1. Let $z = f(x, y)$. Find the slope of the tangent line, a tangent vector, a normal vector, and the equation of the tangent line at a given point.

2. TANGENT PLANES.

   a) Find the equation of the tangent plane (or the equation of the line perpendicular to f) to $f(x, y) = ...$ at (a, b). See 15.4. $f_x(a, b)(x - a) + f_y(a, b)(y - b) - (z - f(a, b)) = 0$.

   b) Find the equation of the tangent plane to something like $x^2 + 2y^2 - z^4 - z^2 = 4$ at the point (a, b, c). See 15.6. $F_x(a, b, c)(x - a) + F_y(a, b, c)(y - b) + F_z(a, b, c)(z - c) = 0$.

3. DIFFERENTIAL. Let $f(x, y) = ...$ Approximate $f(1.1, -.02)$. Linearize $f(x, y)$ at the point $(2, -1)$.

4. IMPLICIT DIFFERENTIATION. page 956, 957.

5. CHAIN RULE. Find $\dfrac{\partial f(x, y)}{\partial u}$ and $\dfrac{\partial f(x, y)}{\partial v}$ where x and y are functions of u and v.

6. DIRECTIONAL DERIVATIVE. Let $f(x, y)$ be a continuous function. Let (a, b) be a point in the domain of f. What is the rate of change of f in the direction of the vector $u =< 2, -3 >$? What is the greatest rate of change of f and in which direction is it happening?

7. LOCAL-GLOBAL MAX-MIN.

   a) Find and classify the critical points of $f(x, y)$: set the partial derivatives $=0$, then solve for x and y.

   b) Find the global max-min of f on the closed bounded set D: if D is a square, or a triangle, or any polygon find out what f looks like on each edge and maximize (minimize) it on each edge. If D is the inside of some curve (circle, ellipe, etc..) use Lagrange multipliers or parametrize the curve.

8. LAGRANGE MULTIPLIERS. Find the max-min of a function $f(x, y)$ subject to $g(x, y) = k$.

9. DOUBLE INTEGRALS. Integrate a double integral over a region D. You need to be able to recognize if D is of type I or II or both, or a polar region. If D is of both types, you need to be able to choose the correct order of integration so you can calculate the integral.

Good luck!