Math 224 Multivariable Calculus Chapter 15

Section 15.1 Local Extrema

- The concepts of a local maximum and a local minimum.
- The concept of a critical point.
- Relation of critical points and local extrema.
- Classifying critical points: Assume that a point (a, b) is a critical point of a function $F(x, y)$. That is we calculated that $F_x(a, b) = 0$ and $F_y(a, b) = 0$. Next we calculate

$$F_{xx}(a,b), \quad F_{xy}(a,b), \quad F_{yy}(a,b), \quad \text{and} \quad D = F_{xx}(a,b)F_{yy}(a,b) - \big(F_{xy}(a,b)\big)^2.$$

  Then $F(a, b)$ is a local minimum if $D > 0$ and $F_{xx}(a, b) > 0$, $F(a, b)$ is a local maximum if $D > 0$ and $F_{xx}(a, b) < 0$, and $F(a, b)$ is neither local minimum nor local maximum (it is a saddle point) if $D < 0$.

Section 15.1, Exercises and Problems: 1-18, 20, 24 - 29, 34

Section 15.2 Optimization

- There are many practical problems here, like 17-23.
- Theorem 15.1 provides conditions under which a function has a global minimum and a global maximum.

Section 15.2, Exercises and Problems: 1-15, 18-25, 27-30

Section 15.3 Constrained optimization: Lagrange multipliers

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Section 15.3, Exercises and Problems: 1-18 (do most, in particular 4, 8, 14, 15, 17), 19, 20, 22, 24, 25, 26, 28, 33, 38, 40