y) = \lim_{(x,y)\to(x_0,y_0)} h_2(x, y) = 0.$$

- **Tangent Planes:** Let f be differentiable at (x_0, y_0) and assume $z_0 = f(x_0, y_0)$. An equation of the tangent plane to the surface $z = f(x, y)$ at the point (x_0, y_0, z_0) is
$$z - z_0 = f_x(x_0, y_0)(x - x_0) + f_y(x_0, y_0)(y - y_0).$$

- **Differentials:** If $z = f(x, y)$ and f is a differentiable function, then the differential of z is defined by
$$dz = f_x(x, y)\, dx + f_y(x, y)\, dy = \frac{\partial z}{\partial x} dx + \frac{\partial z}{\partial y} dy.$$